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RECENT TRENDS IN APPLIED SCIENCES AND COMPUTING ENGINEERING (RTASC)

-A multidisciplinary approach

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Dr. D. Raajasubramanian
Dr. A. Kanagalakshmi**

**Association of Global Academician and Researchers
(AGAR) Publications,
Tamil Nadu, India.**

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MESSAGE FROM EDITOR-I



It is indeed a pleasure and honour to be part and involvement to releasing the book entitled “Recent Trends in Applied Sciences and Computing Engineering -A multidisciplinary approach” by Association of Global Academician and Researchers (AGAR), Tamil Nadu. This remains as a history due to its tremendous response across the globe. I am indeed grateful to the members of the association for providing me an opportunity and for reposing faith in me. All this has been made possible with their guidance. My thanks to the faculty members, Research scholars and students who have contributed the chapters to this dynamic publication. I am very thankful to Dr. I. Niyas Ahamed; President of AGAR for assisted me in times of need. I am very fortunate and blessed to be part of this prestigious publication

With Regards,

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MESSAGE FROM EDITOR - II



Dear Friends,

It is wonderful to see the Association of Global Academician and Researchers (AGAR), Tamil Nadu taking up an important experimental education and research strategies and at the same time an important problem in the society to publishing the book entitled on “Recent Trends in Applied Sciences and Computing Engineering -A multidisciplinary approach.

The topic “Recent Trends in Applied Sciences and Computing Engineering” gives much room to search for the latest trends in dealing with important education role and emerging research strategies. This publication offers more strategic, holistic education and research approach to integrate aspects from the different field of research. It will enlighten the broaden minds of the young researchers to search for new solutions to real life strategies.

Congratulations and God Bless Your Effort.

With Regards,

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MESSAGE FROM EDITOR - III



“Science knows no country, because knowledge belongs to humanity and is the torch which illuminates the world.” - Louis Pasteur.

We are now experiencing a rapid shift of national priorities in research and development. As we have stepped into twenty-first century, we see biology emerging as one of the top priorities in the field of science. This book of Recent Trends in Applied Sciences and Computing Engineering -A multidisciplinary approach” released by Association of Global Academician and Researchers (AGAR), Tamil Nadu bears the articles to approach emphasizes the importance of integrating new knowledge gained through basic research with applied research and development programs. A strong continuity of research and development, from the basics to the applied, facilitates the development of benefits for the society. The subject material is presented by various authors specialized in their field. These chapters will provide information of their research done in various pillars.

I am grateful to my colleagues of Association of Global Academician and Researchers, the authors, technical team, review committee and all who skilfully assisted in completion of this book with ISBN. I wish for more publications from AGAR, which will enlighten the scholars in their field.

With Regards,

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MESSAGE FROM EDITOR - IV



This book provides us with a snapshot of what is going on in this fascinating field, and I would like to congratulate all contributors on making their wonderful posts vibrant and full of material for this edition. I am sure readers can find material that is very helpful and interesting, and my sincere gratitude goes to the publisher, my fellow associates, and all those who have taken care to get this wonderful edition out of it.

This Contributed book entitled “Recent Trends in Applied Sciences and Computing Engineering -A multidisciplinary approach” published by Association of Global Academician and Researchers (AGAR), Tamil Nadu. I am very glad that all authors took the opportunity to exchange their knowledge, experiences and ideas and also made contacts and established further collaboration. This educational material, rich in events, provided more relaxing atmosphere during the meetings among colleagues in this pandemic situation.

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MESSAGE FROM EDITOR - V



This contributed book published by the Association of Global Academicians and Researchers (AGAR), Tamil Nadu, entitled "Recent Trends in Applied Sciences and Computing Engineering -A multidisciplinary approach". I am very happy that all writers have taken the opportunity to share their information, insights and thoughts and have also formed connections and further collaboration. During the meetings between colleagues in this pandemic situation, this instructional content, rich in activities, created a more calming environment.

This book provides us with a snapshot of what is happening in this interesting area, and I would like to congratulate all contributors for making this edition of their wonderful posts lively and full of content. I am confident that readers will find very helpful and informative content, and my heartfelt appreciation goes to the printer, my fellow colleagues, and all those who have been diligent to get this wonderful edition out of it.

With Best Wishes
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MESSAGE FROM EDITOR-VI



Dear Readers,

It's my delight to congratulate the Association of Global Academician and Researchers (AGAR), Tamil Nadu for bringing out other milestones. The importance and impact of Research in human life is unarguable because the very sustenance is tangled in it. The world is witnessing a huge scientific development in the field of Computer Science and Technology. It is worth mentioning that the recent researches in the biological systems. Hence it is apparent that the researchers are engaged in understanding the functioning of our Research and Education System and in doing so they believe that we can address so many vital issues that are connected with present system etc.

This book gives us a glimpse of what is happening in this fascinating field and I would like congratulate all the contributors for their wonderful articles for making this edition colourful and content-full. I am sure the readers will find very useful and interesting information and my sincere appreciation goes to the editor, my fellow associates and all those who took pains to bring out this wonderful edition.

With Prayers and Wishes
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MESSAGE FROM EDITOR - VII



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Congratulations and God Bless Your Effort.

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MESSAGE FROM EDITOR-VIII



Dear Readers,

It's my delight to congratulate the Association of Global Academician and Researchers (AGAR) for bringing out other milestones. The importance and impact of Research in Applied Sciences and Computing because the very sustenance is tangled in it. It is worth mentioning that the recent researches in the multidisciplinary approach. Hence it is apparent that the researchers are engaged in understanding the functioning of our Research and Education System and in doing so they believe that we can address so many vital issues that are connected with present system etc.

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With Prayers and Wishes

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MESSAGE FROM ASSOCIATE EDITOR - I



It is indeed a pleasure and honour to be part and involvement to releasing the compilations of book chapters “Recent Trends in Applied Sciences and Computing Engineering -A multidisciplinary approach” by Association of Global Academician and Researchers (AGAR), Tamil Nadu. This remains as a history due to its tremendous response across the globe. I am indeed grateful to the members of the association for providing me an opportunity and for reposing faith in me. All this has been made possible with their guidance. My thanks to the faculty members and students who have contributed the articles to this dynamic publication. I am very thankful to Dr. I. Niyas Ahamed, President of AGAR for assisted me in times of need. I am very fortunate and blessed to be part of this prestigious publication.

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MESSAGE FROM ASSOCIATE EDITOR - II



This book provides us with a snapshot of what is going on in this fascinating field, and I would like to congratulate all contributors on making their wonderful posts vibrant and full of material for this edition. I am sure readers can find material that is very helpful and interesting, and my sincere gratitude goes to the publisher, my fellow associates, and all those who have taken care to get this wonderful edition out of it.

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MESSAGE FROM ASSOCIATE EDITOR - III



I am pleased to share that Association of Global Academician and Researchers (AGAR), Tamil Nadu., has released a book on "Recent Trends in Applied Sciences and Computing Engineering -A multidisciplinary approach." My sincere congratulations to the organisers, members of the committee and all the participants for their untiring enthusiasm and enthusiasm for providing the student community with knowledge.

A good education opens our horizons and provides us with good opportunities in life. Awareness helps individuals to develop and affect their condition. "Your mindset, not your ability, will decide your altitude." "If you think education is costly, try ignorance." "The only person who is educated is the one who has learned how to learn and improve." "Education is the passport to the future, for tomorrow belongs to those who plan for it today."

My sincere thanks to the members of the Review Committee for the purpose of this "Recent Trends in Applied Sciences and Computing Engineering -A multidisciplinary approach" I am pleased to wish the organisers great success with the contributed ISBN narrative.

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MESSAGE FROM ASSOCIATE EDITOR - VI



Research is “creative and systematic work” undertaken to increase the knowledge of humans, culture and society and devise new applications. Education can be thought of as the transmission of the values and accumulated knowledge of a society. It’s a great privilege and honour to be associated with this “Recent Trends in Applied Sciences and Computing Engineering (RTASC) -A multidisciplinary approach” released by Association of Global Academician and Researchers (AGAR), Tamil Nadu. The outbreak of the COVID-19 pandemic has led to a sudden shift in the dynamics of workforce behaviour. RTASC has facilitated the academicians and researchers to get connected and share their knowledge and dramatically provided an opportunity for collaboration with colleagues who are dispersed across time zones, countries, and continents. I thank the contributing academicians and researchers for making this great success.

With Regards,

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Chapter No.	NAME OF THE CHAPTER	Page No.
1.	<p>PUBLIC HEALTH CONCERNS PERTAINING ALMAJIRI EDUCATION IN NIGERIA: A REVIEW</p> <p><i>Yusuf Sarkingobir, Balarabe Aliyu Adiya and Aliyu Umar Sharu</i></p>	1
2.	<p>EFFECTS OF NATIVE HAUSA LANGUAGE AS LANGUAGE OF INSTRUCTION ON ATTITUDES TOWARDS BIOLOGY AMONG SECONDARY SCHOOL STUDENTS IN SOKOTO STATE, NIGERIA</p> <p><i>Ashafa, Abdulrahman Nafisa and Yusuf Sarkingobir</i></p>	30
3.	<p>BASICS OF TAMSULOSIN DRUG: A REVIEW</p> <p><i>Dikko Malami</i></p>	41
4.	<p>MICROBIAL DEGRADATION OF CELLULOSIC SUBSTRATES BY <i>BACILLUS SP</i>, <i>VIBRIO SP</i> AND <i>PSEUDOMONAS SP.</i></p> <p><i>Dr.V.Jeyanthi Kumari and M.Mangayarkarasi</i></p>	55
5.	<p>MICROFLUIDICS- A NEW APPROACH FOR ANTIBIOTIC SENSITIVITY STUDIES</p> <p><i>Shabeer Ahmed N, Murali R and Prakash G Williams</i></p>	70

6.	<p>COMPUTER AIDED DRUG DESIGN (CADD) - A PERFECT BLEND OF COMPUTATIONAL AND BIOLOGICAL SCIENCES</p> <p><i>G.S. Mary Fabiola and P. Dhivya</i></p>	94
7.	<p>PRELIMINARY STUDY ON WETLAND ANGIOSPERMS IN SELECTED PONDS OF SOORANKUDY, KANYAKUMARI DISTRICT, TAMILNADU, SOUTH INDIA.</p> <p><i>Albino Wins J, Nishanthi and N Selvanandhini.T</i></p>	116
8.	<p>AFFECT OF CORIANDER AND CURRY LEAVES ON LACTIC ACID BACTERIA IN BUTTER MILK AS AN IMMUNO MODULATOR.</p> <p><i>Dr. Prasanna Srinivas.R</i></p>	132
9.	<p>PROBLEM OF SAME-SEX RELATIONSHIP AMONG TERTIARY INSTITUTIONS IN SOKOTO</p> <p><i>Yusuf Sarkingobir and Safina Abdullahi Yarima</i></p>	141
10.	<p>RECENT TRENDS IN APPLIED SCIENCES AND COMPUTER ENGINEERING</p> <p><i>Dr. Shankar Kumar JHA</i></p>	149
11.	<p>REVIEW OF IODINE STATUS IN THREE (3) AFRICAN COUNTRIES (NIGERIA, GHANA, AND ETHIOPIA) AMONG ADOLESCENT GIRLS AND WOMEN OF CHILDBEARING AGE</p> <p><i>Umar AI, Umar and Sarkingobir Y</i></p>	178

12.	<p>CHEMICAL ANALYSIS OF OIL EXTRACTED FROM <i>JATROPHA CURCAS</i> SEEDS FROM SOKOTO, NIGERIA</p> <p>Mustapha Sahabi</p>	198
13.	<p>SYNTHESIS OF SILVER NANOPARTICLES - AN OVERVIEW</p> <p>Anshiba J, Swathilakshmi A V and Poonkothai M</p>	212
14.	<p><i>SYZYGIUMCUMINI</i>: AN OVERVIEW OF TRADITIONAL AND THERAPEUTIC USES</p> <p>E. Deepika, Gunavathi, P Jenifer and K. S. Santhy</p>	245
15.	<p>TOOLS FOR DRUG DISCOVERY - INSILICO</p> <p>Ariya S S and Baby Joseph</p>	268
16.	<p>IMPACT OF COVID-19 PANDEMIC ON THE SOCIO- ECONOMIC STATUS OF THE FISHERY SECTOR</p> <p>Pushparaj Karthika</p>	283
17.	<p>MICROBIAL SURFACTANTS WITH MULTIFUNCTIONAL POTENTIAL</p> <p>Niti Chawla</p>	298
18.	<p>BIO-POTENTIAL OF A GREEN MARINE ALGAE <i>Chaetomorpha antennina</i> (Bory de Saint-Vincent) Kützing) ON THE LIFE CYCLE OF A POLYPHAGOUS INSECT <i>Spodopteralitura</i> (Fabricius)</p> <p>Murugaiyan, K and Kannan, R.</p>	318

19.	THE COST OF OPEN DEFECATION IN NIGERIA <i>Yusuf Sarkingobir and Safina Abdullahi Yarima</i>	334
20.	SURVEY OF EXPERT SYSTEMS AND COGNITIVE APPROACHES TO EFFECTIVE TUTORING <i>Dr. Atul Kumar Dr, Amol Gawande and Ms. Geetika</i>	348
21.	THE DATA MINING AND INFORMATION SECURITY <i>Dr. Amol Gawande, Dr. Atul Kumar and Dr. Sonali Saha</i>	383
22.	MACHINE LEARNING ALGORITHMS <i>Dr. Atul Kumar, Dr. Amol Gawande and Dr. Sheetal Darekar</i>	394
23.	BIOINFORMATICS IN BIOMEDICAL IMAGING <i>Dr. Atul Kumar Dr. Amol Gawande and Dr. Atul Ramgade</i>	417
24.	RESOURCE ALLOCATION TECHNIQUES IN CLOUD COMPUTING <i>Dr. Amol Gawande Dr. Atul Kumar and Dr. Sachin Napate</i>	447
25.	CLOUD COMPUTING <i>Mr. Prabhdeep Singh, Dr. Raja Sarath Kumar Boddu and Mr. Venkata Srinivasu Veesam</i>	472

26.	SURFACING THE ART OF PEDAGOGY Ms. Pallavi Asthana, Mr. Mohit Tiwari and Ms. Tripti Tiwari	484
27.	AN ANALYSIS OF DATA MINING: PAST, PRESENT AND FUTURE Dr. Bramah Hazela, Mr. Mohit Tiwari and Ms. Tripti Tiwari	511
28.	CLOUD COMPUTING Girjesh Kumar Mishra, Neha khare and Dr. D. Hemanand	529
29	LASER APPLICATIONS FOR NANOTECHNOLOGY Dr. J. Madhusudhanan, Mr. T. Selvamohan and Dr.KS Kiran	543
30	MATHEMATICAL BIOLOGY Dr. Bijal Yeolekar, Mr. G.Veeramalai and Dr Someshwar Siddi	568
31.	COPPER: SYNTHESIS TECHNIQUES IN NANOSCALE AND POWERFUL APPLICATION AS AN ANTIMICROBIAL AGENT Mr. Akshay.S, Dr. Sridhar Arelli and Ms. Kamalashri N	585
32.	THE USE OF GENETIC ALGORITHMS IN DATA MINING Dr. D. Vimal Kumar,Ms. Simi Paxleal. Jand Mr. Biswadip Basu Mallik	628

33.	QUALITY ANALYSIS OF NETWORK SECURITY USING CRYPTOGRAPHIC TECHNIQUES <i>Dr.P.C. Senthil Mahesh, Mohit Tiwari and Ms. Tripti Tiwari</i>	656
34.	ARTIFICIAL NEURAL NETWORKS- A HIGH PERFORMANCE COMPUTING IN THE MODELING OF HIV EPIDEMIC <i>Mr. Shashi Kant Gupta, Dr. S. Vennila and Mr. Kuldeep Anil Hule</i>	667
35.	ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING <i>Mr. Amit Kumar Jaiswal, Dr. D. Hemanand and Ms. Sowjanya Tadanki</i>	704
36.	LASER ABLATION SYNTHESIS FOR THE PRODUCTION OF SILVER NANOPARTICLES <i>Akshay.S, Dr. Sridhar Arelli and Dr M K Gupta</i>	716
37.	SILVER NANOPARTICLES AND ITS APPLICATIONS <i>Dr. Charumathy M, Kamalashri and Akshay S</i>	801

38.	MACHINE LEARNING FOR CYBER SECURITY <i>Ms. Gomathi J, Mr. Santosh Kumar, Dr. S. Chitra and Mr. Rajesh Kanna P</i>	896
39.	SYNTHESIS, CHARACTERIZATION AND APPLICATIONS OF COPPER NANOPARTICLES <i>Dr.V.V. Hari Babu, Dr. Niti Chawla, Dr. S. Padmavathy and Dr. M.Jemimah Carmichael</i>	917
40.	CYBER SECURITY CHALLENGES AND ITS EMERGNING TRENDS ON LATEST TECHNOLOGIES <i>Dr. S. Hemalatha, Ms. Vijetha Bhat and Dr.S.Chitra</i>	966
41.	APPLICATIONS OF NANOTECHNOLOGY IN COMPUTERS <i>Ms.Neha Khare, Mr. Jitendra Singh Kuntal and Dr. S. Vennila</i>	983
42.	NANOTECHNOLOGY APPLICATIONS IN SCIENCE AND ENGINEERING <i>Dr. Niti Chawla, Dr. Sridhar Arelli and Dr. P. Sangeetha</i>	996
43.	APPLICATIONS OF SILVER NANOPARTICLES IN DIFFERENT FIELDS <i>Dr. N. Ashokkumar, Dr. S. Padmavathy and Sugumari Vallinayagam</i>	1039

44.	APPLICATION OF GENETIC ALGORITHMS TO DATA MINING Mr. Sandeep Srivastava, Mr. Pavan Kumar E and Ms. Vijetha Bhat	1057
45.	HUMAN RESOURCE MANAGEMENT PHILOSOPHY Dr Sriram E, Dr. A. Suresh Kumar and Mr. Ajit Prasad Mahato	1075
46.	MINING BIG DATA USING GENETIC ALGORITHM Dr. Sunita Bansal, Ms. S Violet Beulah and Dr. A. Clementking	1093
47.	INFORMATION SECURITY TOWARDS CYBER SECURITY Mr. Basavaraj Patil, Dr. A. Clementking, Mr. Harikumar Pallathadka and Dr. Syed Masaid Zaman	1112
48.	RECOMBINANT DNA TECHNOLOGY AND ITS APPLICATIONS Dr. Punithavathi Manogaran and Dr. Charumathy Marimuthu	1128

49.	CYBER SECURITY USING MACHINE LEARNING TECHNIQUES Dr. Syed Masaid Zaman, Dr. Sarika Lohana and Mr. Mrutyunjaya S Yalawar	1156
50.	ANTICANCER ACTION OF INSILCO DOCKING AND DRUG DESIGN OF HERBAL LIGANDS Dr Kavita Khatana and Dr. K. Shoba	1173
51.	HISTORY AND DEVELOPMENT OF PLANT SCIENCE Mr. Sandipan Babasaheb Jige	1213
52.	B CHITIN AND CHITOSAN - A MINI REVIEW. Zoyeb Mohamed Zia and Dr.M.Asrar Sheriff	1241
53.	COVID-2019 OUTBREAK IN INDIA AN OVERVIEW S. Shanmugam	1253
54.	A REVIEW ON PRODUCTION OF ECO ENZYME AND ITS APPLICATIONS Sangeetha S and Poonkothai M.	1265

55.	CANCER THERAPY Dr. K. Shoba and J. Buenefa Shalom Trephosa	1286
56.	MACHINE LEARNING AND THE BUSINESS OF CYBER SECURITY Dr. D. Vimal Kumar, Dr. Raja Sarath Kumar Boddu and Ms. Gomathi J	1313
57.	INTERNET OF THINGS TO USE ARTIFICIAL INTELLIGENCE (AI) AND MACHINE LEARNING (ML) Dr. S. Hemalatha, Ms. Simi Paxleal. J and Ms.Zareena Noorbasha,	1338
58.	COMPUTER NETWORK AND ITS TYPES Ms. A. Bathsheba Parimala	1355
59.	BIOGENIC SYNTHESIS OF CuO NANOPARTICLES AND THEIR BIOMEDICAL APPLICATIONS Dr. P. Selvaraj, Dr. V.Malarvizhi and Dr. C. Ramathilagam	1391

60	<p>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING APPLICATIONS IN SMART PRODUCTION: PROGRESS, TRENDS, AND DIRECTIONS</p> <p><i>Dr. Hemant Kumar Singh, Mrs. S. Rani and Ms. R. Roseline</i></p>	1443
61	<p>AN ANALYSIS OF DATA SECURITY AND PRIVACY IN CLOUD COMPUTING</p> <p><i>Mr. Ashish Kumar Pandey, Dr. Raja Sarath Kumar Boddu, Mr. Mohit Tiwari and Ms. Tripti Tiwar</i></p>	1514
62	<p>A THEORETICAL STUDY ON AMONG NETIZENS BEHAVIOUR IN SOCIAL MEDIA AND CYBER BULLYING IN INDIA</p> <p><i>Jayadatta S, Gangadhar Sheeri and Nitin Bhasker</i></p>	1536



BOOK CHAPTERS

01

PUBLIC HEALTH CONCERNS PERTAINING *ALMAJIRI* *EDUCATION* IN NIGERIA- A REVIEW

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ABSTRACT:

Almajiri schools are as old as the advent of Islam in Nigeria. They did well in the past for providing the basic requisite knowledge to Muslim community, but when colonialism took over the mantle of leadership from the leaders of Sokoto Caliphate, the *Almajiri* practice continue to languish and yet unattended. The *Almajiri* schools, teachers, and the system are in deplorable conditions, which affect the health of the *Almajiri* child and even the public. This paper discussed the public health concerns cause by present *Almajiri* practice. Relationships of *Almajiri* and the following were discussed: immunization, early child care, food security, insecurity, trafficking, and child labour among others. Government should wake up from the slumber and implies a good system of *Almajiri* using traditional (emirs and Muslim clerics), otherwise the existing problems are just tip of the iceberg.

Keywords: *Almajiri*, Qur'anic schools, trafficking, food insecurity, child labour, immunization, begging, homelessness.

1. INTRODUCTION

Public health is a science or art that tends to study the health of a population. It consists of many disciplines and aspects, in other hand, the *Almajiri* or its system of education is a phenomenon involving populations, engaged by a large population, and affected either positively or negatively by a large population, mostly in northern Nigeria and other countries that have similar polity with Nigeria. This aspect of *Almajiri* has not been mostly explored by public health scientists often left only in the hands of educationists, albeit it required much attention. As said earlier, *Almajiri* is a public health phenomenon that should have been examined using public health tools and perspectives, so as to reveal the challenges abound, and proffer solutions, because it has the potential of spurring public health threat from various ramifications. Thus, this review will try to look at how the *Almajiri* system affects the *Almajirichild*, and the society he lives in, from the public health perspective.

2. WHO IS ALMAJIRI?

Almajiri is a singular word, with plural (*Almajiri*), that participates in the practice of seeking knowledge under the headship

of *mallams* in a system called *Almajiri* or *Almajirci*. Thus, an *Almajiri* is some one who left his home to another place (within his town or outside his town), in the search for Islamic knowledge (mostly Quranic recitation) (Khalid, 1997; Maigari, 2017). They practice boarding system. But the worrying issue is they don't have enough or proper shelter, they don't have food to eat or money to do their lively needs, there are a lot of issues of concerns in this system of education, which affect health of many including them. The other concern about is, they are young, within the age range of 4-30 (or above), in most of the situations.

This age range of youngness is very vulnerable and fragile, that is why it needs much concern and care, because of its ability to make or mar the lives of future generations. They are class of people, that are developing, requiring much and careful training, very diverse, very sensitive to pressures, very expulsive, e.t.c(Yunusa, 1994; Nigeria Research Network, 2013; Shiitu and Olaote, 2015).

The other issue is, albeit most of the *Almajiri* are males, there are some *Almajiris* that are females. Taiwo (2013) argued that, the government is doing nothing to avail the *Almajiri* probably because

they know western education of *Almajiri* may lead to competition. Until recently, President Good luck Jonathan tried to take a step further by integrating *Almajiri* into Western education. He created some schools (very few) in northern Nigeria where Islamic and western education are taught to *Almajiri*. Only time to come will tell if this move may be fruitful, since many policies failed because of mismanagement and implementation (Good luck and Juliana, 2015; Ibrahim and Rabi, 2017).

3. VIOLENCE IN ALMAJIRI SCHOOLS

The convention on the Rights of the child (CRC), 1989 emphasis that all violence against children should be prohibited, includes violence in the school environment. Despite this echoed statement and other commitments like Dakar (2000) treaty, *Almajiris* are with greater risks of violence because of their high vulnerability. It is common to see an *Almajiri* who undergone through violence of one form or the other. Their vulnerability is associated with their weakness, being of poor environment, lack of early child care, lack of proper parental or guiding care, lack of convenient environment etc. One of the widely seen violence at *Almajiri* schools is the flogging and

coercive method of teaching The Malams and superior are always supervising the *Almajiri* beating them with canes. Some that are stubborn among the *Almajiri* are chained in some circumstances (Sarkingobiret *al.*, 2019). Basically, there are 4 main forms of violence in schools as reported by UNESCO (1990). They are: Physical and psychological punishment, bullying, sexual and gender-based violence, external violence (gangs, conflicts, fighting).

4. SANITATION AND HYGIENE OF ALMAJIRI IS POOR

It is widely known that *Almajiri* schools are lacking proper sanitation and hygiene, this breeds a fertile ground for transmission of infections among the *Almajiri*, and to non-selves (community) while significant amount of *Almajiri* are children, this make them vulnerable to poor sanitation and hygiene. They are future parents; it is likely that if they have good sanitation and hygiene behavior, it can be taught to future generations. Findings revealed that:

- *Almajiri* teachers were not trained on sanitation and hygiene
- No functional water supply and sanitation facilities
- Inadequate awareness on sanitation and hygiene (Sarkingobiret *al.*, 2019).

5. OPEN DEFECATION IS PREDOMINANT PRACTICE AMONG *ALMAJIRI*

Open defecation (OD) is the practice of defecating not in sanitary facility. It is defecation in fields, forests, bushes, etc This practice is the order of the day in most of the *Almajiri* schools, because there are no enough or proper toilets, the communities are unaware of the dangers of the practice due to poverty, and illiteracy (Sarkingobire*etal.*2019).Sanitation coverage is largely presented as a four-step ladder that includes the proportion of the population. Open defecation: refers to defecation in fields, bushes, forest water bodies, open spaces, disposal of human faeces with solid waste.

The people ppractising open defecation has no any form of sanitation. They are on the bottom of the ladder living in indignity of defecating in the open. This is widely practice bbehaviour by *Almajiri* because they don't have enough toilets, illiteracy and there are no enough public toilets. They have to recourse to this practice posing health hazards to anyone living nearby. The communityy members are at the risk of diarrhoea, hepatitis, polio etc. Some *Almajiri* climb the second step in the sanitation ladder. In that, they are not

defecating in the open, but resort to some sort of facility which cannot separate human faeces from human contact.

It is a little bit sanitation behaviour and is mostly practice in rural areas (eight out of ten of the practice is carried out in the rural areas). Examples of unimproved sanitation facilities are: pit latrines without slab or platform, hanging latrines, bucket latrines, improved facilities without adequate disposal facilities (porable, pour-flush toilets that dispense directly into open drains, ditches, or water bodies) (Sarkingobir and Sarkingobir, 2017).

The next step of ladder used by *Almajiri* is the improved sanitation facility. This practice is very rare, because of the illiteracy and poverty. In rare cases, philanthropists, or governments or non-governmental organization (NGOs) constructs an improved sanitation facility (toilet) in *Almajiri* schools. Improved toilets ensure the separation of human excreta from human contact. They include: flush or pour-flush toilet/latrine, ventilated improved pit latrine with slab, composting toilets etc. Health educators and relations should make people aware on the importance of improved toilets, so that it will be of priority in their agenda. This will attract more help from

NGOs, philanthropists and shape communities to construct their own improved toilets (UNICEF, 2012).

The other form of sanitation used by *Almajiri* is the shared sanitation facilities. In some schools there are toilets constructed by selves, wealthy individuals, NGOs or governments in rare case. Also, when they leave the schools and entered the town or villages, they can resort to using public toilets, whenever there are, but these public toilets are mostly shared by a large number of users, hence they are untidy in most of the situations (Sarkingobire *et al.*, 2019).

6. HOW OPEN DEFECATION CAUSE PROBLEMS WHEN A PERSON DEFECATES IN THE OPEN?

Some problems of OD are underlined below:

- Disease causative agents in the excreta travel from the hand to the mouth.
- OD causes faeces transmitted diseases (FTDs) like diarrhoea, tropical antipathy, trachoma, typhoid fever, ascariasis, and hookworm infection. All of these can be controlled through improved sanitation.

- Under nutrition, poor sanitation, hygiene accounted for 50% of maternal and childhood under nutrition. A fecal infection reduces absorption, which in turn lead to malabsorption, under nutrition and stunting.
- Stunting children who are exposed to more faecal microbes presents stunted growth.
- 1 out of 3 women in the world risk shame, disease, harassment, assault, because of lack of toilets.
- OD causes environmental degradation. It is one of the leading sources of organic bacteria, groundwater, and surface water pollution. CO₂ and CH₄ are produced due to OD, which are greenhouse gases stimulating global warming. OD also reduces the beauty and fresh air of a place, thereby affecting tourism
- In most of the refuses or waste that scavengers mingled with there are defecations due to OD, they face hazards. Hazards to their healthy dignity, shame and other social humiliations.

7. IMMUNIZATION IS IMPORTANT FOR THE (CHILDREN AND TEEN) YOUNG

In immunization vaccines work to trigger the immune system

to fight against certain diseases. When a vaccinated person gets in contact with these diseases, their immune system will respond effectively, thereby preventing the disease or its severity, it protect individuals, and the broader community by reducing the spread of disease some of the serious disease that individuals can be vaccinated are: Cough, measles, German measles, chicken pox, tetanus, polio, diptheria, hepatitis, rotavirus, mumps, pneumococcal disease, meningococcal C, all these can cause hospitalization, and are very fatal. Children and teen require immunization from birth to 18 years of age. But *Almajiri*, have left their homes and live at schools or elsewhere this led them to miss the routine polio immunization and other forms of vaccinations performed by the Nigeria government (Sarkingobire *et al.*,2019).

8. CHILD TRAFFICKING AND ALMAJIRI

Almajiri child is vulnerable to trafficking because of his peculiar nature. For example, Taiwo (2015) listed some of the unbecoming situations suffered by *Almajiri*. “The *Almajiri* are children living under a horrific condition, few of them do not know their homes or who their parents are as they left early in life”. These *Almajiri* are very

vulnerable for trafficking because of their weakness. Some of their weaknesses are:

- they mostly come from poor families
- They mostly come from an illiterate family
- They are extremely young (mostly between 7-13 years)
- They don't have food, good shelter or other basic needs

These factors and others easily make them vulnerable to exploitation. Several occasions were reported some *Almajiri* are been sexually abused, engaged in forced stealing, forced labour, militarization etc. thus, availability and easiness of *Almajiri* child for trafficking affect their present and future health. It is also serving as threat to other members of the public, because a child without proper care can serve as nuisance by engaging in sorts of juvenile delinquencies (Sarkingobir *et al.*, 2019).

9. MOST AALMAJIRI ARE NOT HAVING PROPER NUTRITION (FOOD SECURITY)

Due to their vulnerability, *Almajiri* are mostly food insecure (malnourished). They usually rely on begging to get what they can eat. Thus, there is no guaranteed safety and quality of the food they

consume. They scavenge for food remains at homes, restaurants and markets through begging or labour. Thus, their level of nutrition may not be up to expectation. This happens because most of them come without food (from home), or small amount, which sometimes is stolen or snatched by superiors (Otaha 2013; Nwazuoke and Igwe, 2016; Sarkingobir, 2019).

Almajiri as a young, required proper food (balanced diet) for proper growth and development, but that could not be found. Hence, their health is at risk of diseases and impaired growth and development. Nutrition is a powerful factor in life, which affects growth, development and production. It is a fundamental human right, and it is a goal of sustainable development goals (SDGs). But despite efforts by the government, NGOs, philanthropists, etc *Almajiri* is still been denied this right (Food and Research Action Centre 2011; Otaha 2013; Sarkingobiretal.2019). Most of *Almajiri* are at risk of malnutrition because of the followings:

- ❖ They are from poor families (economic reason)
- ❖ They cannot come with enough and proper food. Or their superiors snatched the food they came with from home

- ❖ They are from illiterate families which are unable to make wise decisions on their ward nutrition.
- ❖ They are from rural villages, which have more risk to malnutrition.
- ❖ They are from places that are affected by poverty, food scarcity and environmental extreme events that affect food.

Poor nutrition in *Almajirüs* associated with consequences via:

- ❖ It retards their physical, mental, and health development in present and future life. Because poor nutrition at younger ages have a lifelong consequence.
- ❖ It diminishes their learning, and education ability
- ❖ It affects their economic production ability in the future life.

Noteworthy, Nigeria loses billions in GDP every year because of malnutrition. (Mohammed *et al.*, 2015).

10. AMAJIRI CHILDREN AND PERSONAL HYGIENE

Personal hygiene among children is regarded as the best tool to improve community health, so as to attack the communicable diseases that affect children's growth and development (Balogun, 2015). Younger school children are more prone to poor personal

hygiene than the older ones (UNICEF, 1998). Indeed, personal hygiene is a major public health problem that affects several children in many developing countries. Lack of personal hygiene disadvantages children's health, render them prone to respiratory infections, gastrointestinal infections such as diarrhoea, cold, fever, flu, abdominal pain, vomiting, distension, gum disease, dermatitis, itching. Thus, their immunity is affected by poor personal hygiene (Balogun, 2015).

The term personal hygiene is a routine of personal care that keeps your whole body clean, fresh and healthy. Children hardly stay clean for long; they tend to explore everything around. For example, they tend to play with sand, mud, water, pants etc. Most of the *Almajiri* knows or learns nothing about personal hygiene or care and ultimately cannot abide by it. They are mostly from poor families with little knowledge or practice of personal care. Most of *Almajiri* gallivant with dirty clothes (sometimes torn), sometimes no barefooted.

They can stay for weeks without taking bath. Some of them scavenge in dirty places like refuses, wastes etc. They are lamponers, because they could not receive proper child care,

poverty, youngest and illiteracy. Thus, they can easily contract or communicate communicable diseases especially those that are related to personal hygiene. They also serve as infections carriers that can harm the impending community (Sarkingobiret *al.*, 2019)

11. ALMAJIRI S POOR SETTLEMENT/LIVING ENVIRONMENT AND THE PUBLIC

Several years ago, the housing or living place is recognized as one of the principal settings that affects public health .Living conditions like indoor air quality, home safety, noise, humidity and mould growth, indoor temperature, poor hygiene, overcrowding, etc affects physical and mental health of humans, albeit the body of evidence reported by some studies cannot straightforwardly outline a strong causality, while other successfully reported an association or causality. Every human has the right to live. He also needs a healthy housing settlement. A home, a place that provides privacy, physical and psychological wellbeing, supports development and social integration to the occupants is needed (Bonnefo, 2007). Above all, immediate environment (housing) is related to our health.

For example, poorly planned residential area with no public

amenities (water supply, toilets, light, roads, markets etc) is characterized with many problems to our health. *Almajiri* schools are very rampant in rural communities and even in urban ones their conditions are deplorable. They do not have adequate hostels or sleeping environments, some of them resort to homelessness. With the inadequate housing problem, they face, the hostels are also in bad settings (poor hygiene, poor design, overcrowding, lack of sanitation/toilets, and lack of enough water supplies, among others). Thus, the living places of *Almajiri* may help in causing health problems to them and neighbours. It is possible to trigger two main consequences of environment, which are Building Related Illnesses (BRI) and Sick Building Syndrome (SBS). A BRI is a health problem that has clear etiology and originates from the building in question. Parable, house dust allergy, legionnaires disease. Whereas, SBS is a couple of unspecified symptoms and signs that supersede after leaving the building (Every Woman Every Child, 2015; National Children Bureau, 2016; Sarkingobire *et al.*, 2017).

12. SOME HOME ISSUES IN ALMAJIRI SETTLEMENT

ACCIDENTS

Home accidents are public health problems. Most *Almajiri* are younger ones that have poor knowledge and experience to recognize danger. They are impulsive and curious to do things (being young). There is wide practice of burning sticks, firewood, farm remnants which they mostly collect from bushes. It also serves them in cooking food or heating cold water. No frequent fire outbreak is being reported because of that burning, but this cannot be absolving from rare incidents which cause injury and property loss. The practice of searching for those materials in bushes could expose them to violence, injuries and even snake bite (Amzat, 2008; Sarkingobiret *al.*, 2019).

Noise disturbance

Sleep and attention are two things required by humans and essential for their proper functioning. But the duo can be disturbed by noise. Usually, the *Almajiri* engage in recitation, rehearsal, discussion, playing, etc, which in turn may have the tendency of disturbing selves and neighborhood. Environmental noise due to *Almajiri* is mostly occurring at levels that cannot cause hearing damage, but can cause sleep disturbances, attention disturbances

and distractions etc

Air quality

Emissions from burning of woods and other fuels cause smoke and other pollutants, which in turn affect respiratory illness in children. It leads to increase in respiratory problems like asthma (Bonney, 2007).

Mould

Mould spores are very present in most of the buildings, especially older ones. Mould is precipitated by moisture that gets into the buildings and it is associated with problems like dizziness, fatigue, headache (Bonney, 2007).

Pets and relations

Pests are threat to homes. They can act as carrier of pathogens and other diseases. Almajiri homes have no pest and rodent control measures. This gives them fertile place to live. In fact, the students are in the habit of catching them to eat (Sarkingobiret *al.*, 2019).

Overcrowding

Majority of the places (classes and hostels) *Almajiri* reside are extremely overcrowded. In turn, it can easily giveaway to

communicable diseases (Bonney, 2007; Amzat, 2008; Sarkingobiret *al.*, 2019).

13. SIGNIFICANT NUMBER OF ALMAJIRI CHILD EXPERIENCE HOMELESSNESS

If you move around urban or rural areas you can see *Almajiri* child living or sleeping along streets, in markets, in uncompleted places etc. Not all of them are experiencing homelessness, but a significant portion of them. This happens because of so many reasons (Abari and Audu, 2013). Homelessness and ill-health are linked. Some of consequences of homelessness are:

- It can exacerbate ill-health
- It can have impact on later life of the child
- People that are homeless report more poor health than the general public
- It can prevent child from having accessibility to healthcare services
- Children experiencing homelessness are more vulnerable than their counterparts

- Children experiencing homelessness are more likely to receive trauma, abuse, and over adversaries
- Younger ones that are homeless are more likely to engage drugs
- Children that are homeless are more likely to face exploitation, trafficking, abuse, crime etc (Senterfeit *et al.*, 2013 Sarkingobiret *al.*, 2019).

14. THE INTERACTION OF ALMAJIRI AND INSECURITY

In many cases, the *Almajiri* strives to live without parental care, right from the early age of 4 or something like that. They are left under the whip and caprice of the society. They are vulnerable and readily available for any bad behavior that may pick them up. They can be vulnerable to drug abuse, health problems, accidents etc (Amzat, 2008). The weakness, vulnerability, and short-of-parental care involved in *Almajiri* practice has made him a ready-mades in gyres for many crisis in the country, from olden days to date .Parable, there are allegations that the *Almajiri* are just tools for tomorrow's thugs .Some of the young ones transformed to thugs in later life, as cited by many (Gomment and Esomchi, 2017).

The *Maitatsine* crisis was one of the problematics upraise in

the history of Nigeria, which is still having remnants in the Northern part of the country. There are reports that said that most of the adherents of *Maitatsine* were *Almajiri*. Presently, *Bokoharam* (remnant of *Maitatsine*) is threatening the existence of this country, especially the Northeast. The wandering *Almajiri* can be recruited into the *Bokoharam* militia especially for suicide bombing purposes (Aghedo and Eke, 2013).

15. SUGGESTIONS TO SOLVE ALMAJIRI PROBLEMS

There are diverse strategies that should be employed to solve the current predicaments facing *Almajiri*:

- Youth employment programmers. One of the factors causing *Almajiri* is the poverty. Some governments utilized employment initiatives to solve youth problems; consequently, the *Almajiri* should be helped to get jobs, or skills to empower their selves. Some governments use allowances to Mallams, which is good and encouraging. For better result Malams should be earning salary (Onoyase, 2010).
- Feeding the *Almajiri*. Some reports suggested that the government and the wealthy individuals partner to feed *Almajiri* child. For

example, one-child-per-house initiative (where every house caters for one child) (Zaid, 2017; Onoyase, 2010).

- Regular census of *Almajiri* schools. *Almajiri* schools should be recounted on regular basis to aid effective policy making and implementation
- Western schools should be improved and made more accessible to the poor, including the *Almajiri*.
- Mobilization of the public. The public should be more educated and aware on the pros and cons of *Almajiri*, the underlying problems, and the way forward (Amzat, 2008).
- Enrollment of *Almajiri* into Integrated Schools. More *Almajiri* Integrated Schools should be created and made in accordance with traditions of the communities affected (Isah, 2013; NRN, 2013; Creative Associates International, 2015; Shittu and Olaofe, 2015; Zaid, 2017).
- Community/ traditional leaders (Mallams and Sarakuna) participations. There is no any intervention that can be successful in the North without the consent of support of traditional leaders. Several new interventions have proved successful with the help

of traditional leaders, for example, indirect rule, resolving noncompliance to immunization, zakat and endowment policies, maintenance of peace, etc. There is a huge role those leaders can play.

- The wealthy and the government should wake up to fight poverty decisively (Charles and Osah, 2018).
- There should be laws that cater for rights and conditions of *Almajiri*.

16. CONCLUSION

Presently, *Almajiri* system and adherents are suffering from diverse health problems, which may in turn affect the public negatively.

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Chapter –II

02

EFFECTS OF NATIVE HAUSA LANGUAGE AS LANGUAGE OF INSTRUCTION ON ATTITUDES TOWARDS BIOLOGY AMONG SECONDARY SCHOOL STUDENTS IN SOKOTO STATE, NIGERIA

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ABSTRACT:

Biology is one of the school subjects in Nigeria in which students are performing below expectations in Senior Secondary School Certificate Examination conducted by NECO and WAEC. Therefore, this study investigated the effect of Hausa language as medium of instruction on attitudes of students towards Biology in Sokoto state, Nigeria. 186 students were randomly assigned as control (English instruction) and experiment (Hausa instruction) groups respectively. Significant difference was found between the two groups in the mean scores of attitudes towards Biology $-t(368) = 4.600, P < 0.05$. Also, there was significant difference between the male and female students of the experimental group in attitude towards Biology $-t(184) = 2.648, P < 0.05$. The study concluded that the use of Native Hausa language as a medium of instruction in Biology enhances performance and attitudes among students.

Keywords: Biology, attitudes, Hausa language, experiment, control.

1. INTRODUCTION

Presently, Science and Technology have become an integral part of world culture stirring growth and development. Any country that plays with Science and Technology is doing at its own peril. Science imparts knowledge of environment and physical objects around us, and ability to manipulate them to the benefits of mankind (Wushishiet *al.*, 2016). It makes innovations that make life easier. That is why; there is constant demand for enrollment of students into Science, which could only be profitable if there are good attitudes motivating the students (Hussainiet *al.*, 2015).

An attitude refers to predisposition to classify things, to react to them with evaluative consistency (Sakariyauet *al.*, 2015). It might be any concept that shows individuals or groups feelings of dislike or like towards a particular thing (Hussainiet *al.*, 2015). Attitude is formed due to some kinds of experiences or learning. It can frequently change or remain unaltered overtime, but usually amenable to deliberate or accidental motives of change (Sakariyauet *al.*, 2015). Attitude can incite negative behaviors or actions. It can also trigger positive behaviors or actions depending on the motives that are ready

to incite the change (Sakariyau *et al.*, 2015). That is why attitudes have been subjects of exploration among scholars and researchers, more especially the Science educators (Khan and Ali, 2002; Hussaini *et al.*, 2015). In Nigeria, several studies have echoed low enrollment and poor performance of students in Science, biology inclusive, because of poor or negative attitude (Hussaini *et al.*, 2015)

One significant factor that is crippling the development of science or biology education is the use of foreign English language as medium of instruction (Agbedo *et al.*, 2012; Okonko, 2016). To avail the issue of language barrier, the National Policy on Education (1970), recognized the importance of mother tongue, major languages, community language (Okonko, 2016). Hussaini *et al.*, (2016) recognized the significance of using Hausa language to teach Biology for secondary school students in Birnin Kebbi, Kebbi state, Nigeria. Therefore, the objective of this paper was to study the effect of Hausa language as medium of instruction on attitudes of students towards Biology in Sokoto state, Nigeria

2. MATERIALS AND METHODS

STUDY DESIGN

The study design utilized for this research was an Experimental study, consisting of control and experimental groups subjected to different interventions.

POPULATION OF THE STUDY

The population for this study comprises all the senior secondary school students across the Sokoto state, Nigeria with a total number of 21,367 students.

SAMPLE AND SAMPLING TECHNIQUES

The sample consisted of 370 SS2 (senior secondary school) students which were drawn using stratified sampling fashion.

RESEARCH INSTRUMENTS, DATA COLLECTION AND ANALYSIS

Valid, reliable instruments were used according to Ashafa (2015). The instruments are: BATIHL (Biology Achievement Test in Hausa Language), BATIEL (Biology Achievement Test in English Language), and BAS (Biology Attitude Scale). During the study, Control group was taught Biology using English, and Experimental group was taught using Hausa Language; and they were evaluated. Then, the results were analyzed using SPSS version 16.

3. RESULTS AND DISCUSSION

Table 1: Descriptive statistics of the study groups

Group	Number(N)	Df	Mean	Standard Deviation (SD)
Experimental	186	368	58.16	15.27
Control	184		43.75	12.21

From table 1, the descriptive statistics of the study was shown. There are 186 students in the experimental group, and 184 students in the control group. The degree of deviation was 368, and the mean scores were 58.16, and 43.75 for Experimental and Control groups respectively

Tale 2: T-tests analysis of the posttest scores of the study groups in Sokoto, Nigeria

Group	Number(N)	Dyf	Mean	Standard Deviation (SD)	t-cal	Sig(2 tailed)
Experimental	18 6	368	58.16	15.26	-	0.273(s)
Control	184		43.75	12.30	1.098	

Table 2 reports the t-test analysis of the scores of the students taught in Biology using English and Hausa Native language. It was revealed

that, there is significant difference between the control and experimental groups, hence the Native Hausa language increases the scores/ increases achievement of students taught in Biology.

Table 3: t-test analysis of the difference in the attitudes of students taught Biology using native Hausa and English Languages in Sokoto, Nigeria

Group	Number (N)	Df	Mean	Standard Deviation (SD)	t-cal	Sig(2 tailed)
Experimental	186	368	83.26	9.01	4.600	0.000(s)
Control	184		78.53	10.7		

Table 3 reports the t-test analysis of attitudes of students taught Biology using Hausa and English languages. The analysis revealed that, there was significant difference between the control and experimental groups.

Table: 4 t-test analysis of the difference in the attitudes of male and female students taught Biology in Hausa Language in Sokoto, Nigeria

Group	Number	Df	Mean	Standard	t-cal	Sig(2
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	(N)			Deviation (SD)		tailed)
Male	109	184	82.2	9.42	2.648	0.008(s)
Female	77		79.30	10.9		

Table 4, reports the t-test analysis of the difference in the attitudes of male and female students taught Biology in Hausa Language in Sokoto, Nigeria. It was indicated that, male and female students taught in Biology using Hausa differ in attitudes towards Biology, with males having more positive attitudes. This was in agreement with the findings reported by Mustapha (2015), that males expressed positive attitude to Biology than their counterparts.

English language has been adopted as national language, which served as medium to teach students in the country. However, the teaching of students in English has been recognized as one of the issues dwindling the progress of education in the country (Usman, 2004; Osunro and Egbeji, 2015; Husainiet *al.*, 2018). Biology is a core Science subject, which most courses, especially the health sciences. Thus, it is always required for national development and growth. To circumvent the poor biology performance, there is need to

study the attitudes of students to the subject when taught in Hausa language. These study findings revealed positive attitude towards the biology, when taught in Hausa language.

From the findings of this study, it can be inferred that, teaching secondary schools students using Native Hausa language increases their scores, and attitudes. It is in agreement with findings of Nasr and Soltani (2011), who reported that makes have more positive attitudes towards Biology. Whereas, Protokopet *al.*, (2011) reported that girls expressed more positive attitudes to Biology than males.

4. CONCLUSION

From the outcomes of this study, it could be said; students taught Biology in Hausa performed better than those taught in English language, and exhibits better attitudes.

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Chapter-III

03

BASICS OF TAMSULOSIN

DRUG: A REVIEW

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ABSTRACT:

Tamsulosin hydrochloride (Flomax), a selective alpha-1 adrenoceptors antagonist was an initial drug of choice to treat lower urinary tract symptoms (LUTS) suggestive of benign prostatic hyperplasia (BPH). Tamsulosin selectively blocks subtypes alpha-1a and 1d adrenoceptors found in the external sphincter of the bladder, prostate, and urethra which lead to decrease smooth muscle tone of the bladder neck and prostate and eventually reverse LUTS associated with BPH. Other basics of tamsulosin were discussed in this paper.

Keywords: Tamsulosin, lower urinary tract symptoms, benign prostatic hyperplasia, diabetes mellitus, bladder, alpha receptors.

1. INTRODUCTION

Tamsulosin is an oral drug manufactured in Netherland by Yamanouchi pharmaceutical (now part of Astellas pharm.). The drug is used in men for the treatment of lower urinary tract symptoms (LUTS) suggestive of benign prostatic hyperplasia (Schulman, 2008). This paper will discuss the basic properties of tamsulosin drug.

2. PHARMACODYNAMICS PROPERTIES OF TAMSULOSIN

Tamsulosin is an alpha 1-adrenoceptor blocker with specificity for the alpha-1A and alpha-1D. Alpha-1 adrenoceptors are subtypes into alpha-1A, alpha-1B, and alpha-1D (Dikko, 2019). The mRNA expression of alpha-1A and alpha-1D subtypes are predominant in the smooth muscle of the prostate and urinary bladder neck respectively, while alpha-1B are more predominant in the vasculature (Dikko, 2019). Selective antagonizing of alpha-1A and 1D adrenoceptors by tamsulosin causes the prostate smooth muscle and destructor muscle of the bladder to relax thereby improving urine flow and prevents storage symptoms (Lyseng-Williamson *et al.*, 2002). Tamsulosin was found to have minimal effect on alpha-1B adrenoceptors found predominantly in the vasculature; this makes tamsulosin to have less effect on cardiovascular parameters.

In a study conducted, tamsulosin was reported to have roughly 10 times higher affinity for the alpha-1A than alpha-1B (Neill *et al.*, 2008). In another study, the efficacy of tamsulosin on alpha-1 adrenoceptors subtypes was shown to be alpha-1A= alpha-1D>alpha-1B (Oyama *et al.*, 2014). In radio ligand binding studies,

tamsulosin was shown to have selectivity for alpha-1A and alpha-1D adrenergic receptors more than alpha-1B adrenergic receptor. Lyseng-Williamson *et al.* (2002) showed the selectivity of tamsulosin to alpha-1A receptor was greater than to alpha-1B and higher than to alpha-1D.

Noble *et al.* (1997) investigated the effect of tamsulosin on alpha-1A and alpha-1D adrenergic receptor subtypes in human and Wistar rats. The author found out that tamsulosin exhibited high affinity as a competitive antagonist on the alpha-1D receptor of rat aorta, with lower affinity as a competitive antagonist for the alpha-1B receptor of the rat spleen. In conclusion, the data showed that tamsulosin higher affinity antagonism on alpha-1 adrenoceptors was $\alpha 1D > \alpha 1A > \alpha 1B$. Tamsulosin has a relatively high affinity for alpha 1A- and alpha 1D-adrenoceptors compared to the alpha 1B-adrenoceptor (Oyama *et al.*, 2014) but exhibits only a relatively small 3.3-fold greater affinity for the alpha 1A- over the alpha 1D-adrenoceptor subtypes (Dikko, 2019).

3. PHARMACOKINETIC PROPERTIES OF TAMSULOSIN

Tamsulosin oral absorption is 90% with a bioavailability of

almost 100%. Tamsulosin is 94-99% protein bound mostly to alpha-1 acid glycoprotein and it has volume of distribution of 16L after intravenous injection which confines to extracellular fluid (Franco-Salinas *et al.*, 2010). Tamsulosin is metabolized in the liver by CYP 450 enzymes (2D6 and 3A4) with negligible first-pass effect. Several of its glucuronide and sulfate metabolites are significantly inactive. After a single dose administration of the tamsulosin (0.4mg) in healthy volunteers, the elimination half-life was 9-13 hours while in the elderly patients it was 14-15 hours. Tamsulosin is excreted as water-soluble through the renal route with 8.7-14% excreted as unchanged drug. Excretion of tamsulosin in healthy volunteers receiving 0.2mg oral dose was 76.4% and 21.4% through urine and feces respectively (Franco-Salinas *et al.*, 2010).

4. EFFECT OF FOOD ON TAMSULOSIN

Tamsulosin when administering with food, the time to reach maximum concentration increases to 6 hours when compared to 4 hours in a fasting condition. The effect of food on the cardiovascular safety of tamsulosin modified release capsules in fasted and fed elderly subjects were studied using single and multiple doses of

tamsulosin. In the study, it was shown that vital signs were more influenced in the fasted than in the fed condition. Tamsulosin absorption during fasting condition was rapid and extensive compared to feed condition.

This would lead to a reduction in time to maximum plasma concentration and an increase in maximum plasma concentration and area under the curve (Michel *et al.*, 2005a). Also it was reported that when tamsulosin was taken in fasting condition, maximum plasma concentration and area under the curve (AUC) increased by 70% and 30% respectively (Michel *et al.*, 2005b). Such pharmacokinetics changes may exaggerate tamsulosin adverse effects in fasted condition such as dizziness, headache, palpitation, tachycardia and orthostatic hypotension (Michel *et al.*, 2005b).

5. URODYNAMIC PROPERTIES OF TAMSULOSIN

Tamsulosin blocks alpha-1A and alpha-1D adrenoceptors in the smooth muscle of the prostate thereby relaxing the smooth muscles and increasing the urinary flow rate. Similarly, blockade of alpha-adrenoceptors in the sympathetic nervous system and spinal cord by tamsulosin causes a reduction in detrusor muscle

contractions thereby relieving storage symptoms of the bladder(Fonseca and Martins da Silva, 2015). Tamsulosin was also found to be effective in preventing post-operative urine retention (Madani *et al.*, 2014). Lo, (2010) showed that tamsulosin is ineffective for treating overactive bladder in women with lower urinary tract symptoms, but terazosin was showed to be effective in improving female lower urinary tract symptoms especially in those with frequency and straining (Dikko, 2019).

6. THERAPEUTIC EFFICACY OF TAMSULOSIN

Tamsulosin improved the symptoms score largely when used in patients with mild to severe LUTS. A 12-week study of treatment with a daily dose of tamsulosin 0.4 mg as compared with placebo was conducted. In the study, tamsulosin improved symptom scores significantly higher in men on tamsulosin than in men on placebo. In another study, tamsulosin was found to significantly improve symptom scores and peak flow rate of urine at both 0.4mg and 0.8mg doses (Neill *et al.*, 2008; Dikko, 2019).

7. TOLERABILITY OF TAMSULOSIN

Tamsulosin is well tolerated in the long term studies in

patients with LUTS (Kawachi *et al.*, 2010). The most common adverse effects occurred is abnormal ejaculation, others are headache, dizziness, asthenia and orthostatic hypotension. A case report from the database of the Netherlands pharmaco vigilance center and World Health Organization (WHO) database for adverse drug reactions have linked liver disorders with the use of tamsulosin. Tamsulosin use could cause iris floppy syndrome during cataract surgery (Wu *et al.*, 2016). Cooney *et al.* (2012) showed that tamsulosin use has no significant difference in mydriasis of patients when compared with the controls (Dikko, 2019).

8. DOSAGE AND ADMINISTRATION

Tamsulosin is used for the treatment of BPH. The usual dose is 0.4mg once daily after a meal, and the dose may be increased to 0.8mg once daily for the patients who fail to respond to the 0.4mg dose after 2-4 weeks of treatment. The capsule should not be crushed as this affect the modified release tamsulosin. It should be taken after the same meal each day to produce consistent plasma drug concentration (Dikko, 2019).

9. TOXICITY DATA OF TAMSULOSIN

Available toxicity study data of tamsulosin show that tamsulosin has little or no toxicity. In an acute toxicity test that involves different experimental animals with different routes of administration, it was shown that the LD₅₀ of tamsulosin in rats (oral, intravenous and subcutaneous) was 650mg/kg, 70mg/kg and 347mg/kg respectively. The LD₅₀ of tamsulosin in mice (oral, intravenous and subcutaneous) was 1023mg/kg, 98mg/kg and 254mg/kg respectively. The LD₅₀ of tamsulosin in the dog (oral) was 1000mg/kg (Tellnt, 2004; Dikko, 2019).

10. HYPERGLYCEMIA AND TAMSULOSIN

Case reports have shown that some BPH patients developed hyperglycemia during tamsulosin use. In December 2008, the Eudravigilance database contained eleven reports of increased blood glucose in patients using tamsulosin. Similarly, the Netherland pharmacovigilance center reported that three patients with comorbidity of diabetes, hypertension, hypercholesterolemia, and BPH developed hyperglycemia when using tamsulosin (Borgsteede *et al.*, 2010). However, when tamsulosin was withdrawn from their medications, their blood glucose level returned to normal.

eHealthme, an online dynamic platform for drug safety evaluation reported that as at 12th April 2014, 2,188 patients were reported to have had side effects when taking tamsulosin hydrochloride in which two (2) of them have diabetes symptoms. Similarly, in December 2014, 7,535 patients were reported to have had possible side effects associated with tamsulosin use out of which 31 patients had moderate hyperglycemia and 80.65% of the patients developed hyperglycemia within the first month of tamsulosin use (eHealthme, 2014). Besides, in February 2017, 12,565 patients were also reported to have side effects associated with tamsulosin use out of which 45 patients (0.36%) had hyperglycemia (eHealthme, 2017). In May 2018, out of 16,828 patients that used tamsulosin, 56 (0.33%) had developed hyperglycemia (eHealthme, 2018).

11. CONCLUSION

Basic properties of tamsulosin drug were discussed in this paper.

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04

MICROBIAL DEGRADATION OF CELLULOSIC SUBSTRATES BY *BACILLUS* *SP*, *VIBRIO SP* AND *PSEUDOMONAS SP*

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ABSTRACT

Microbial degradation of cellulosic substrates like Carboxyl Methyl Cellulose (CMC), Crude filter paper and what man NO.1 filter paper and enzymatic activities were carried out in this study. For microbial degradation of cellulose, three bacterial strains were used. They are *Bacillus* sp, *Pseudomonas* sp and *Vibrio* sp. When CMC was provided as a substrate, the maximum growth was shown at 800mg level by *Bacillus* sp, *Pseudomonas* sp and *Vibrio* sp. Utilization of What man No.1 filter paper at 400 mg level was found to be the most optimum for *Bacillus* sp and *Pseudomonas* sp followed by *Vibrio* sp. The use of Crude filter paper as a substrate recorded the higher growth rate at 400mg level by *Bacillus* sp followed by *Pseudomonas* sp and *Vibrio* sp. In enzymatic studies, when CMC was provided as a substrate, the maximum combined glucanase synthesis was recorded at 400mg level. The crude filter paper revealed the maximum combined glucanase assay at 200mg concentration and in what man No.1 filter paper; the maximum production was shown at 600mg concentration. In all these substrates used, the enzyme activity of *Bacillus* sp was more followed by *Pseudomonas* sp and

Vibrio sp. On comparison, it was noted that all the three strains preferred to grow CMC first followed by what man No: 1 filter paper and Crude filter Paper. The same result was obtained in the enzyme activity also.

Keywords: Cellulose, Combined glucanase, CMC, Cellulose Powder Peotone, cellulose

1. INTRODUCTION

A prominent carbonaceous constituent of higher plants and probably the most abundant organic compound in nature is cellulose (Kasingapunet *al.*, 2000). Since a large part of the vegetation added to the soil is cellulosic, the decomposition of these carbohydrates has a special significance in the carbon cycle and the recycling of these matters is necessary to prevent pollution and to conserve natural resources (Padmaja and Leena lavanya, 2006).

Cellulose biodegradation by cellulases and cellulosomes produced by numerous microorganisms which represents a major carbon flow from fixed carbon sinks to atmospheric CO₂ is very important in several agricultural and waste treatment processes (Berner, 2003). Cellulose, the largest renewable carbon available is

frequently found in close association with other compounds such as hemicelluloses, lignin and other polysaccharide, which make its bioconversion more difficult (Person *et al.*, 1990).

A number of biomass conversion methods have been proposed and employed ranging from direct chemical methods like acid hydrolysis and pyrolysis to biological methods such as application of cellulose enzymes (Cooney *et al.*, 1978). Cellulosic degradation by acid treatment is uneconomical and yields poor products (Haper and Lynch, 1981). Microbial enzymatic hydrolysis of cellulose gives a relatively pure products with the consumption of less energy during the process (Bakare *et al.*, 2005).

Cellulolytic microorganisms produce a wide variety of enzymes which acts synergistically on their substrate (Bayer *et al.*, 1998). The bacterial cellulose is becoming a well understood multi protein complex found in cellulolytic microorganisms (Ding *et al.*, 2003).

So, an attempt was made to degrade the cellulose substrates by *Bacillus* sp, *Vibrio* sp and *Pseudomonas* sp and to determine the growth rate of these organisms by providing Carboxy Methyl Cellulose (CMC), what man No: 1 filter paper and crude filter paper

as cellulosic substrates. The production of endo and exo β 1, 4 glucanase by the above said strains were also analysed in the provided substrates.

2. MATERIALS AND METHODS

ENRICHMENT OF THE STRAINS

The selected 3 bacterial cultures were confirmed (Table 1), inoculated and enriched in Cellulose Powder Peptone Broth (CPPB). After 24hrs the cultures were streaked onto two sets of Cellulose Agar Plates and incubated at $35\pm 0.05^{\circ}\text{C}$ for 24-48 hrs.

CONFIRMATION OF THE CELLULOLYTIC ACTIVITY

After 24 hrs of inoculation, one set of plates were flooded with 0.1% congo red and kept for 10 minutes. The plates were then washed with 1M NaCl. The congo red stained the cellulose region and formed a red color. Halo zone appeared if bacteria utilizing the cellulose were found. This was considered as a positive result.

The plates could also be acidified by using 5% H_2SO_4 to arrest the cellulose activity. The cellulose region would turn to blue.

Colonies showing clear zones were picked up from the other set of plates and streaked onto nutrient slants. After bacterial growth,

they were stored at 4°C for further identification and characterization and for determining their enzyme activity.

IDENTIFICATION

The isolated cellulolytic microorganisms were subjected to the biochemical tests as charted by Sadhasivam and Manickam, 1972.

SUBSTRATE UTILIZATION

Different substrates like Carboxy Methyl Cellulose (CMC), Crude filter paper and What man No 1 filter paper were taken in 10ml of the medium in various substrate concentrations (mg levels) like 200,400 600 and 800 mg. Media with different substrates and at varied concentrations were prepared and sterilized. One ml of the culture with the same optical densities were transferred into 10ml of sterile prepared medium, homogenized well and kept for a period of 30days, at 37°C. After 30days, the growth was observed using a colorimeter at 580nm.

ESTIMATION OF CELLULOSE

After 30days, the inoculated media were subjected to the estimation of cellulose enzyme activity (Endo and exo β 1, 4 glucanase) (Sadhasivam and Manickam, 1972).

PREPARATION OF ENZYME EXTRACT

The inoculated samples were centrifuged at 10,000 rpm for 20 minutes. The cell free supernatant phase was collected and used as a stock crude enzyme solution. The standard was prepared using glucose by taking different concentrations ranging from 50 μ g to 1000 μ g/ml of distilled water.

3. RESULTS AND DISCUSSION

Among the various substrates tested for the growth of cellulolytic microorganisms at varied concentrations, CMC (Carboxy Methyl Cellulose) was found to be the best utilizable substrate by all three cellulolytic strains, followed by what man No: 1 filter paper and Crude filter paper (Table 2).

When CMC was provided as a substrate, the maximum growth was shown at 800mg level by *Bacillus*sp (1.69). The utilization of what man No: 1 filter paper at 400mg was found to be the most optimum for *Bacillus*sp and *Pseudomonas*sp (1.26 and 1.42 respectively). The use of crude filter paper as a substrate recorded the higher growth rate at 400mg level for *Bacillus*sp and *Vibrio*sp (1.69 and 1.09 respectively).

On comparison, it was noted that all the three strains preferred to grow CMC first followed by what man No: 1 filter paper and crude filter paper.

In enzymatic studies, when CMC was provided as a substrate for *Bacillus* sp, the maximum combined glucanase synthesis was recorded at 400mg level. When crude filter paper was used, the maximum combined glucanase enzyme synthesis was observed at 200mg concentration. When what man No: 1 filter paper was provided as a substrate, the maximum combined glucanase production was shown by *Bacillus* sp at 600mg concentration.

Among the various substrates used for the cellulolytic utilization at varied concentrations, CMC was found to be the best utilized substrate by all three cellulolytic strains. The growth of the *Vibrio* sp was best when CMC was used as a substrate, followed by *Bacillus* sp and *Pseudomonas* sp. This corroborates with the investigations of Stoppoket *al* (1982), who pointed out that CMC was better used by *Cellulomonas uda* as compared to microcrystalline cellulose, printed newspaper and some monosaccharide

Han and Srinivasan (1968) working on the cellulose activity

using an extreme thermophilic strain *Clostridium thermocellum* with carboxymethyl cellulose as a substrate reported that pH exerted a greater influence on enzyme secretion. The enzyme activity was optimum at neutral pH (6.5-7.0). Higher activity was observed at acidic pH (5.5), and less enzyme activity was seen in an alkaline pH.

Robson and Chambliss (1984) working with *B. subtilis* demonstrated that the production of the carboxymethyl cellulose is enhanced by the presence of sucrose, maltose, glucose, cellobiose or lactose in the medium. In the present work, instead of basal salts peptone medium, cellulose powder peptone medium was used, which enhances the growth of cellulolytic bacteria. Apart from this medium, CMC, crude filter paper and what man No: 1 filter paper was added at varied concentrations as a carbon source, to check the cellulolytic strains ability to produce the cellulose enzyme. The net result showed that the production of combined and exoglucanase was more.

The present work shows that cellulose can be utilized as inexpensive substrates for the production of cellulose enzyme from different microorganisms. This would reduce the cost of the production of cellulose enzyme.

To further reduce the cost of the process, the unfermented sugars and other products obtained from the fermenter used for enzyme production as well as the effluents from the fermentation of hydrolyzed, can be used to get biogas.

Table 1. Biochemical characteristics of cellulolytic bacteria.

BIOCHEMICAL TESTS	BACILLUS SP	VIBRIO SP	PSEUDOMONAS SP
MORPHOLOGICAL CHARACTERISTICS	G+. rods	G - rods	G- rods
Gram Staining	Motile	Motile	Motile
Motility			
BIOCHEMICAL CHARACTERISTICS			
Oxidize	+	+	+
Catalase	+	+	+
Gelatin Hydrolysis	+	+	+
Starch Hydrolysis	+	+	-
Oxidation-Fermentation	Acid Gas	Acid Gas	Acid Gas
Oxidation Test	+	+	+
	-	-	-
Fermentation	-	+	- -
	-	-	
Arginine Utilization	+	-	+
Ornithine utilization	+	+	+
Fluorescence	-	-	-

Table 2. Utilization of varied cellulosic substrates by *Bacillus*sp, *Vibrio*sp and *Pseudomonas*sp at varied concentrations. (mg).

S. No	STRAINS USED	SUBSTRATE CONCENTRATION (MG)	O.D RECORDED FOR BACTERIAL GROWTH IN MEDIUM CONTAINING		
			CMC	CRUDE FILTER PAPER	WHATMAN NO:1 FILTER PAPER
		CONTROL	0.54	0.45	0.39
1.	<i>BACILLUS</i> sp	200	0.72	0.89	0.91
		400	0.81	1.69	1.26
		600	1.01	0.87	0.73
		800	1.96	0.66	0.38
2.	<i>VIBRIO</i> sp	200	1.51	0.74	1.16
		400	1.09	1.09	0.83
		600	1.01	0.73	0.96
		800	1.37	0.66	0.76
3.	<i>PSEUDOMONAS</i> sp	200	0.91	0.67	0.88
		400	0.70	0.52	1.23
		600	1.36	0.48	0.48
		800	1.55	0.42	0.39

Fig 1..Production of Cellulase enzyme at varied Concentrations (mg) of CMC by selected Organisms.

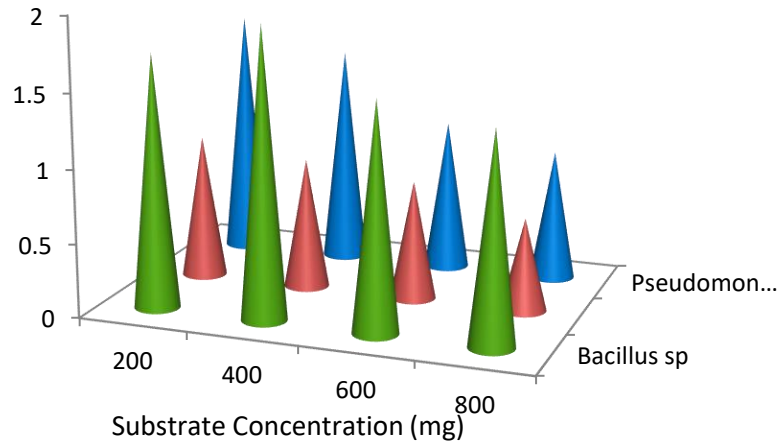
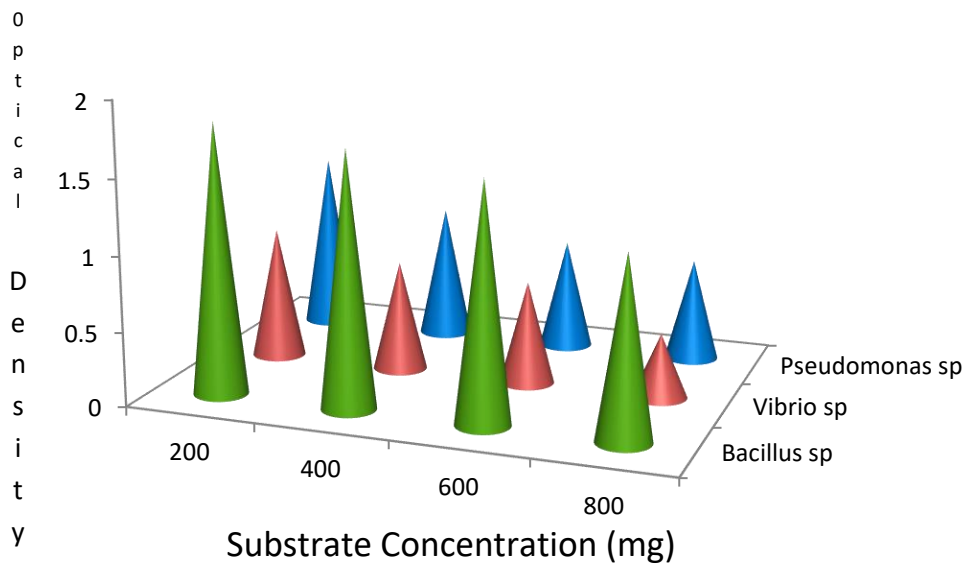
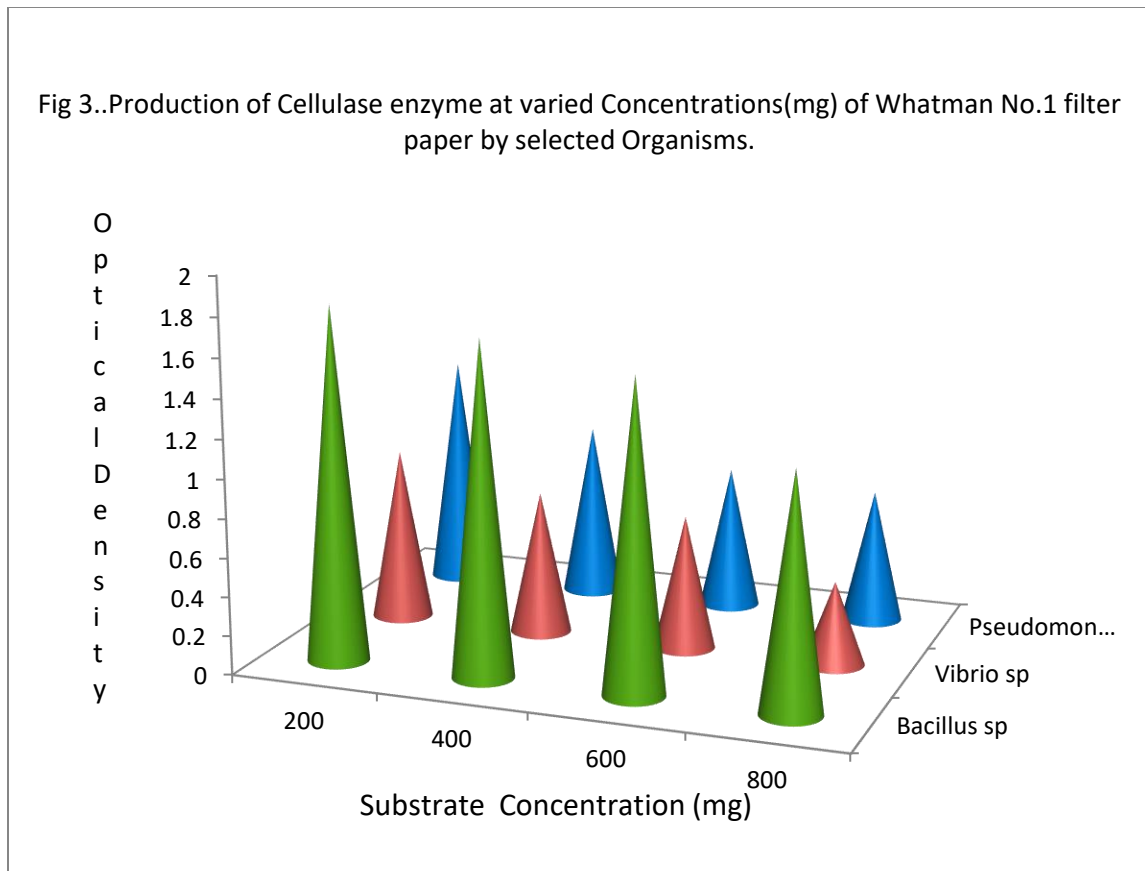


Fig 2.Production of Cellulase enzyme at varied Concentrations (mg) of Crude Filter Paper by selected Organisms.





4. ACKNOWLEDGMENT:

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Chapter –V

05

MICROFLUIDICS- A NEW APPROACH FOR ANTIBIOTIC SENSITIVITY STUDIES

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ABSTRACT

Antimicrobial sensitivity study has emerged as one of the prominent areas of research. Antibiotics, because of their destructive property have been widely used in every field wherever the threat of microbes exists. Even though antibiotics are beneficial but the uncontrollable use in various areas has created a threatening situation in disease diagnosis and treatment. Nowadays a primary investigation is required for advising a specific antibiotic to a particular disease. The conventional methods for the determination of the presence of an antibiotic and its effectiveness against a wide spectrum microbe are relatively expensive and less accurate. The development of the Micro fluidics system has become one alternate methodology for overcoming the limitations of conventional techniques used for antimicrobial sensitivity studies. This chapter aims to familiarize some micro fluidics systems used in antibiotic sensitivity studies.

1. INTRODUCTION

Antibiotic Sensitivity studies have become one of the major areas of research now. This much of wide acceptance and consideration came because of its wider application of antibiotics in infection control. Antibiotics are widely used in agriculture, food, and beverages and livestock mainly for infection control. Antibiotics provide a sustainable maintenance and growth of both plants and animals in the field of agriculture and livestock. But its wide and uncontrolled use has now developed a situation of microbial resistance against these antibiotics. Studies reported high prevalence of these chemicals in food items, soil, water, etc. This had become a major area of concern now. Extensive use of antibiotics increased the level of presence of these chemicals in food items, through which it had reaches the human body and creates a situation of ineffectiveness in treatment against microbial infections. In near future it will create a situation that no diseases can be treated with antibiotics.

Appropriate detection methodologies are needed for determining the presence of antibiotics, especially in food and beverages. WHO

had already been alarmed about the danger of uncontrolled use of antibiotics in food products. The major difficulties in the practical implementation of antibiotic sensitivity test are requirement of a higher number of samples, microbial culture and higher level of standardization procedures for the detection of such chemicals. Microfluidics procedures have now become a solution for these difficulties. Microfluidics procedures are now found to be highly effective, and it can overcome the limitations of conventional detection methods.

2. MICROFLUIDICS

Microfluidic systems represent the miniaturization of analytical chemistry processes onto a device with micron-scale features. The major advantages are portability, minimal reagent consumption and fast response time. It's a new methodology developed for the determination of bacterial growth and for antibiotic assay.

Unconventional method it takes 1-2 days for getting the results of an antibiotic susceptibility. But in the case of Microfluidics techniques, results are obtained within a short period of time. Other advantages include faster assays, increased multiplexing, smaller

volumes of microbial culture and antibiotics, increased portability for potential point-of-care use, higher sensitivity, and rapid detection methods. Micro fluidics basically involves chip-based detection, gradient generators, and antibody-based captures devices.

Now a day's antimicrobial susceptibility test (AST) remains in the mainstream of detection procedures because of the high prevalence of antibiotic resistant bacteria and its adverse effect on the treatment procedures. Molecular markers and PCR based techniques were also employed for such studies, but high degree of genetic mutation was affecting the efficiency of such test. This situation demands rapid, inexpensive, and accurate antimicrobial sensitive test. Micro fluidics techniques answer such questions.

3.MICRO FLUIDICS AND ANTIMICROBIAL SENSITIVITY TEST

Conventional methods use turbidity as a measure of growth (with a limited sensitivity of 10^7 CFU/mol); bacterial populations must grow 16–20 h before reaching a detectable level (Dalgaard et al., 1994). Thus, methods with much lower limits of detection are needed to accelerate ASTs. The field of micro fluidics promises several advantages over existing macro-scale methods (Sackmann et al.,

2014). Increased multiplexing means that many tests can be run in parallel on a single sample. Automated assays require less training for operators and improve reproducibility. The advantages of using smaller volumes of antibiotics is that the overuse of precious reagents can be avoided, and reduce costs. A smaller footprint also increases portability and potential point-of-care use. Finally, and most importantly, shorter diffusion distances and sensitive detection methods allow for faster assay times.

4. BACTERIAL GROWTH DEPENDENT MICRO FLUIDICS ASSAY METHODS

In Micro fluidics method, it confines the microbe in a particular area. Microbes are confined to a small volume (wells, channels, or chambers), captured with antibodies (coated beads or membranes), or encapsulated in agarose. The method will increase more sensitivity by decreasing the diffusion distance and allows the easier microscopic tracking of bacteria. Various Micro fluidic platforms have been developed. Some chips function as microscopy platforms (dilutions and incubations are performed off-chip) while others are almost entirely autonomous (all reagent manipulations and

incubations are conducted on-chip). Still others incorporate both microbial identification and AST into a single platform.

There exist various Micro fluidic AST approaches. The simplest chips platform includes mixing, incubation, and microscopy. Because reagent dilutions must be made off-chip before loading them onto the devices, set-up complexity is equal to the corresponding micro broth dilution methods.

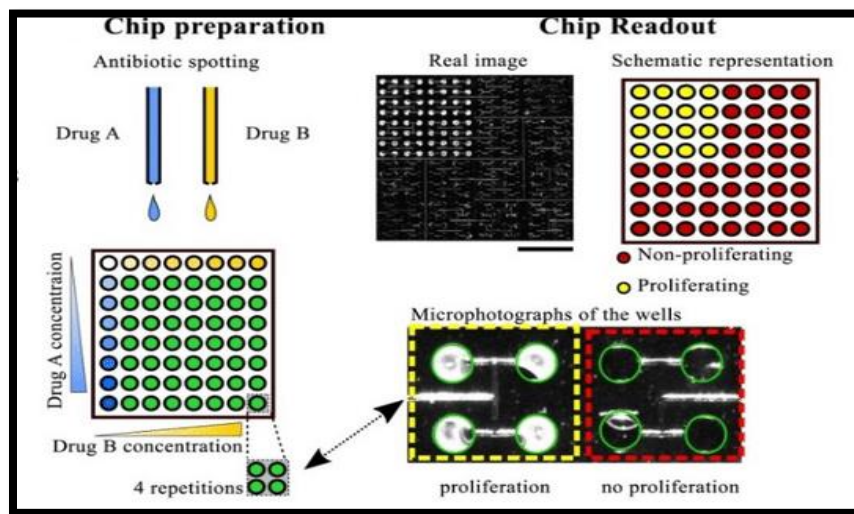


Fig. 1: Figure showing Micro fluidic chip Preparation for AST and Read out of sensitivity.

5. CHIP ALONE METHOD

In this type, a Micro fluidic AST device that utilizes negative pressure to fill channels that lead into chambers has been used. It involves a set of twelve chambers with an antibiotic channel and a

cell channel. Once both sides of chip are filled, the mixing valve is actuated to obtain homogeneous mixtures within the 3-nL chambers. This platform relies on the fluorescence detection of individual bacteria for precise quantification of bacteria.

Utilizing the above system and GFP-expressing bacteria, a group of researchers studied the interactions of poly microbial mixtures in the presence of antibiotics over time. Fluorescence images were acquired every 30 minutes over the course of the assay 16 h (Mohan et al., 2015).

The studies groups have also used GFP-expressing *Escherichia coli* to test the effects of ampicillin, cefalexin, chloramphenicol, and tetracycline alone and in combination (Mohan et al., 2013). The antibiotic efficiency against fluorescent mutants can be determined in 2–4 h. The authors emphasize the advantages of the system, including enhanced detection sensitivity, reduced reagent volumes, and increased combinatorial capabilities.

Another Chip based system was based on a Micro fluidic platform in which bacteria are loaded into channels containing pre-loaded, dried antibiotic. Three concentrations of five antibiotics (plus

controls) are tested on a single chip, giving a susceptible or resistant result. Following on-chip incubation (3 h), the four closely spaced channels are observed simultaneously by phase contrast microscopy.

A group of researchers have used this technique and found that the solution phase bacteria can settle in the micro fluidic channels and, in some cases, sink more rapidly due to morphological changes (*i.e.*, elongation). They also tested their method using 101 clinical isolates of *Pseudomonas aeruginosa* (at starting concentrations of *ca.* 10^7 CFU/mol) against a mikacin, ciprofloxacin, meropenem, ceftazidime, and piperacillin. Even though the assay is simple and does not require expensive instrumentation, different susceptibility criteria need to be defined for each drug and programmed into dedicated software (Matsumoto et al., 2016).

6. HYDRO GEL BASED SYSTEM

This method involves chips that act as incubators and microscopy platforms, which utilize agarose to immobilize the bacteria or define their growth chamber. In both cases, the diffusive properties of the agarose (to both chemicals and gases) are vital.

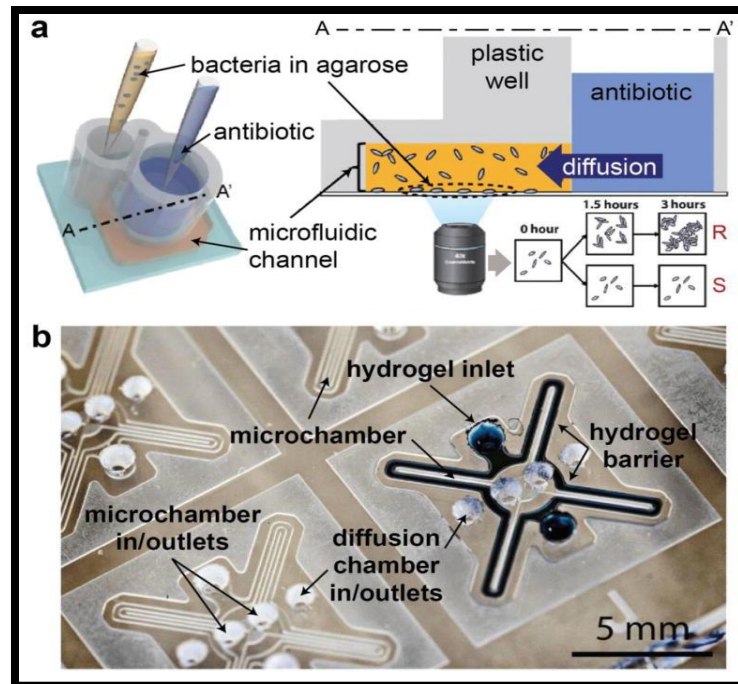


Fig .2, Figure showing use of Hydrogels in Micro fluidic AST System

Diffusion of antibiotics into agarose to measure the MIC (Minimum Inhibitory concentration) of encapsulated bacteria were developed and used effectively. In this methodology warm agarose was mixed with the bacterial strain of interest ($200 \mu\text{L}$ of 5×10^8 CFU/mol) before being introduced into a central inlet and spreading into six radiating channels. Once solidified, antibiotics at different concentrations were then introduced in the side-branched channels and diffused into the agarose. The growth of individual

bacteria was then monitored over time at the interface of the two channels using Bright Field Microscopy, and processed images were used to determine MICs within 3–4h (Choi et al., 2013).

An advanced system of the same was developed recently. In this the efficiency of system was increased by developing a micro fluidic chip in which bacteria is mixed with agarose (10^7 CFU/mol) into thin, flat slabs surrounding liquid sample wells in a 96-well plate format. It improved the accuracy of the image analysis by including morphological changes in the characterization.

Researchers used this new system to test four CLSI strains (The Clinical and Laboratory Standards Institute) and 189 clinical isolates, including extended-spectrum beta-lactamase positive *Escherichia coli*, Imipenem-resistant *Pseudomonasaeruginosa*, methicillin resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococci* from hospitals. Including morphological changes in their analysis reduced their major error rates from 12.8 to 0.9% for *E. coli* and from 48.1 to 13.7% for *Pseudomonas aeruginosa*.

Accurate MICs can be determined from imaging just 10–20

bacteria for 3–4 h; however, high initial bacterial concentrations are still required, and an auto-pipetting system is needed to load bacteria and pre-made antibiotic solutions into the chip (Choi et al., 2014).

A novel methodology which utilizes hydrophilic phase guides to direct the passive and autonomous capillary priming of hydro gel into a micro fluidic chip. The hydro gel forms a diffusive barrier that defines the growth chamber and allows for the diffusion of oxygen, antibiotics, and other reagents. If the outer chamber is filled with media, the device can also operate in anaerobic mode.

Some workers tested the growth of *Escherichia coli*, *Bacillus amyloliquefaciens*, and *Enterococcus faecalis* in growth chambers that were surrounded with agarose that contained ampicillin or gentamicin at concentrations varying between 0 to 128 µg/mL. After 3h incubation with the antibiotics, fluorescent reagents (Syto 9 and hexidium iodide) were added to determine the number of bacteria, their phenotype, and their Gram type.

The researchers also showed that their device supports enzyme assays and continuous shearfree culturing *Saccharomyces cerevisiae* (Puchberger-Enenglet al., 2015).

7. GRADIENT GENERATOR SYSTEMS

A new development in the field of Micro fluidic AST platforms is the inclusion of additional functionality of on-chip gradient generation. Such devices can utilize channels, micro fluidic traps, or hydro gel slabs to generate either discrete or continuous gradients. Because the antibiotic dilutions are made on-chip, these methods have the advantage of simplified off-chip assay preparation.

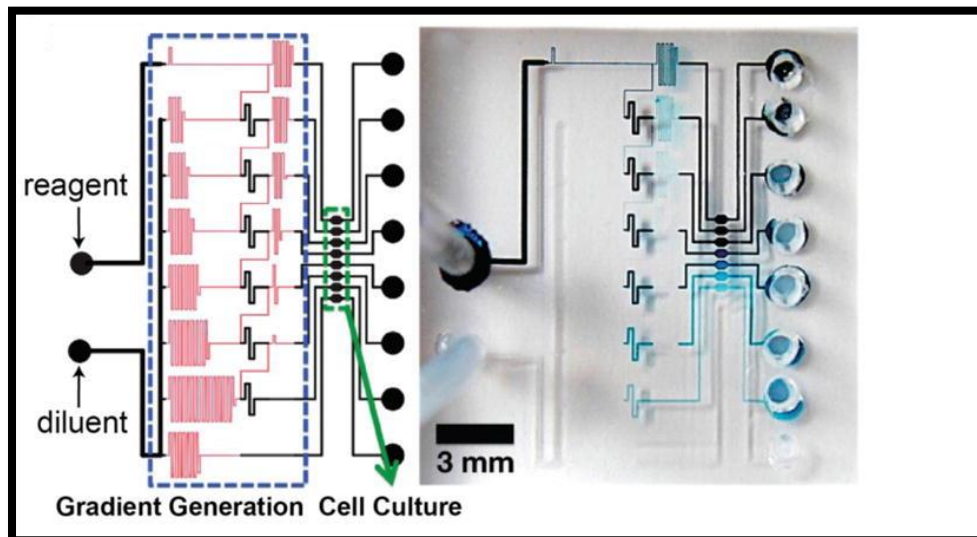


Fig .3, Figure showing Gradient Generation in Micro fluidic System

One among this methodology is the concentration gradient-forming micro fluidic AST platform that tracks the number of bacteria within eight growth chambers.

Bacteria (5×10^5 CFU/mol) mixed with an antibiotic of interest and a buffer is injected into the two input ports, and a concentration gradient is generated *via* automatic or manual pressure. The number of bacteria in each 30-nL chamber is then monitored over time using standard phase contrast microscopy.

This methodology is used to test the responses of a model *E. coli* strain against ampicillin and streptomycin and can determine their MICs within 3 h. Though the platform is simple, a humidified incubator is required for their assay and further experiments are needed to generalize the cell counting method (Kim et al., 2015).

In a study, researchers have used a micro fluidic AST device that measured the EC_{50} values of antibiotics against GFP-expressing *Pseudomonas aeruginosa* in a zero-flow micro fluidic chip was used. It contains 14 chambers of antibiotic metering channel, for concentration gradient formation, and a cell channel (3.5×10^8 CFU/mol). Once both sides are filled, mixing valves are actuated to obtain homogeneous mixtures within the 8-nL chambers. In keeping with standard AST methods, fluorescence images are acquired at 16, 20, and 24 h.

The researchers used GFP-expressing *Pseudomonas aeruginosa* to test the effects of gentamicin and ciprofloxacin. (Dai et al., 2015). Advances in the technology paved the way to the development of a different type of gradient-forming micro fluidic platform. In this method a chip which utilizes the passive capillary action of hydrodynamic traps to meter, merge, route, and store nL - sized samples. This biphasic chip allows them to load bacteria and generate an 11-point dilution series in just five pipetting steps.

In a study, researchers had used the above system to determine the reduction of reassuring as a read-out for viable bacteria, and measured fluorescence using a gel imager after 4 h of incubation at 37 °C. For proof of principle, ampicillin was diluted on chip to generate concentrations between 47 and 0.3 µg/mol and was tested against a model strain of *Escherichia coli* (at a starting concentration of 5×10^5 CFU/mol). The chip was designed to give a dilution ratio of two but diluted the sample by 1.68-fold. The researchers acknowledge that if other dilution ratios were required for an assay, the geometry of the channels and traps would need to be engineer accordingly (Derzsi et al., 2016).

8. HYDRO GEL BASED GRADIENT GENERATION METHOD

The diffusive and immobilizing properties of agarose were used to accomplish gradient generation on-chip. Such approaches generate continuous rather than discrete gradients, with antibiotic concentration corresponding to distance. The need to generate fresh agarose slabs (with or without bacteria) at the beginning of each experiment increases the set-up complexity.

The platform that tracks the growth of bacteria immobilized within a linear concentration gradient of antibiotic to provide growth curves as functions of time and antibiotic concentration were used. Here encapsulated bacteria (5×10^6 CFU) in an agarose gel within a commercially available micro fluidic chamber and used phase contrast time-lapse photography to acquire (average grey scale) data for 2.5–4 h.

This method was used in a study to analyze the responses of *Escherichia coli*, *Streptococcus aureus* and *Salmonella typhimurium* to five different classes of antibiotic, obtaining MIC values and bacterial growth rates at sub-MIC concentrations. One

advantage of this system is that it exempted the need of pre-labeling the bacteria for detection. Also measuring the growth inhibition of antibiotics over a continuous gradient (rather than in discrete two-fold increments) can give more finely tuned MIC values and makes the method impervious to changes in CLSI standards (Hou et al., 2014).

For determining the growth of single bacteria exposed to different concentrations of an antibiotic, a three-layer micro fluidic device was recently developed. Bacteria ($3 \mu\text{L}$ of *ca.* 4×10^7 CFU/mol) are sandwiched between a glass slide and thin agarose membrane while two parallel channels in the top PDMS layer (source and sink) generate a linear concentration gradient across the device.

In a study this methodology was used to track the morphological changes of single *Escherichia coli* against amoxicillin for 5 h to quantitatively measure antibiotic inhibition over time. Using this methodology, researchers were able to determine the effects of amoxicillin against *Nitrosomonas europaea* in four days (rather than the weeks it takes in culture). All tests were performed at room temperature, eliminating the need for bulky microscope

heaters, and making the assay more comfortable for point-of-care applications (Li et al., 2014).

9. ON CHIP PAPER MICRO FLUIDICS

This methodology involves multiplexed testing of multiple antibiotic dilutions with a single sample addition step. The paper-based test offers several advantages including low sample volume requirement and lack of need for humidity control during incubation, an innovation that addresses a key limitation of conventional paper-micro fluidic devices. Examples of paper-micro fluidic AST approaches include a paper-poly dimethyl siloxane (PDMS) hybrid disk diffusion culture device, 18 a paper-PDMS cell culture array and a paper-based β -lactamase test.

10.PAPER-MICRO FLUIDIC AST METHOD

It mainly consists of a sealable paper-based test chip that provides visual susceptibility readout. Printed wax channels allowed for antibiotics and growth sensitive dye to be pre dried in spatially separate zones on the test chip, thereby enabling multiplexed testing of multiple antibiotic concentrations with a single sample addition step (Ruisheng et al., 2021).

It mainly consists of hydrophobic wax channels which create a network of test zones to enable susceptibility testing at multiple antibiotic concentrations with a single sample. Serially diluted antibiotics along with the colorimetric redox indicator resazurin were predried in the test zones. Bacterial cultures are then allowed to be incubated in the presence of a specific antibiotic concentration in each test zone. The indicator resazurin is reduced into resorufin by metabolically active bacteria, which provides a visual indication of bacterial growth when the test zone antibiotic concentration is insufficient to inhibit growth (i.e., below MIC). When considered collectively, the number of “positive” test zones exhibiting colour change is correlated with the bacterial strain’s MIC value and susceptibility category.

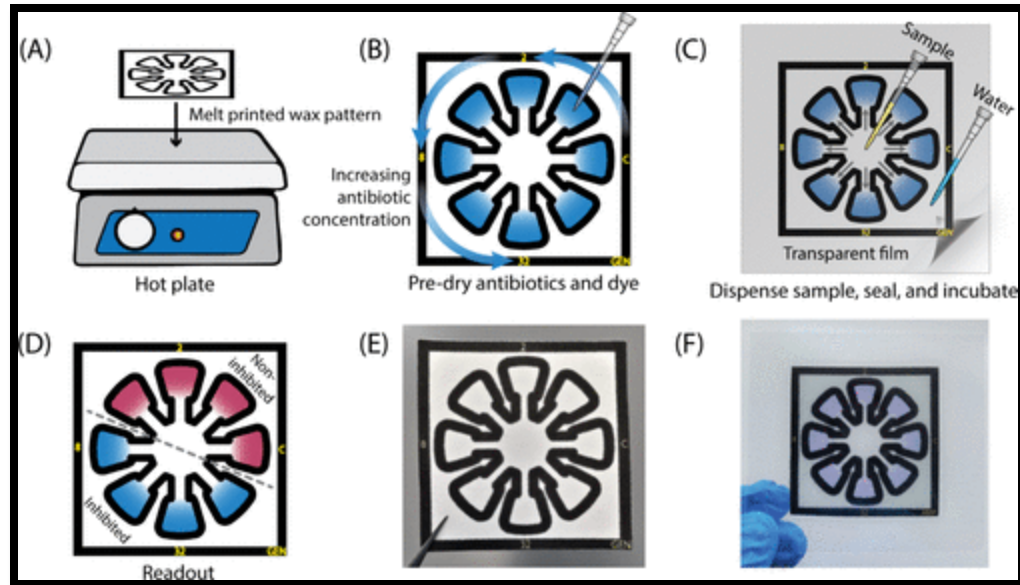


Fig .4, Figure showing Paper-Microfluidic AST method

11.DIGITAL MICRO FLUIDICS (DMF)

A DMF chip consists of a grid of small electrodes to discrete droplets of sample. DMF is widely used for multiple chemical analyses processes which can be automated and reconfigured on a single device. The ability for automation and versatility of DMF devices makes them an effective methodology for on-site dairy testing of chemicals especially presence of antibiotics.

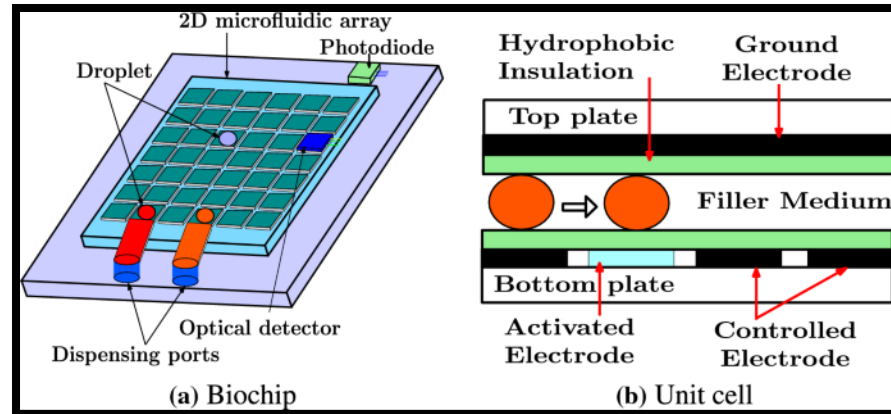


Fig.5, Figure showing DMF system.

12. CONCLUSION

The antibiotic resistance of microbes to the widely used antibiotics necessitated the need to shift to targeted narrow-spectrum antibiotic therapy. The innovative approaches in AST provide satisfactory conservation of samples and immediate generation of results. Interdisciplinary scientific approaches are required to achieve these goals, and to develop disruptive technologies that will improve patient outcomes and safeguard our antibiotics.

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Chapter –VI

06

COMPUTER AIDED DRUG DESIGN (CADD) – A PERFECT BLEND OF COMPUTATIONAL AND BIOLOGICAL SCIENCES

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ABSTRACT

Drug design is the creative process of discovering new medications based on the knowledge of the target. Traditional methodology of drug designing consumes huge capital and time. Computer aided drug designing has materialized the role of designing a drug with the progressions in science and technology. Computer Aided Drug Discovery (CADD) facilitates the design and discovery of novel therapeutics. CADD contains digital repositories or libraries providing detailed information regarding the drugs and helps in the virtual screening and identification of potential lead candidates that binds towards the target from a pool of compounds. The data source and the computational methods offer a systematic evaluation and designing a drug. Thus, Computer Aided Drug Discovery (CADD) helps in the perfect blend of Computational and Biological Sciences

Keywords: Drug, Designing, Computation, therapeutics.

1. INTRODUCTION TO DRUG DISCOVERY

A drug is a substance that is used to diagnose, treat, cure or prevent an ailment in body. Drug discovery and development has undergone a major changeover during the last 25 years. The

traditional methodology of drug discovery runs down the stream of extraction of compounds from plants (Newmann et al. 2007). Primeval method of treatment of human disease involved the distinctive use of plants and herbs. All parts of a plant/ herb/ tree were exploited for their medicinal value. However, the use of herbal medicine can cause severe dangerous side effects and can lead to allergic reactions in man. The healing process is time consuming and may not effective in case of serious illness or accidents. A prolonged consumption of herbal medicine may lead to kidney failure and liver damage as they may contain toxic chemicals or heavy metals. They possess an adverse effect to the environment as well, where it leads to risk of extinction or endangered species in near future. Hence there was a gradual move over from herbal medicines to synthetic drugs. Late 19th century witnessed extensive substitution of natural products by synthetic substances (Lourenco et al. 2012). Synthetic drugs are artificial and chemically created in the laboratory which is used to treat ailments.

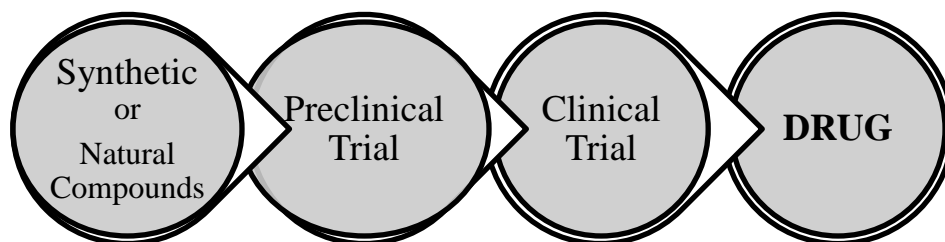


Fig.1. Traditional Methodology of Drug Designing

In United States, it takes around twelve years for an experimental drug to reach market and only five in five thousand is approved by the Food and Drug Administration (FDA), a government regulatory agency. The process of drug approval in India is governed by The Central Drugs Standard Control Organization (CDSCO) under Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India. The process of drug discovery is a tedious, time consuming, expensive and complex one. The exploitation of rationally designed drugs in clinical applications has surpassed traditional therapeutic modalities. Early detection of chronic diseases while being asymptomatic, with no signs or symptoms may lead to cure or longer survival rate. A precise and early diagnosis would indeed be the need of the hour and is therefore

an important public health strategy for effective treatment.

2. NEED FOR COMPUTER AIDED DRUG DESIGN CADD

The designed or selected molecule should preferentially be organic, should be in complementary in shape with the target molecule and should be oppositely charged to the bio molecular target to enable an efficient binding. Thus, the designed molecule interacts with the target, binds competently with the target and finally activates/inhibits the function of a biomolecule like protein (Veselovsky et al. 2014; Song et al. 2009). The process of drug designing often but not necessarily depends on computational methods. When computational methods are employed to design a drug towards a biological target, it is called Computer aided drug design (CADD).

Computer aided drug design provides a perfect combination between two important complementary disciplines - computer science and biology together unleashing the doors towards the development of potential therapeutics in health science. The renaissance and efforts of alchemists suffered a major setback due to the complexity involved in drug development, the uncertainty of

the success of the drug, the ever failure to recapitulate an entire disorder or disease in animal models and challenges in specific target identification. Advances in technology and extensive research of pharmaceutical companies aid the development of combinatorial science via Computer aided drug design.

Computer Aided Drug Design (CADD) provides a combinational framework of advanced computational techniques, biological sciences and chemical synthesis which accelerate drug discovery. The drug discovery pipeline involves the detection of the disease, identification of the cause and mechanism of the disease, target identification, mass screening (active compound selection), binding studies and searching for desired efficacy. Subsequent usage of computer aided drug design with computational tools, pre-clinical trials, clinical trials, new drug application and approval, launch of the drug in the market (Bisht et al. 2018).

The objective of CADD is to avoid random screening of numerous drugs against disease assays and to elude the toxicity of synthetic chemicals and indiscriminate use of natural products.

3. EVOLUTION AND HISTORY OF COMPUTER AIDED DRUG DISCOVERY (CADD)

The late 80's and early 90's (1880-1930) marked the establishment of pharmaceutical industries, where research was focused on creating new drugs, isolating active ingredients of cure from natural products and subjecting the same for biological assays. Towards the end of nineteenth century, Paul Ehrlich during his M.D. thesis research discovered the selective attachment of methylene blue to nerve fibers, when he was trying to stain bacteria to make them visible under microscope.

Subsequent to this experimental observation, Ehrlich inculcated his ideas towards therapeutics and chemotherapy. The transformation of Elrich's research from chemical dyes gradually moved over towards the search of chemical substances with pronounced biological effect. This marked the beginning of the concept of "Pharmacophore" –A molecular context that carries the crucial features accountable for a drug's biological or pharmacological biological.

Around 1970's, the concept of QSAR was established by it suffered a major limitation as it involved 2-dimensional and retrospecific analysis. Early 1980s noted the rise of a new era of Computer Aided Drug Discovery (CADD), combined with molecular biology, X-ray crystallography, multidimensional NMR and molecular modeling with computer graphics. The complete transformation to modern techniques like Human genome bio-informatics along with combinatorial chemistry and high throughput screening was launched in 1990's worldwide in the field of medicine.

4. CADD ASSISTED PHASES OF DRUG DISCOVERY



Fig.2. CADD assisted Phases of Drug Discovery

CADD involves three stages of drug designing process:

Stage 1: Target Identification

Target identification forms the first and foremost step down the drug discovery pipeline. It involves the creation of a heterogeneous library of small molecules to be tested against the target. This eases the process of target identification, which can be attained through literature referring, Genomic analysis and pathway analysis (OuYang et al. 2012).

Stage 2: Target Validation

The next stage after target identification is target validation, which includes an evaluation to determine the modulation of target with respect to the therapeutic effect. This step checks the specificity of the selected hits by docking at binding sites of known drugs.

Stage 3: Lead Optimization

Leads are selected hits which passes the computational ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity) profiling studies. Structure based design helps in the identification of leads. The structure of the target protein in the complex with lead molecule proposes ways to enhance the affinity of the lead towards the target. Lead optimization can be achieved by modifying their structural features.

5. CATEGORIZATION OF DRUG-RECEPTOR INTERACTION ANALYSIS THROUGH COMPUTER AIDED DRUG DISCOVERY (CADD)

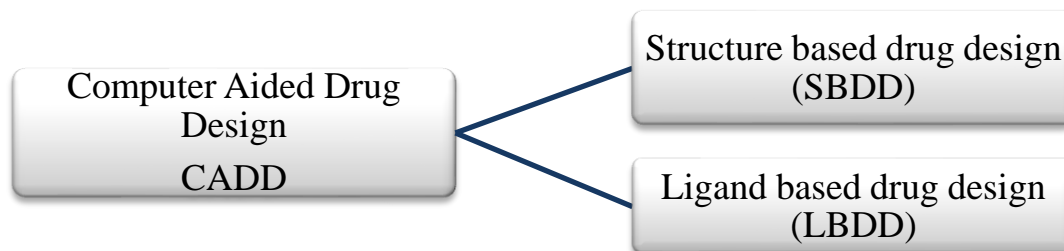


Fig.3. Approaches of Computer Aided Drug Discovery (CADD)

The two general approaches till date in Computer Aided Drug Discovery (CADD) for drug designing are

- (i) Structure based drug design (SBDD)
- (ii) Ligand based drug design (LBDD)

(i) Structure based drug design (SBDD)

Structure based drug design (SBDD) is used when the 3D structures of proteins are known. The principle of Structure based drug design (SBDD) involves prediction of binding mode and affinity of a small molecule to fit into the binding site of the target of interest (Lavecchia et al. 2013, Griner et al. 2014).

This can be achieved by Binding site identification followed by Docking and Scoring. In Structure based drug design (SBDD), with the aid of the awareness of the binding site of the 3D macromolecule, the interaction of the ligand with the protein binding sites can be predicted. Thus, in case of SBDD, the identification of the valid drug target and attainment of its structural information are the preliminary and key steps. The protein structure can be ascertained with the use of X-ray crystallography, nuclear magnetic resonance, cyro-electron microscope (EM), homology modeling and molecular dynamic simulations (Anderson. 2013; Kalyaanamoorthy et al. 2011).

The concave region containing the chemical functional groups are capable of interacting with the ligand to achieve the targeted result by activation, modulation and inhibition is considered as the ideal binding site (Anderson. 2013; Kalyaanamoorthy et al. 2011). Proteins co-crystallized with substrates or known inhibitors deliver necessary information in SBDD. Mutation studies identifying key residues also contribute in providing the knowledge in SBDD.

When no information is rendered about the binding site, added methods of analyses are employed to arrive at Structure based drug design (SBDD). At present, in silico approaches have been reported for recognizing the binding regions in proteins (Laurie et al. 2006; Zhang et al. 2011). The docking of small molecules into macromolecular structural targets and scoring their potential complementarity to binding sites are vividly used in hit identification and lead optimization. Docking of small molecules can be carried in one of the three different ways: (a) Rigid docking – in which both the target and ligand are considered rigid, (b) Flexible ligand docking – in which the target is held rigid, (c) Flexible docking – in which both the target and ligand are treated flexible.

(ii) Ligand based drug design (LBDD)

When their 3D structure of the target protein is not known, information can be abstracted from a set of ligands, which are active against the target, which may be a receptor or enzyme (Prathipati et al. 2007).

This depends on the substantial structural data and the corresponding physicochemical properties.

Thus, Ligand based drug design relies on the knowledge of other molecules that bind to the biological target of interest. It is used to develop a pharmacophore model that outlines the minimum required structural features a molecule must possess to bind towards the target molecule. Initially a model of biological target may be built on the knowledge of what binds to the target, and this model may be used to design new molecular moieties that interact with that particular target. Alternatively, a quantitative structure-activity relationship (QSAR) may be derived which correlates the calculated properties of molecules with the experimentally determined activities. This correlation can be extended to foresee the activity of new analogs (Lavecchia et al. 2013; Melo et al. 2014).

6. SUCCESS AND CHALLENGES OF COMPUTER AIDED DRUG DISCOVERY (CADD)

The advent of applicability of CADD in the development of novel and potent drugs in a tremendous breakthrough in the pipeline of drug designing process. Early 1990s perceived a successful application of CADD in the development of drugs for HIV and flu. A characteristic application of CADD is the discovery of Rlenza and

HIV protease inhibitors (Armour et al. 2006; Filikov et al. 1998; Wang et al. 1996). In the year 1990, Relenza, a neuraminidase inhibitor was licensed to GlaxoSmithKline Inc. and approved by FDA in 1999 (Woods et al. 1993). It was HIV protease inhibitors that was developed much before the development of neuraminidase inhibitors, but the launch of Relenza was indeed the need of the hour.

The first HIV protease inhibitor, Ritonavir was synthesized with sufficient oral bioavailability in the year 1991 (Krohn et al. 1991). In the year 1996, this compound places a record of being approved by FDA in 72 days. This drug was synthesized in a span of eight years which is approximately half the time required to develop a typical drug. This was made possible based on the application of structure-based approach and a faster review by FDA. Around the same time, a number of other HIV proteases were identified (Pai et al. 1999).

The following drugs stands approved to the credit of CADD: Captopril for anti-hypertensive in 1981 (Talele et al. 2010),

Dorzolamide for carbonic anhydrase inhibitor in 1995(Vijayakrishnan. 2009), Indinavir in 1996, Ritonavir in 1996, Saquinavir in 1995 for HIV (Van Drie. 2007), Triofiban for fibrinogen

in 1998(Hartman et al. 1992), Raltegravir for HIV (Schames et al. 2004), Zanamivir for Neuraminidase inhibitor in 2007 (Kim at al. 1997), Boceprevir has undergone phase III clinical trials for Hepatitis C virus (HCV) inhibitor, Nolatrexed has undergone phase III clinical trials for liver cancer (Talele et al. 2010),

TMI-005 has undergone phase III clinical trials for Rheumatoid arthritis and LY-517717 has undergone phase II clinical trials as Serine protease inhibitor (Levin et al. 2006), NVP-AUY922 has undergone phase I clinical trials as inhibitor for HSP90 and in the year 1999 (Eccles et al. 2008), Oseltamivir proved to be active against influenza A and B viruses (An et al. 2009) and Aliskiren as human renin inhibitor in 2007(Cohen. 2007).

Though CADD has come across several success stories, the complexity and the factors governing the biological systems are quite tedious and not reliable, which accounts for the limitation of the same.

With the advancements of technology, it is impossible to copy and stimulate the biological system virtually on a computer. Another setback in CADD is the target flexibility.

Most of the tools follow Flexible ligand docking – in which the target is held rigid. Thus, the protein is kept fixed with limited flexibility of the residues within or near the active site. The major disadvantage in providing molecular flexibility to the protein, increases the space and time of computation. Still research is focused to inculcate these parameters as well. In the solution phase, owing to the conformational changes, both the receptor and target molecules are confined to be flexible. Hence it is not possible to ascertain a single and rigid structure would be misleading.

7. CONCLUSION

Drug discovery aims at identification and interaction of a viable chemical substance with the relevant biological target and arrive at a cure for diseases. The entire process of drug designing is a tedious one both in terms of capital requirements and time. This rise in the complexity of drug designing is often associated with the risks associated with the clinical trials.

CADD has emerged out to be an efficient tool to identify potential lead compounds and developing possible drugs to a multitude of disease. CADD has initiated the process of designing a

drug from the scratch. Thus CADD aids in the rational drug designing and testing, speeds up the screening process, provides a focused and target directed efficient screening, integrates the testing into a design process and eliminates the failed drugs faster. The future of CADD holds the integration of computer aided chemistry and biology, in addition to cheminformatics and bioinformatics.

List of Abbreviations

CADD = Computer-Aided Drug Design

SBDD = Structure-based Drug Design

LBDD = Ligand-based Drug Design

MD = Molecular Dynamics

HIV = Human Immuno Deficiency Virus

QSAR = Quantitative structure-activity relationship

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Chapter –VII

07

PRELIMINARY STUDY ON WET LAND ANGIOSPERMS IN SELECTED PONDS OF SOORANKUDY KANYAKUMARI DISTRICT TAMILNADU SOUTH INDIA.

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ABSTRACT:

The present investigation was performed in selected ponds of Soorankudy, Kanyakumari District. The biodiversity survey on wetland pond ecosystem in the village area is analyzed and documentation of the plant diversity was done. The present investigation explores the enumeration of plant species and floristic analysis of taxa. The study is the result of intensive exploration carried out during the August 2020 - October 2020. A total number of 28 vascular plant species were recorded.

Keywords:

Wetland plants, Chinnakulam pond, Taxonomy, Vascular plants.

1. INTRODUCTION:

Aquatic and wetland plants are mostly confined to the marshes and wetland habitats. These waterlogged or wet soils form the diverse habitats for specific aquatic plant a community, which in a broader sense is known as wetland (Cowardianetal., 1979). Although wetlands cover only six percent of the earth's surface (Mitsch et al., 1993), they provide habitats for about 20 percent of the earth's total biological diversity (Gopal 1995).

In India the first comprehensive work on the wetland flora was Produced (Biswas and Calder 1984). In India very little attention used to be paid separately to aquatic plants.

Wetland supports plant species intermediate between true aquatic and terrestrial habitats (Banerjee and Venu, 1994). Wetland ecosystems typically show three characteristic ecological conditions, all of which are potential stressors for plant survival and growth: periodic to continuous periodically anoxic (hydric soils); and hydro soils with rhizospheres experiencing periods of low or no oxygen availability (Craft et al., 2005).

Village ponds are one of the most important freshwater resources in entire rural and remote regions of globe. The village ponds are of great ecological, religious, aesthetical, spiritual and mythological significance. They fulfil all the requirements in the form of fresh water, food, fodder, fuel, medicine, timber, resins etc. (Gaur, 1999; Chapman, 2001). These small aquatic ecosystems are also important for their importance in birds' migratory route as well as habitat to resident birds (Parsadet al., 2002; Sokaet al., 2013).

The first and foremost process in appreciating the biodiversity is the taxonomic treatment of living organisms. Without appropriate knowledge of the exact species composition, it will become very difficult to identify and implement conservation priorities for any ecosystem (Ragavanet al., 2016). Therefore, the present study was conducted to prepare an inventory of floristic diversity of plants found in wet periphery of village pond of Kanyakumari district in Tamil Nadu.

2. METHODOLOGY

The selection of study area is Chinnakulam pond, Vadakoor pond, Poolamputtikulam and Periyakulam in Karthigaivadali and Leppaikudiiruppu, North soorankudy, Nagercoil, Kanyakumari District. There are so many vegetation coverings, stream, channel and pond ecosystem (Raj, 2002).

3. PLANT IDENTIFICATION

Taxonomic identification, photographic documentation and ornamental characterization of each species are recorded .All the specimens collected were identified with help of recent literature by local floras (Hooker 1872-1897; Gamble and Fischer, 1915-1935;

Henry *et al.*, 1989; Mathew, 1993).The identity is authenticated and matched with type specimens available in the herbarium of Botanical Survey of India, Southern Circle, TNAU Campus, Coimbatore, Tamilnadu. The plant taxa were arranged to families according to APG IV (2016) system of classification. For all documented species, the binomial and author citation were checked thoroughly with IPNI (2012) and The Plant List Version 1 (2010) available online.

4. PLAN OF PRESENTATION OF DATA

In the present work, families are arranged according to APG IV (2016) system of classification. Under each clade, the order and the family are arranged. The species are arranged alphabetically with nomenclature.

5. RESULTS AND DISCUSSION

In the present study a total of 28 species of vascular plants were enumerated. This comprises 27 angiosperms and 1 Pteridophytes (Table - 1).

Table: 1 List of wetland angiosperms in the study area

S.N O	BOTANICAL NAME	FAMILY	TAMIL NAME	HABIT	CLASS
1	<i>Cissus quadrangularis L.</i>	Vitaceae	Perandai	Climber	Dicot
2	<i>Sida acuta Burm.f.</i>	Malvaceae	Arivalman aippun̄tu	Herb	Dicot
3	<i>Hibiscus rosa-sinensis L.</i>	Malvaceae	Sembarut hi	Scrub	Dicot
4	<i>Tradescantia fluminensis Vell.</i>	Commelina ceae		Herb	Monocot
5	<i>Senna obtusifolia (L.) H.S.Irwin&Barneby</i>	Leguminos ae	Chirutaka rai	Herb	Dicot
6	<i>Musa acuminata Colla</i>	Musaceae	Vaazha	Herb	Monocot
7	<i>Sphagneticola trilobata (L.) Pruski</i>	Compositae		Herb	Dicot
8	<i>Pancratium illyricum L.</i>	Amaryllidac eae		Herb	Monocot
9	<i>Moringa oleifera Lam.</i>	Moringacea e	Murungai	Tree	Dicot
10	<i>Senna italica Mill.</i>	Leguminosa e		Herb	Dicot
11	<i>Gomphrena celosioides Ma rt.</i>	Amarantha ceae		Herb	Dicot
12	<i>Nymphaea alba L.</i>	Nymphaeac eae	Neytarkila nku	Herb	Monocot
13	<i>Solanum mauritianum Sco p.</i>	Solanaceae		Shrub	Dicot
14	<i>Impatiens balfourii Hook.f.</i>	Balsaminac eae	Aivartenki ttumpai	Herb	Dicot
15	<i>Laburnum anagyroides Me</i>	Leguminos		Tree	Dicot

	<i>dk.</i>	ae			
16	<i>Ruellia humilis Nutt.</i>	Acanthaceae	Pottakanchi	Herb	Dicot
17	<i>Hemidesmus indicus (L.) R. Br. ex Schult.</i>	Apocynaceae	Nannari	Climber	Dicot
18	<i>Catharanthus roseus (L.) G. Don</i>	Apocynaceae	Nithyakalyani	Shrub	Dicot
19	<i>Mirabilis jalapa L.</i>	Nyctaginaceae	Andhi Mandarai	Herb	Dicot
20	<i>Acacia mangium Willd.</i>	Leguminosae		Tree	Dicot
21	<i>Ficus benghalensis L.</i>	Moraceae	Alai	Tree	Dicot
22	<i>Plectranthus amboinicus (Lour.) Spreng.</i>	Lamiaceae	Karpuravalli	Herb	Dicot
23	<i>Ocimum basilicum L.</i>	Lamiaceae	Tirunittru	Herb	Dicot
24	<i>Solanum americanum Mill.</i>	Solanaceae	Manatakali	Herb	Dicot
25	<i>Solanum virginianum L.</i>	Solanaceae	Kantankatiri	Herb	Dicot
26	<i>Clitoria ternatea L.</i>	Leguminosae	Kannikodi	Climber	Dicot
27	<i>Solanum torvum Sw.</i>	Solanaceae	Sundaikka	Shrub	Dicot
28	<i>Phegopteris connectilis (Michx.) watt</i>	Thelypteridaceae	Beech fern	Epiphytes	Ferns

Fig.1. Distribution of species in clades/ grades

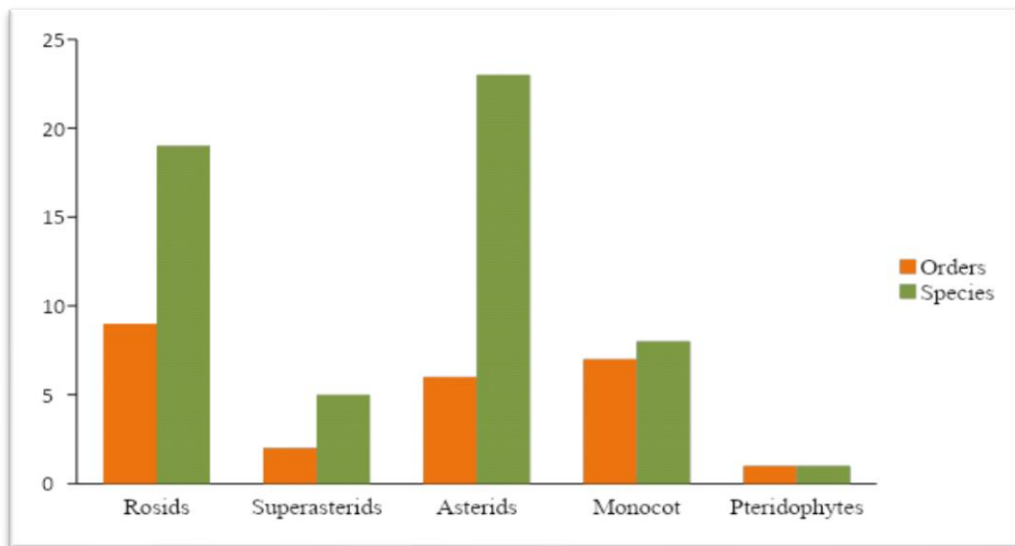


Figure 2 Distribution of species in dominant order as per APG

IV system of Classification

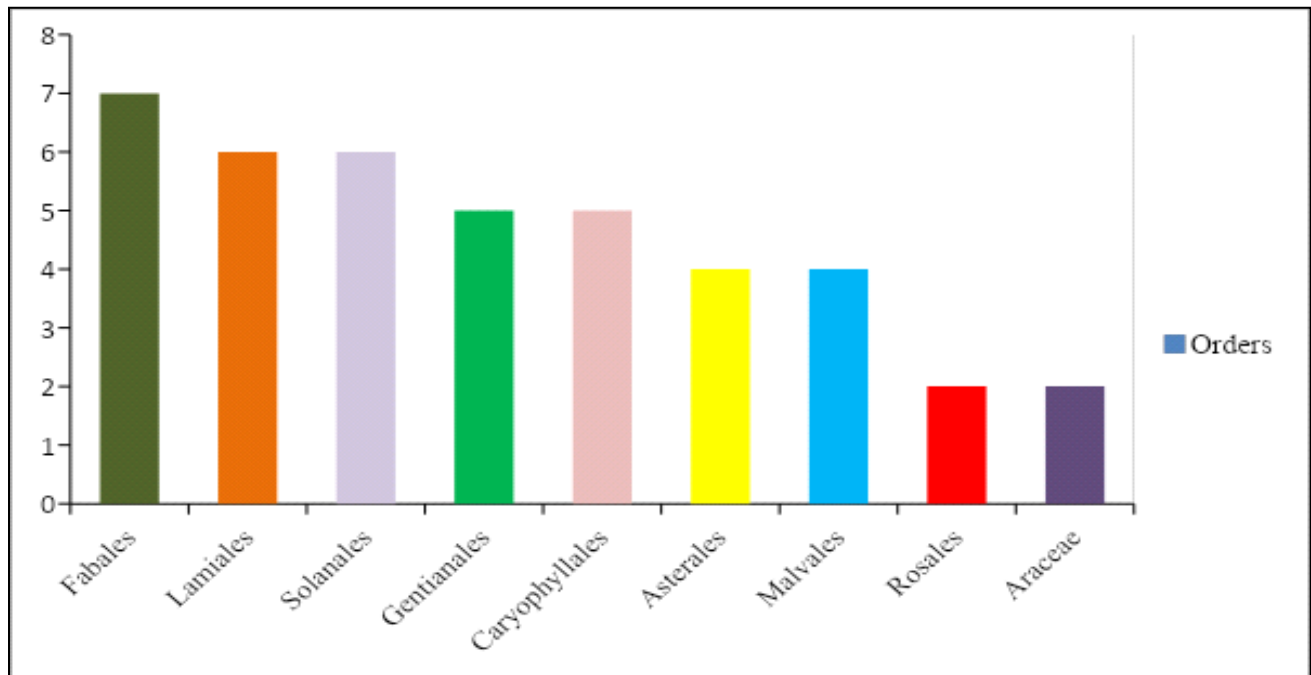
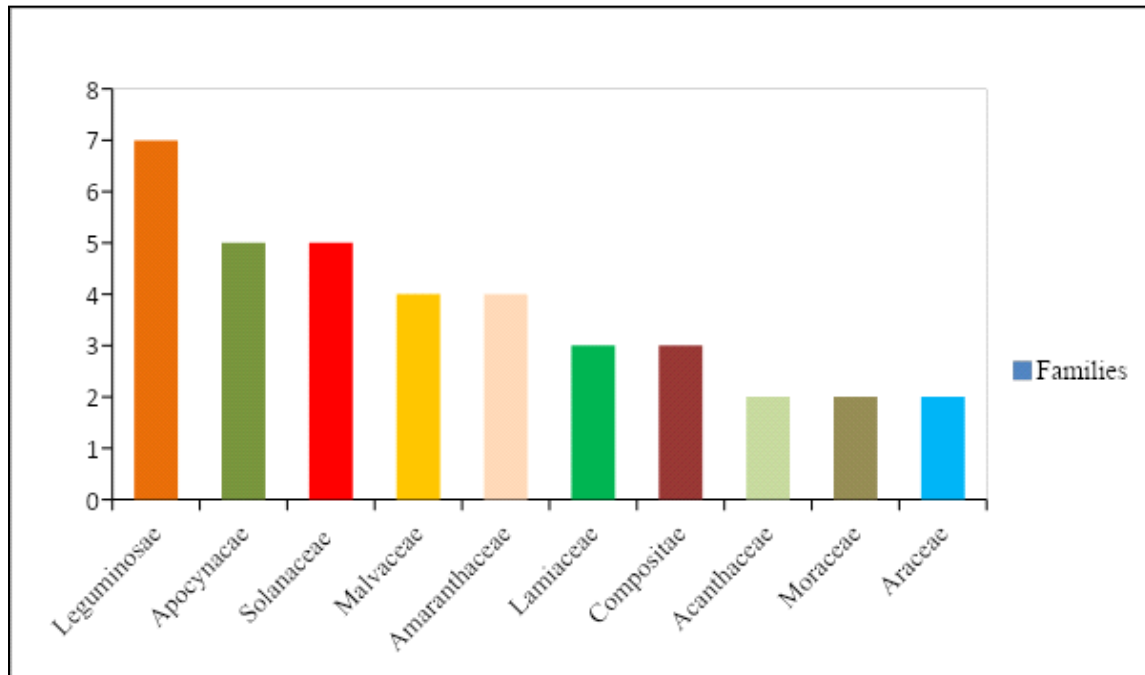


Fig. 3 Dominant plant families of wetland angiosperms

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Chapter–VIII

08

**AFFECT OF CORIANDER AND
CURRY LEAVES ON LACTIC
ACID BACTERIA IN BUTTER
MILK AS AN IMMUNO
MODULATOR**

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1. INTRODUCTION:

Milk is the secretion of milch animal to nourish the young calves which contains 87% water and 13% milk solids. The milk solids are made up of 4% fat and 9% solids non fat (snf). The 9% contains 5% lactose, 3.3% casein protein and lactoglobulin, ash content of 0.7%. Milk and milk products have a significant role in our daily life especially fermented products like curds, yogurt, cheese etc. Milk is a complete food as it constitutes nutrients such as lactose, casein, fat, minerals and vitamins.

The lactic acid bacteria comprise the most significant organisms in fermentation of milk they produce metabolites which have nutritional, therapeutic values and preservative potentials in foods. The lactic acid bacteria include *Lactobacillus* sp. and *Streptococcus* sp. These are aero tolerant anaerobes and are the bacteria devoid of catalyses and can grow in the presence of air. The lactic acid produced by the LAB makes the milk acidic and the calcium bound to casein, leads to coagulation of casein known as curd.

2. LACTOBACILLUS AND ITS CHARACTERS:

Lactobacillus is the normal flora on the skin of milch animals, certain plant products like black gram and cabbage. It can be found on certain fruits like grapes. They are Gram-positive rod-shaped bacteria which divide by binary fission and fragment by asexual reproduction. These bacteria are categorized under the family Lactobacillaceae. Such special media favours the growth of different groups of bacteria like *L. acidophilus*, *L. bulgaricus*, *L. caseii*, and various species of *Lactococcus* like *L. lactis* and *L. cremoris*. The *Lactobacillus bulgaricus* is a bacterium from Bulgaria which has characteristics to produce many probiotics and help in prolonged healthy life.

These bacteria can be isolated on artificial medium like Milk agar and Tryptone Yeast Extract Agar. Milk agar contains fresh milk or the milk powder which acts as a nutrient supplement favoring the growth of all lactose utilizing bacteria. Hence the beneficiary bacteria can grow to utilize lactose sugar to bring a desirable fermentation.

In a similar pattern the undesirable bacteria belonging to the family Enterobacteriaceae can also utilize lactose, to produce mixed

acids bringing a similar curdling of milk but it is considered to be an undesirable fermentation produced by *Escherichia coli*, *Enterobacter aerogenes*, etc.

3. FERMENTED MILK- BUTTER MILK

Milk is boiled for sterilization and cooled to room temperature and inoculated with the starter culture of *Lactobacillus* sp. and incubated at room temperature or at 37° C for curdling to occur with separation of milk solids from the whey to obtain curds or Dahi. The curd is diluted with water and subjected to churning to remove the fat. After the removal of fat, the liquid is known as Buttermilk. It contains beneficial Lactobacilli, probiotics and lactic acid.

4. EFFECT OF CORIANDER LEAVES AND CURRY LEAVES ON LACTOBACILLUS SP. AND ESCHERICHIA COLI.

The use of plant extracts in the production of fermented milk was experimented to study about the effect of the extract on beneficial Lactic acid bacteria and contaminants like coli forms.

Coriander (*Coriandrum sativum*) an annual herb in the family Apiaceae and the plant as a whole is edible, hence used in cooking.

The essential oil extracted from the leaves and seeds have anti-

bacterial and anti-fungal properties. The leaves are rich in vitamin C, vitamin A, calcium and have a fair amount of iron in them.

Curry (*Murray koenigii*) Leaves are extremely popular in Indian foods adding flavor and aroma to vegetable curries. It has a distinctive aroma, anti diabetic and anti-cholesterol property, anti-microbial activity, anti oxidative and cytotoxic activity.

The use of coriander and curry leaves extracts showed a considerable increase in the inoculums of lactobacillus for fermentation. The extracts also showed an inhibition of coli forms in the fermented milk.

CORIANDER (CORIANDRUM SATIVUM)

No of samples.	Total lactic acid bacterial count cfu/ml	Coliform count -- cfu/ml
1	230	Nil
2	200	Nil
3	250	Nil
4	235	Nil

Interpertation:

Bio curd prepared from using cow's milk fortified with the extract of Coriander was subjected to microbiological quality. The results are provided in table number. Apart from 200 to 250 cfu/ml.

Curry (*Murrayakoenigii*)

No. of samples	Total Lactic acid bacterial count -cfu/ml	Coliform count - cfu/ml
1	265	Nil
2	270	Nil
3	280	Nil
4	290	Nil

Interpertation:

Bio curd prepared from using cow's milk fortified with the ingredient of *Murrayakoenigii* (Curry) was subjected to microbiological quality. The results are provided in table number. Apart from 290 to 305 cfu/m

5. DISCUSSION:

Lactobacillus produces probiotics which can help in absorption

of trace elements in diets rich in phytate present in whole grains, nuts and legumes. It improves T cells and Natural Killer cells, improves phagocytosis and hence developing a good immune system.

A Meta analysis suggested that probiotics may reduce antibiotic associated diarrhea, decrease severity of rotavirus infection. It also helps in reducing inflammation and hypersensitivity responses, due to regulation of cytokine function. It also reduces the risk of atopic eczema in children.

Lactobacillus sp. improves symptoms of irritable bowel syndrome in women. It also improves digestive health, maintains the gut micro flora immune modulation, good bowel habits and prevents constipation. It also helps in fighting against *Helicobacter pylori*.

The probiotics in curds help in anti-ageing, anti-cancerous and also a significant decrease in allergy. Hence Probiotics are now used in Dairy products and probiotic fortified foods. It can be manufactured as tablets, capsules, powders and sachets containing bacteria in freeze dried form.

To conclude buttermilk is a product which is very useful in the Dairy products which contain beneficial micro-organisms and rich in

probiotics. It contains natural antibiotics like Nisin and such antibiotics help in creating a healthy gut and lead to longer healthy life. In addition, the extracts of coriander and curry leaves not only adds to taste and also acts as immune modulator and preserve the product in a better way as a natural preservative to kill the contaminants in the product.

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09

PROBLEM OF SAME-SEX RELATIONSHIP AMONG TERTIARY INSTITUTIONS IN SOKOTO

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ABSTRACT:

Same-sex practice or lesbianism is among the pandemic practice that is ravaging our higher institutions. It is associated with diverse array of problems, ranging from health, mental health, economic, education and related effects. Therefore, a review of the practice and its effect was described.

Keywords: same-sex marriage, lesbians, lesbianism, depression, mental problems

1. INTRODUCTION

The practice of sexual relationship or sexual attraction of woman/girl to woman/girl is dubbed as lesbianism (Atoi and Ojedokun, 2013; Edobor and Ekechuku, 2015). This practice originated recently from United States of America (Edobor and Ekechuku, 2015). It has now become a growing pandemic in Africa and Nigeria in particular. Albeit, the number of lesbians is still very small even in the Western world, but they are recruiting other members of the society using covered and overt tactics.

However, the practice of lesbianism is not in line with the status quo, traditions of local people, the biological system; and therein are

attached wide array of adversaries to health, society, family, and education of the society at large (Diggs, 2002; Edobor and Ekechuku, 2015; Sarkingobir *et al.*, 2020). In a move to curb the spread of this practice, in 2011 a bill was passed by the Nigerian Senate specifying punishment for same-sex marriage and relations (Atoi and Ojedokun, 2013). Based on this, this chapter aimed to review problems of lesbianism, with emphasis on higher institutions in Sokoto.

2. MATERIALS AND METHODS

A review of past studies was conducted online, and an interview with key informants from 2 different higher institutions in Sokoto was conducted.

3. CASE STUDY AT TWO HIGHER INSTITUTIONS IN SOKOTO, NIGERIA

A key informant interview with 2 respondents was carried out because it is difficult to get respondents that can voluntarily participate. One of the respondents only said the practice is been carried out with very large prevalence at hostels in higher institutions in the state. She said one of lesbian students who is at final year level tried to lobby her into the practice by giving her money for birthday

preparations. At the end she asked her for her hands into the practice, but she declined and repays her money. This shows that money is one of the things that are used by lesbian members to buy young girls into the practice.

The second respondents believed that the lesbian activities are been practiced at rampant stage in higher institutions hostels in Sokoto. She said she know some who practice it. She said in every room at least two individuals are into the practice. The members openly display signs for attracting new ones. The use rings one legs, tongue, nose to court for members. Thus, this practice is been carried out in the state and it is dangerous considering the health and other problems tied to it. Most girls who are into it find it difficult to attend to their marriages. It can also affect their studies adversely.

4. HIGHER RISK OF STDS

Lesbians have higher risk of sexually transmitted infections (STDs) and other health problems than heterosexuals. Studies show that lesbians have had sex with lots of men. They are 4.5 times likely to have had more than 50 lifetime sex partners compared to heterosexual women.

The 3-4 times more likely to have sex with men of high risk for HIV and other risky behaviors (drugs users) compared to heterosexual. Lesbians have higher prevalence of vagionosis, Hepatitis B, Hepatitis C, heavy cigarette smoking, alcohol abuse, intravenous drug use, and prostitution. Diseases such as crabs, genital warts, Chlamydia and herpes have been reported among lesbians (Diggs, 2002).

5. PSYCHIATRIC PROBLEM

Many studies have revealed high prevalence of psychiatric illnesses (such as depression, drug abuse, suicide attempts in lesbians. A Netherlands study proved that, these problems were not due to homophobia (Lee, 2000; Diggs, 2002; American Psychological Association, 2008; International Lesbian, Gay, Bisexual, Transgender, Intersex, Association, 2011).

6. RECKLESS SEXUAL BEHAVIORS IS COMMON AMONG LESBIANS

Situations and behaviors of lesbians (such as depression, drug abuse) elicits reckless sexual behaviours among many lesbians.

7. PROMISCUITY PROBLEM

Studies have revealed that lesbian individuals have no faithfulness to their partners compared to heterosexual individuals. They tend to engage with several individuals, some engage in prostitution. Promiscuity leads to medical consequences. It serves as a recipe for transmission of diseases (Lee, 2000; Diggs, 2002).

8. PHYSICAL HEALTH PROBLEM

Practices of lesbians lead to problems that are dangerous to health, causing physical injury and transmission of sexually transmitted diseases. They often use toys in anal sex, which cause extraordinary prevalence of anal cancer, Herpes simplex virus, Chlamydia trachomatis, Giardia lamblia, Human papilloma virus, Gonorrhea, viral hepatitis types, syphilis and HIV (Lee, 2000; Diggs, 2002). Physical injuries associated with anal sex are hemorrhoids, anal fissures, and rectal trauma, retained foreign bodies.

Anal sex is been reported of having high risk of sexually transmitted diseases (STDs) transmission. Mouth-vagina sex, vagina-vagina sex, exchange of sex toys, mouth-anus are very risky and dangerous. They are with high risk of diseases and injuries (Lee, 2000; Diggs, 2002).

9. HEALTHCARE PROBLEMS

There is need for regular visits to hospitals to check for problems such as breast cancer, STDs, cervical cancer, etc; but lesbians tend to abstain from hospitals more than their counterparts, there by risking their health (International Lesbian, Gay, Bisexual, Trans, and Intersex Association, 2011).

10. VIOLENCE, SCHOOL ABSTINENCE, AND HOMELESSNESS

Individuals practicing the lesbian activities in many parts of the world are minorities. They are into practices that are in deviation from the major population. Consequently, many studies have revealed that they met with series of violence, leading to homelessness and other problems. In school, lesbians have been constantly faced with violence, leading to running away from classes or schools, drop-out, or low academic performance (Lee, 2000; Diggs, 2002).

11. CONCLUSION

The practice of lesbianism is growing in higher institutions in Sokoto, and attached are problems. Thus, there is need for further information to curb the issue.

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Chapter-X

10

RECENT TRENDS IN APPLIED SCIENCES AND COMPUTER ENGINEERING

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ABSTRACT

Technology is emerging consistently and the future is ever appealing and attracting and it is clear that the core of digital (or numerical) transformation will be a real world and existence with innovative increasing at an enormous rapid growth.

Technology – driven based profession or business are not changing simultaneously but they are increasing and the experienced information technology professionals know that their assignment is not intending to be the same. In this twenty first century, professionals in the field of IT sectors should be continually learning and keeping modernized with advancements in technology.

In today's technological era, computer knowledge is very crucial and is used in every sector of business or occupations etc. This social revolution has altered the fundamental concept of computing. Computing in current's information age is not definite to computer programmers and computer engineering. The need for technological era has emerged because to answer divergent insignificant issues by many approaches and methods of systems that are much greater efficient than body of human beings.

The need for Artificial intelligence, deep learning and machine learning has emerged because it was felt necessary to use competent and experienced coded here and now knowledge and regulation into a computer, which turn simplifies the issues resolving endeavors. Subsequently, a new programming language such as Artificial Intelligence; cybernetics; computer technology; data processing; information retrieval and technology; robotics; patch or plug in gets released nearly every residence. A technology or a programming language I.e. making the rounds this week perhaps outdated by the short span of time or a day. Computer scientists and engineering professionals are steadily twisting and improving current technologies to make full utilization of them.

Researcher, scientific and engineering professionals for monitoring and control systems, data analysis and development and improvement of works.

Keywords: Applied, Computer, Engineering, Recent, Sciences, Trends.

1. INTRODUCTION

Technology has been increasing so rapidly or exponentially over

recent years, there has been continuously growing requirement for brilliant computer science and computer engineers to appear and support and advice to transform areas shifting from digital or data infrastructure to cyber security. The Technology is applied science paradigm in the philosophy of technology is reflected in education. So, today one can easily recognize the technology is applied science paradigm (Marc J. Debris; 1996).

Computer science is the science that deals with the theory and methods of processing information in digital computers; the design of computer hardware and software; and the applications of computers. It is the branch of engineering science that studies (with the aid of computers) computable process and structures (<https://www.thefreedictionary.com>). Thus, applied science is the same as the computer science, only thing is that one has to utilize them practically what has learnt in computer science.

Computer science (CS) is the scientific and practical approach to computation and its applications.

It is the systematic study of the feasibility, structure expression and mechanization of the methodical procedures (or algorithms) that

underlie the acquisition; representation; processing; storage; communication of ; and access to information. Briefly, CS is the study of automating algorithmic processes that scale. A computer scientist specializes in the theory of computation and the design of computational systems. Whereas, computer engineering is a discipline that integrates several fields of electrical engineering and computer science required to develop computer hardware and software. Computer engineers usually have training in electronic engineering (or electrical engineering); software design and hardware–software integration instead of only software engineering or electronic engineering.

Hence, CS deals with data and algorithms while computer engineering is focused on hardware and firmware. CS started as a branch of mathematics, while computer engineering initiated as a branch of electrical engineering. In CS one can learn about computing theory; programming; environments; algorithms; data security and transfer etc.

Computer engineering discover how to develop; prototype and test microchips; circuits; processors conductors and any other

components used in computer devices or systems for instances, supercomputers; smart phones; Laptops; servers; Internet of Things gadgets. They also develop the firmware, an essential type of software that allows separating systems and applications to take full advantage of the hardware. Computer scientists work with computational theories, powerful algorithms and mathematical models which are used to develop software programmers and systems. On the other hand, computer engineering develops the hardware and firmware on which software and system run.

Some of the recent trends in CS are Artificial Intelligence (AI); Machine Learning; Big data or Data science; Cloud computing; Cyber security; Human – Computer – Interaction; Video Game Development etc. Whereas recent trends in computer engineering are computer and networking security; computer graphics and visualization; Robotics and cybernetics; Embedded systems; Medical image computing; Hardware systems; Distributed computing etc.

2.RECENT TRENDS IN APPLIED SCIENCES AND COMPUTER ENGINEERING:

Following are the recent trends in Applied Sciences and

Computer Engineering:

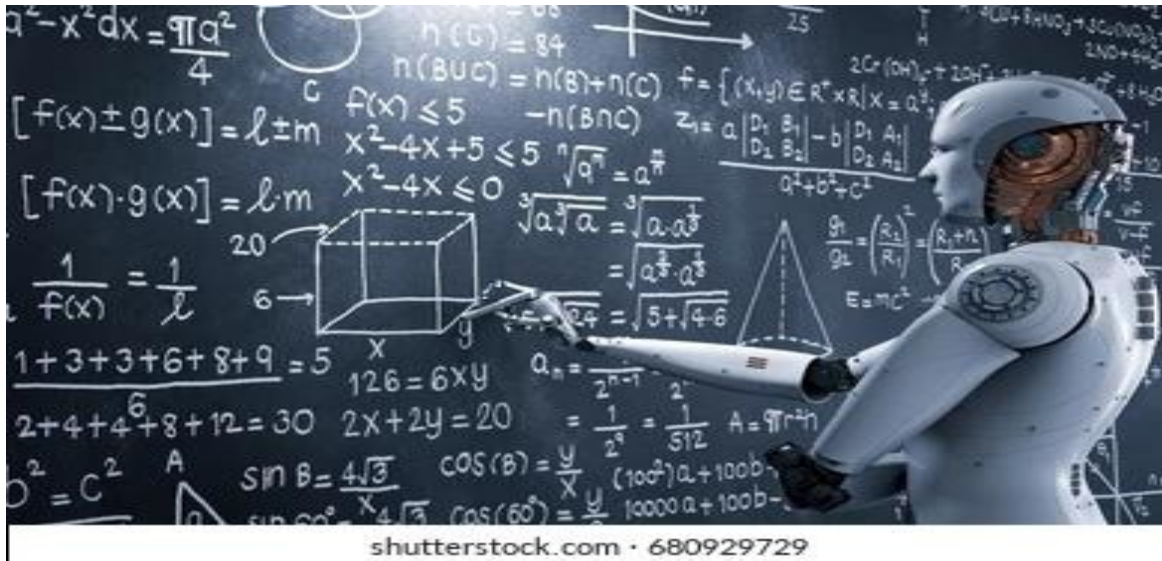
- **Artificial Intelligence (AI):** According to oxford dictionary, it defines the two terms as “Artificial” and “Intelligence”. Artificial means not natural or imitating nature and Intelligence means as quickness in understanding the information. John McCarthy was founding father of AI. By him, Intelligence is the computational part of the ability to achieve goals in the world. AI thus can be defined as a field that focuses on building techniques to enable computer systems to perform activities that are quick and are above human intelligence (McCarthy J; 1968).Konar(1999), defined AI as “the simulation of human intelligence on a machine, so as to make the machine efficient to identify and use the right piece of “knowledge” at a given step of solving a problem. Thus, AI is branch of computer science concerned with the study and creation of computer systems that exhibit some form of intelligence: Systems that learn new concepts and tasks, systems than can reason and draw useful conclusions about the world around us; systems that can understand a natural language or perceive and comprehend a visual

scene; and systems that perform other types of feats that require human types of intelligence (Patterson; 1990).

AI is the driving force behind robotics and fuzzy systems. Machine learning is one of the major application of AI. It is one of the latest trending technologies, when AI programmers are fed to systems, the objective is to mimic human intelligence for performing complicated tasks like speech recognition; pattern recognition; weather forecasting; diagnostic systems such as medical diagnosis systems; pathology diagnosis system and customer assistance system etc.; financial decision making systems like fraud detection systems used in credit card companies and systems that expedite financial transactions and classification systems like financial decision making systems and NASA'S Galaxy classification systems.

AI is used in navigation-based applications like Uber; voice assistant like Siri; video streaming services like Netflix; IoT devices and in search engines like Google and Bing. It helps in automating tasks such as traffic; scheduling trains; making business predictions and designing driverless cars and trains.

AI will help in securing jobs such as machine learning engineer, data



scientist, computer vision engineer, and Business Intelligence Developer and Data analyst.

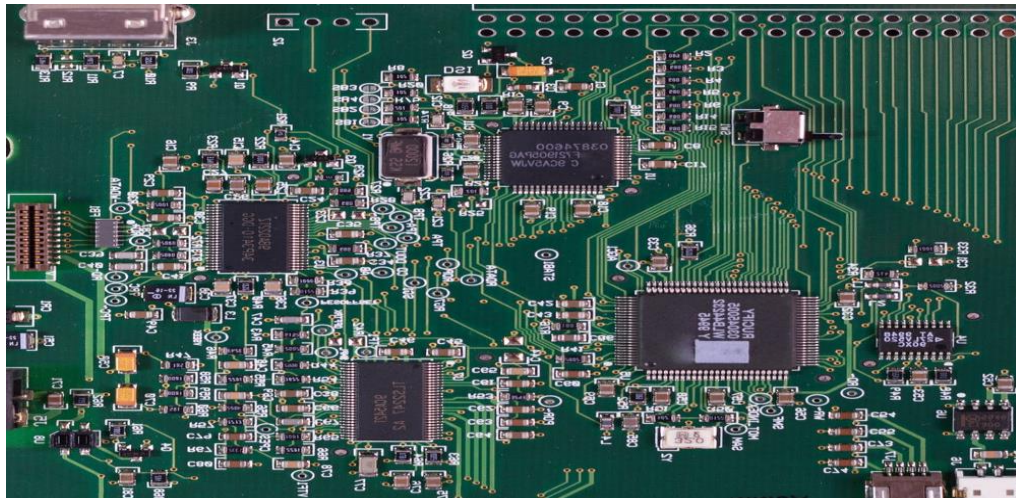
3. ARTIFICIAL INTELLIGENCE

- **Big Data:** Big data or Data science is one of the emerging technologies these days. Data science is the technology that helps to make sense of complicated data. As we know that data is produced in a large amount of everyday by the industries which comprises business data; client profile information; financial data or figures; server data and sales data etc.

Most of these data sets are unstructured and these unstructured data sets are converted into structured data sets by the data scientists. The role of data scientists is to analyze data sets and to identify patterns and trends. These patterns are beneficial for

understanding the company's business performance; customer retention, and how these areas can be improved and developed.

Thus, this technology related with processing; storage and analysis of the large amount of data produced from various sources around the globe. It has large perspectives mainly for research areas. The future prospects and scope of data science will create opportunities for the career roles as a Business Analyst; Business Intelligence Manager; Data Engineer; Data Scientist; Data Analyst; and Data Architect. Currently, data analyst is here and there from corporate world to health sectors.



4. BIG DATA

- **Quantum Computing:** Quantum computing is an area of computing focused on developing computer technology based on the

principles of quantum theory, which explains the behavior of energy and material on the atomic and sub-atomic levels. Thus, Quantum computing is the study of how to use phenomenon in quantum physics to create new ways of computing.

The basis of Quantum computing is Qubit. Unlike a normal computer bit, which can be 0 or 1, Qubit can be either of those or a superposition of both 0 & 1. Quantum computing could contribute generally in the fields of finance, military affairs, intelligence, drug design and discovery, aerospace designing, utilities (nuclear fusion), polymer design, AI and Big data search and digital manufacturing. Its potential and projected market size has engaged some of the most prominent technology companies to work in the field of Quantum computing such as IBM, Microsoft, Google, and D-Waves systems, Alibaba, Nokia, Intel, Airbus, HP, Toshiba, Mitsubishi, NEC, Raytheon, Lockheed Martin, Biogen, Volkswagen and Amgen.



An evolving trend in the technological- driven world. Internet of things is a net work of devices that are connected to each other. Today's internet has become a core part and life line for everyone. IoT devices can interact and share data with each other. These devices perhaps linked through Wi- Fi and they contribute data about their environments and how they are being used. These devices have a computer chip that facilitates this exchange. There is no doubt in the world of science and technology that people choose the internet as a mode of communication. It is one of the reasons that are responsible for bringing in a fraction of seconds or sometimes in minutes millions of People together.

Hence, IoT is a technology in which objects and devices are connected with each other virtually through the internet.

The devices have sensors and actuators to act according to the surroundings environment. Smart homes and smart cities are applications of the Internet of Things.

Thus, Internet of things is network of physical devices connected to each other for exchange of data and information through sensors and actuators. These actuators and sensors are embedded on to these devices which enable them to exchange data with each other. Basically, IoT means enable the devices to connect to internet to make the life of people much easier. The here refers to internet of things devices like chips, cameras; sensors; or such other physical devices. (www.techsparks.co.in).

It is predicted that more than 41 billion devices powered by IoT will be used by 2025. IoT not only enables the connection between various devices but also their remote access. IoT chips embedded on machines help and support business to assess the performance of those machines and assist in their maintenance. Learning to this latest technology will help in to become an IoT software developer; IoT Research Developer; IoT Product Manager; IoT solution Architect; and System Design Engineer



- **Virtual Reality (Vr) And Augmented Reality (Ar):** Virtual Reality (VR) is the technology by which one can engage himself/herself in an environment that appears amazing realistic. It is the use of computer technology for making a initiated or simulated environment. VR is very commonly used for playing computer games. There are big players on the virtual reality market like Oculus, Google and Samsung. Different conventional games where one can experience the gaming environment by looking it on the screen and one can instantly placed in the environment. Sensibility like hearing, seeing, smelling, and touching are initiated in these environments. Using VR gear like headsets, he/she can walk around and play the game in that 3D world.

Thus, the approach and conception of VR is accelerating with application in gaming engineering. It is going to influence the approaches we observe the world. Through this conception, an artificial environment is made which emerge as real world using software and presented to the users.

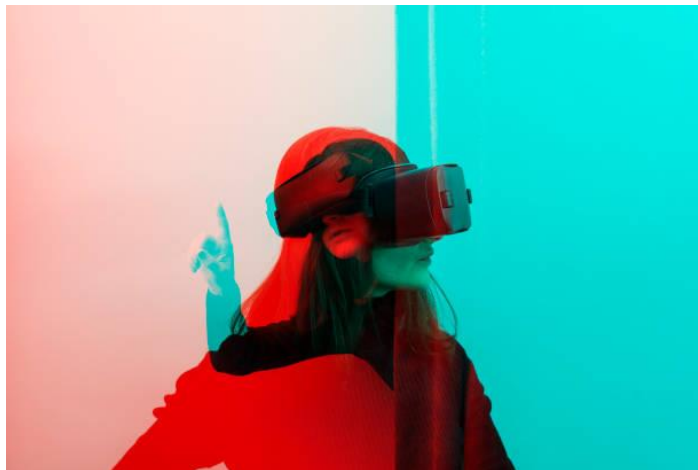
Augmented Reality (AR) is the technology used for improving this virtual environment. The big players in this area are Oculus Rift; Facebook's; Sony's play station VR (PSVR); and the HTC Vive; Google and Samsung. Moreover, there are lot of start-up emerging and recruiting and the demand for VR and AR skills professionals will only increase. It does not need a enough specific understanding and insights to make to join in VR. Fundamental programming skills and cutting – edge mind set can create a job. Even though distinct companies will also glance for observed as a capability and computer programmer or hardware engineers (<https://www.geeksforgeeks.org>).

The VR technology is used for entertainment as well as in United States Navy and coast Guard for the training of staff. AR and VR are also used by doctors while performing surgery. Visitors in an

amusement park or amuseum can also use the technology to increase their experience.

The VR industry is supposed to reach close to \$ forty billion by 2021. There are many job opportunities in the area of VR are: content producer; AR and VR content writers; Product management; Software engineer; UI and UX Design and Quality Assurance (<https://www.bigbanzoicom>)

5.VIRTUAL REALITY



- **Block Chain:** It is the foundational technology that powers electronic currencies like crypto currencies. Simply put, a block chain is an electronic ledger that can be shared amid various users. It helps in creating a record of transactions that cannot be changed. All of these records are time stamped and connected to the earlier one.

It is the top emerging technology of tomorrow. Block chain is a decentralized digital ledger that stores transactions on thousands of computers around the globe. Block chain technology increases security and depression the exchange of information in a manner that is cost-effective effective and more transparent.

- **Cloud Computing: Now-** a- day's technology is changing rapidly with new inventions day by day. It is another recent emerging technological trend in the field of computer science these days and a good area for research. Cloud computing is the technology that provides an on demand shared pool of resources over the Internet to



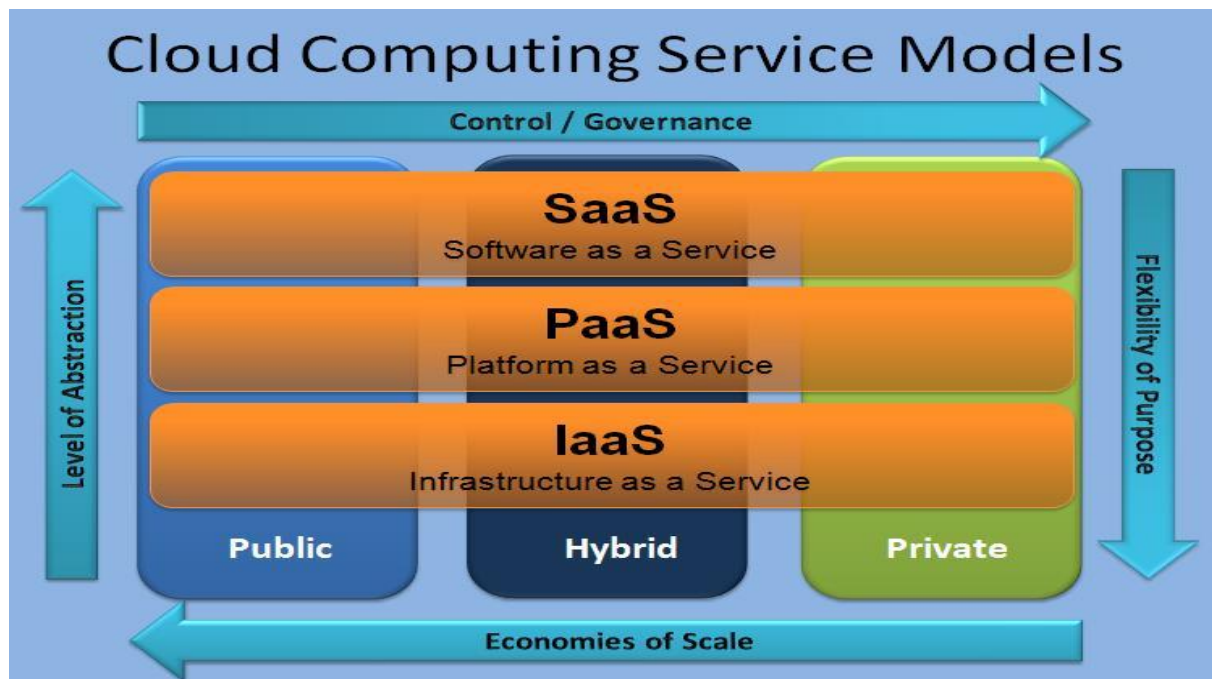
users. The word cloud here means to the internet. Thus, it is an internet-based technology.

Hence, cloud computing is an internet-based services that

provides on demand access to shared computer resources and data. In simple words, cloud computing means delivery of hosted services and resources over the Internet. These resources include storage; server; network and applications. These resources can be quickly equipped and can be freed easily.

Cloud computing services are provided by cloud providers such as Amazon; IBM; Microsoft Azure; and Web services etc. Virtualization is the driving force behind cloud computing. It means the creation of virtual resources rather than actual resources like hardware; operating system; storage network etc. These virtual resources act as a replica of the actual resources. Types of virtualization are Desktop virtualization; Hardware virtualization; Network virtualization; Operating system virtualization; and Storage virtualization.

Cloud computing provides improved security and much more reliable and manageable. It is flexible, more reliable and also environment friendly as it reduces carbon foot print.



- **EDGE COMPUTING :**

Edge computing is the latest technology trend that is getting famous by the day. The technology is relying on on the philosophy of bringing computing power as close to the data source. This helps in reducing bandwidth and latency.

The technology aims to run fewer processes in the cloud and shifting those processes to locations like the user's system or an edge server. Bridging this gap between the data and the computation reduces the long-distance communication between the server and the client, which in turn increases the speed of the process.

This is why edge computing is used for handling time sensitivity data stored in remote locations that have limited connectivity to the central location (<https://www.upgrad.com>)

This edge computing technology will make cloud computing and Internet of Things (IoT) devices faster. It is estimated that by 2022, the edge computing market will be worth \$seven billion. This technology will be popular in areas such as health care, retail and manufacturing. Thus, it will open the doors to many job opportunities. It is expected that the salary range of an edge computing professional will be around \$100,400 to \$123,000 per annum (<https://www.marketsandmarkets.com>).

6. INTELLIGENT APPS: Intelligent Apps are software applications that make use of AI components such as Deep Learning; Data Analysis; Machine Learning; Robotics and Natural Language processing. This help in making decision based on real-time time data or historical data.

Examples of Intelligent Apps are voice assistants such as Siri; Google Assistant and Alexa. As companies like Apple, Google and Oracle continue investing in these applications. It is bound to create a lot of

jobs in the future.

- **BIO-INFORMATICS:** Bio-informatics is the interaction of biology with computer science. It is a field in which the biological data is collected and processed using computer-based programmers. The collected biological data is further converted into a readable form for study and research.

Thus, it has an interesting application of big data, bioinformatics or the use of programming and software development to build huge datasets of biological information for research purposes carries tremendous potential. There are number of applications of bio-informatics including gene therapy, biotechnology and medicines etc. This field also has a promising future. Linking big pharma companies with software companies, bio-informatics is growing in demand and offers good job prospects for computer science researchers and graduates interested in biology, medical technology, pharmaceuticals and computer information (<https://www.topuniversities.com>)

- **ROBOTIC PROCESS AUTOMATION (RPA):** RPA ia technology used for automating daily tasks identical to AI. Here, the software is used for automating repetitive tasks such as handling and replying to

emails, processing transactions and handling business data. This technology is used for automating tasks for low- level employees to higher ranking officials.

Robotic process Automation can automate more than forty per cent of daily tasks. According to McKinsey, more than sixty per cent of all repetitive tasks can be partially automated using RPA. So, this technology is going to threaten a lot of jobs. For instances, companies like Accenture; Deloitte; and Capgemini use RPA tools to automatic their daily operations. So, the demand is big for professional skilled in RPA.

The various Robotic Process Automation job roles are RPA Developer; RPA Business Analyst; RPA Consultant; RPA Solution Architect and RPA Project Manager.

- **CYBER SECURITY:** In today's world, data protection is no longer optional, for either individuals or nations making this another increasing strand of computer science research. Cyber security study programmers teach how to protect computer operating systems, networks and data from cyber attacks. The overall objective of learning cyber security is to help to develop the technical skills

required to prevent attacks and protect the data and privacy of individuals.

Cyber security is required considering the fact that there has been a sharp increase in the cyber crimes in recent times. It is needed in every area including public, private and governmental organizations. It will also help in controlling malware activities and viruses.

- **DEEP LEARNING (DL) AND MACHINE LEARNING (ML):** Deep Learning (DL) is also getting a lot of attention these days. DL is a subset of Machine Learning (ML) where the artificial neural network, the recurrent neural network comes in relations. The algorithms are created just like machine learning but it consists of many more levels of algorithms. All these networks of the algorithm are called as the artificial neural network. Simply put as, it replicates just like the human brain exactly is the concept of deep learning. It solves all the complex problems with the help of algorithms and its process.

Machine Learning is a subset; an application of AI that offers the ability to the system to learn and improve from experience without being programmed to that level. ML uses data to train and find accurate results. ML focuses on the development of a computer

programmer that accesses the data and uses it to learn from themselves (<https://www.geeksforgeeks.org>).

ML is being used in a wide range of fields like art, science, finance and health care. Some are simple such as a basic, decision trek and some are much more complex, involving multiple layers of artificial neural networks. Machine learning with R and machine learning with Python are two popular methods used today (<https://www.simplelearn.com>).

Graph Neural Networks (GNNs) is a sub type of neural networks that operate on data structured as graphs. By enabling the application of deep Learning to graph structured data, GNNs are set to become an important AI concept in future.

In recent times, neural networks have spurred into huge popularity among data and AI community, owing to its ability to mimic human brain neurons. Today, neural networks are capable of image/object classification and video processing to speech recognition and data mining. (<https://www.analyticsinsight.net>)

- **AUTOMATION SYSTEM:** considering the numerous emerging technologies such as cloud computing, big data, AI, and robotics are

heading for high-scale growth. It is not surprising to see that automation is at its height. Many software consulting firms manager automation deployment right from banking to manufacturing and software companies.

For instance, self- driving cars homeostatic control, systems for your house, health monitoring implants, robotic asteroid miners, self-replicating robots for space exploration and the like. For example, most manufacturing plants make use of some automated process in the form of robotic assembly line. Human input is required only to define the processes and supervise them while assembling of the various components is left to the machine which automatically converts raw materials into finished goods.

In the technology domain, the impact of automation is increasing rapidly both in the software and hardware and machine layer. The implementation of new Artificial Intelligence (AI) and Machine Learning (ML) technologies is currently sky rocketing the evolution in this field. In the information technology domain, a software script can test a software tools available in the market which can generate code for an application. The users only need to configure

the tool and define the process.

Advanced Business Intelligence in applications is another new form of high-end quality automation. In other industries, automation has greatly improved productivity, saving time and cutting costs. Hence, from the simplest to the most complex application, automation system is present in many forms in our daily life.

- **DATA VISUALIZATION:** Data visualization is the practice of translating information into visual context such as map or graph, to make data easier for the human brain to understand and pull insights from.

The main goal of data visualization is to make it easier to identify patterns, trends and outliers in large data sets. The term is often used interchangeably with others, including information graphics.

Data visualization is important for almost every career. It can be used by teachers to display student test results, by computer scientists exploring advancements in AI or by executives looking to share information with stakeholder. It also plays important role in big data projects. As businesses accumulated massive collections of

data during the early years of the big data trend, they needed a way to quickly and easily get an overview of their data. Visualization tools were a natural fit.

Visualization is central to advanced analytics for similar reasons. When a data scientist is writing advanced predictive analytics or machine learning (ML) algorithms, it becomes important to visualize the outputs to monitor results and ensure that models are performing as intended. This is because visualization of complex algorithms is generally easier to interpret than numerical outputs.

Benefits of Data Visualization: * The ability to absorb information quickly, improve insights and make faster decisions; * an increased ability to act on findings quickly and therefore, achieve success with great speed and less mistakes.

Some other popular techniques are – Line charts; Area charts; Scatter plots; Tree maps; Population pyramids. Common data visualization uses cases include sales and marketing; politics; health care; scientists; finance logistics; Data scientists and researchers.

7. CONCLUSION

Recent trends in applied science and computer engineering and their applications altered radically the life of each and every one. Really, student learning and corporate business world or any other professionals, computer science and engineering and its applications are boosting their updated or renew support system to provide more effective performance infrastructure in all sphere. The contribution is never – ending and so the development in this field is unlimited.

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11

REVIEW OF IODINE STATUS IN THREE (3) AFRICAN COUNTRIES (NIGERIA GHANA AND ETHIOPIA) AMONG ADOLESCENT GIRLS AND WOMEN OF CHILDBEARING AGE

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ABSTRACT:

Adolescent girls and women of childbearing age are particularly vulnerable to iodine malnutrition, which is regarded as an indispensable micronutrient that is required to produce thyroid hormones. Iodine deficiency disorders (IDD) has an irreversible effect on fetal brain caused by deficient iodine level during early pregnancy resulting to cognitive and neurodevelopment deficits. This review was aimed to condense the studies that measured iodine levels in adolescent girls and women of child bearing age in three African countries. Literatures were reviewed by a systematic approach. Few records were identified, only trace of these record satisfy the requirement criteria and 7 peer-reviewed articles were determined to be suitable for the choice in this review. In spite of most of these three African countries are being considered to be iodine sufficient, the iodine level has decreased with iodine deficiency resurfacing in vulnerable groups such as adolescent girls and women of child bearing age. Although data to conduct a holistic review of iodine status among adolescent girls and women of child bearing age in these three African countries were scarce, majority of the articles

reviewed demonstrate emergent iodine deficiency in these population of adolescent girls and women of child bearing age, indicating alarm for a public health concern needing immediate attention.

Keywords: iodine status, T4, T3, females of childbearing age, review, hyperthyroidism, goiter

1. INTRODUCTION

Iodine is naturally occurring element in seawater, certain rocks, sediments, plants, soils and certain food materials (ASTDR, 2004; Ethiopian Public Health Initiative, 2007; Bonofiglio and Catalano, 2020; National Health Institutes, 2020). The entire biological actions are due to thyroid hormones. The major hormone T4 is released by the thyroid gland, and then converted to T3, the active form of thyroid hormone. The main actions of thyroid hormones are: a. Growth and development and b. Control of metabolism in the body. Thyroid hormone (TH) deficiency from 14 week of gestation to 3 years leads to irreversible brain and central nervous system damage.

On the other hand, TH plays a physiological role in carbohydrate, fat, protein, vitamin, and mineral metabolism (FAO/WHO, 2006). Iodine deficiency (ID) in child, adolescent lead to

goiter, juvenile hypothyroidism, impaired mental function and retarded development (FAO/WHO, 2006). In adult and childbearing, it led to disorders of goiter and related complications, hyperthyroidism, and impaired mental function (FAO/WHO, 2006; EPHI, 2007; Bonofiglio and Catalano, 2020; National Institutes of Health, 2020). Getting high levels of iodine can spur same symptoms like ID, such as goiter, thyroid cancer, burning of mouth, throat, and stomach. It can also cause fever, nausea, vomiting, stomach pain, diarrhea, and coma (National Institutes of Health, 2020). Globally, about 2 billion individuals are having insufficient iodine intake. Africa has been echoed with the highest iodine deficiency prevalence across the globe, with Ethiopia being with the highest burden (Mukhtar *et al.*, 2018). Ghana is among the countries suffering from ID problems, which is implementing methods to contain the situation. Nigeria, serve as the largest in population in the whole Africa.

Thus, having the largest population which is receptive to the nutrition problems. It has been bedeviled with poor nutrition, let alone iodine deficiency. To contain the nutrition insufficiency of ID in

Nigeria, a number of intervention and measures were put in place (WHO, 2004). However, the ID data is very scarce in Africa, and in these trio countries (Ethiopia, Ghana, and Nigeria). Therefore it is important to conduct a review of ID status among girls/women of childbearing age, which will serve as summary and provide evaluation hints on the interventions put in place (United Nations, 1993; FAO/WHO, 2006; WHO, 2004; Emirus, 2016). Female children are 3 times more likely to have iodine deficiency than males.

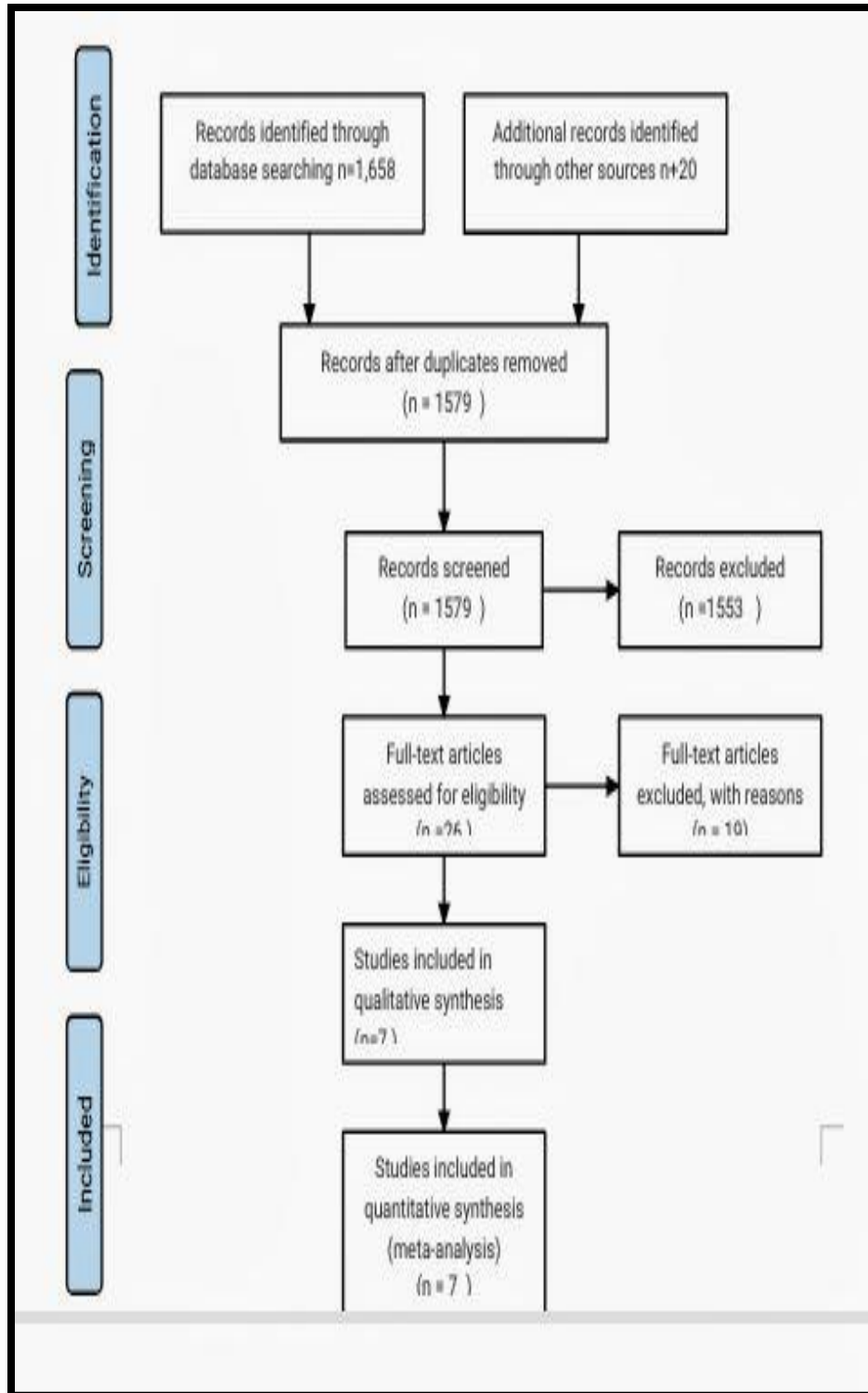
On the other hands as children reaches 9yrs, their need for iodine usually increases as they move higher. Hence, the need to review their iodine status reported by other studies in this region bedeviled with nutrition problems al with other competing topical issues (Mukhtar *et al.*, 2018; Musa *et al.*, 2015).

It will provide a standard for other upcoming studies or interventions and policy making (WHO, 2004; United Nations, 1993; Musa *et al.*, 2015; Kuku-Shittu *et al.*, 2016; Busingeet *al.*, 2019; Umar *et al.*, 2017). To determine the impact of the intervention programs lay to overcome Iodine deficiency (Busingeet *al.*, 2019; Kubugaet *al.*, 2019).

2. MATERIALS AND METHODS

STRATEGY AND DATA COLLECTION

The review study utilized a method in accordance with the PRISMA extension for scoping Reviews (PRISMA-ScR) statement. The study selection process was displayed in fig 1. There in, a systematic searched of literatures in Pubmed, Google Scholar, and Web of Science etc. Assessment was conducted to retrieve all studies revealing the iodine status of adolescent girls and women of childbearing age (9-51) in the 3 selected African countries. Both text word and keyword search using MeSH definitions were utilized. Study reports from book chapters, theses, dissertations were searched. Duplicate publications were abated. The years range for the searched works was 1970-2020.



3. RESULTS

Table: Review on Studies Showing Iodine Status of Adolescent Girls and Women of Childbearing Age from Nigeria, Ghana, and Ethiopia

4. DISCUSSION

Iodine is an important mineral required by human body to make thyroid hormones so as to control metabolism and many other important functions (Umar *et al.*, 2017). Getting enough iodine is important. When a child reaches 9 years, the body requirement needs to be increased as the age increased up to adulthood (Gunnarsdottir and Dahl, 2012; National Institutes of Health, 2020). Females because of their sex-related difference are more iodine deficiency than males. Hence, they have more vulnerable (Chio *et al.*, 2019). 90% of African countries are having the risk of iodine deficiency due to poor nutrition, poor soils, and goitrogens (Businge *et al.*, 2019).

Serial number	Author	Year	Study location	State /province	Age	Status	Study design	Sample size
1	Abuaetal	2008	Boki and Ikom LGs	Cross River state	9-12	Severe Iodine Deficiency (SID) 18.0% Moderate Iodine Deficiency (MID) 18.3% Mild Iodine Deficiency (MID) 35.5% Optimal Iodine Nutrition (OIN) 28.0%	Descriptive cross-sectional	387
2	Nwamara and Okeke	2012	Obukpa	Enugu	9yrs 10yrs 11yrs 12yrs	MID More than adequate 5.56% Optimal 2.78% Possible excess 2.78	Crossectional	160
3	Olifeetal	2013	Oba and Nanka	Anambra	9-10yrs	Optimal 146-164 100%	Crossectional	60

4	Musa <i>etal</i>	20 15	Maidu guri	Borno	20- 41y rs	MID 46.84% Moderate Iodine Deficienc y 4.43% Optimal/ sufficient 48.73%	Crossec tional	60
5	Umar <i>etal</i>	20 17	Sokoto	Sokot o state, Nigeri a	14- 17	MID 20% Moderate Iodine Deficienc y 15% Adequate Iodine(AI) 63% Above Normal(E xcess Iodine) 2%	School- based Crossec tional	246
6	Kubuga <i>etal</i>	20 19	Kasse na Nanka na West and Builsa North Distric ts	North ernG hana	15- 49y rs	Moderate iodine Deficienc y <50 10.2% MID > 50 89.8%	Interven tional- case- control study(q uasi- experim ental, commu nity based)	60

7	Asfew and Belache w	20 20		Dawr o zone Ethio pia	10- 12	Sufficien t 45.1% Insufficie nt 54%	School- based Crossec tional	87
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Therefore, it is utmost to review the available literatures on iodine status of adolescents girls and childbearing women in these 3 African states (Ghana, Nigeria, Ethiopia) to give an update of the current status, to yield a laconic data on policy makers and further studies (Musa *et al.*, 2015; WHO, 2004; United Nations, 1993; Kuku-Shittu *et al.*, 2016, Busingeet *al.*, 2019). We searched for data on the subject matter from the beginning of salt iodization-2020.

But woefully the data is very scanty. Only 7 studies fit to the subject matter of this study. 5 studies were from Nigeria (3 from southern region, and 2 from the northern region), 1 from Ghana, and 1 from Ethiopia. Most of the study subjects are at the age-range of 9-20 years, while the very few falls within the range of 21-49 years. This show that, these subjects are at the age-range of required increased iodine level.

Hence, the studies are important (WHO, 2004). On types of studies, 2 were school-based studies, the rest were none. Most of the studies (6) were cross-sectional studies, only 1 was interventional-

case-control study (otherwise known as quasi-experimental community study). The cross-sectional studies here provide a snapshot of the iodine deficiency status, and help to generate hypothesis for further testing, therefore it provides base data. There is no any problem due to follow-up loss during these types of studies (Levin, 2006). The cross-sectional study designs relatively require shorter period and resources, which is why they are very fit for these areas characterized with scanty data, myriad of other competing issues.

And the tendency of respondents to opt-out in a long study (United Nations, 1993; Levin, 2006; Omair, 2016). The only study reported by Kubuga *et al* (2019) utilized the peakest reliable method used in epidemiological studies. It is used to test hypothesis, test causation, but some investigators might be restricted from using it due to resources, time, and ethical constraints (Omair, 2016). It is also needed for the evaluating interventions on ground, since there have been iodization strategic measures on ground (Harris *et al.*, 2016; James *et al.*, 2017). Inters of sample size, the range was 60-387 childbearing girls.

The earliest study was reported by Abua *et al* (2008) from Cross Rivers State (in 2 local government's areas) the result revealed that 18.0% of the girls had severe iodine deficiency (SID), 18.3% had moderate iodine deficiency (MID). While 28.0% of the population sample of the study had optimal iodine nutrition. Therefore, majority of the 387 girls enrolled had not been within the sufficient (enough) iodine (SI). A study in Enugu was reported by Nwamarah and Okeke (2012). The 9yrs sample of the study had MIF, 10yrs part of the sample had more than adequate.

This is a great concern, because taking too much iodine cause problems such as hyperthyroidism, hypothyroidism, and worsening of thyroid problems in people with underlying thyroid problems (FAO/WHO, 2006; American Thyroid Association, 2020; National Institutes of Health, 2020). Participants with optimal iodine were very few 2.78% at the age of 11yrs, while those at the age of 12yrs had excess. The 3rd study reviewed was reported by Olife *et al* (2013) from Oba and Nankana local governments, Anambra State, Southern Nigeria. Therein, the sample size was 60 and age range was 9-10yrs. All the (100%) respondents from the population had optimal iodine

(OI) 140-164 μ /litre. Thus, the status falls within the sufficient iodine status. The 4th study was reported by Musa *et al* (2015) from Maiduguri, Boron, and Northern Nigeria among 158 respondents 20-41yrs age-range. The iodine status was revealed. 46.84% ad mild iodine deficiency, 4.43% hade moderate iodine deficiency, and 48.73% had optimal or sufficient iodine. Thus, majority of the participants had sufficient iodine.

The 5th study was conducted by Umar *et al* (2017) across the 3 senatorial zones of Sokoto state, Northern Nigeria among 246 participants with age-range of 14-17yrs.20% had mild ID, 15% of te subjects ad moderate iodine (MF), 63% ad adequate iodine (AI),while 2% ad iodine above normal(excess). Thus, 45% had iodine deficiency.

The 6th study was reported by Kubuga*et al* (2019) from Kassena Nankana and Builsa North Districts of Northern Ghana wit 60 subjects with age-range of 15-49yrs. Thus study was quasi-experimental intervention. Therein, they provided a weekly based household iodized salt and community-based feeding of native salt and community *Hibiscus sabdariffaa* leaves meal prepared with iodized salt. In a case-control quasi-experimental fashion.

At baseline ID was prevalent. But, later, the outcome revealed that, 10.2% had moderate iodine deficiency, whereas, the 89.8% had mild iodine deficiency (WHO, 2004; 2012; Zimmermann, 2012; Madukwe *et al.*, 2013; Umar *et al.*, 2017 ;).

The 7th study was carried out in Dawro Zone, Ethiopia by Asfaw and Belachew with 87 participants of 10-12 age-ranges. The result show that, 45% had sufficient iodine, whereas, 54% had insufficient iodine.

Noteworthy, the study is a recently published work, and has continued to portray Ethiopia as iodine deficiency endemic region despite all the efforts to contain the situation (Ethiopia Public Health Initiative, 2007). In the course, from 2008-2020, there was a progress in containing the iodine deficiency more especially in Nigeria, but there is much more to be done; the people with ID are much and occupied a very significant percentage.

However, these problems might arise because of goitrogens intake, poor nutrition, poor hygiene, and poor monitoring (Zimmermann, 2013; Umar *et al.*, 2011). It is similar to what UNICEF says that 72 in West and central Africa had attained 72% households

adequately iodized salt consumption. In Ghana, by 2006 1/3 of the household had been taking adequately iodized salt. While in Ethiopia the proportion of household consuming iodized salt was just 20% (UNICEF, 2006). Thus, this study provides baseline evidence on the Iodine status in the countries.

5. CONCLUSION

Although data to conduct a holistic review of iodine status among adolescent girls and women of child bearing age in these three African countries were scarce, majority of the articles reviewed demonstrate emergent iodine deficiency in these population of adolescent girls and women of reproductive age, indicating alarm for a public health concern needing immediate attention.

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Chapter–XII

12

CHEMICAL ANALYSIS OF OIL EXTRACTED FROM JATROPHA CURCAS SEEDS FROM SOKOTO NIGERIA

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ABSTRACT:

The chemical analysis of oil extracted from *Jatropha curcas* was carried out. The oil was extracted using Soxhlet extraction method, Gas Chromatography and FTIR. The results show acid value (0.14mg/KOH), iodine value (98 I₂/g), saponification value (180 mg/KOH/g) and peroxide value (155). The fatty acids content revealed that the dominant fatty acids are oleic acid and linoleic acid. The saponification value, peroxide value and iodine value were high. The determined acid value was low. Thus, the oil is suitable for soap, paint, lubricants, insecticides making. It is also suitable for medicinal purposes.

Keywords: Seeds, saponification, soap, oil, fatty acid, Sokoto, *Jatropha curcas*

1. INTRODUCTION

Jatropha curcas is a shrub from the Euphorbiaceae family, cultivated in many parts of the world such as South America, Central America, South Asia, India and Africa (Nayak and Patel, 2009). It can grow well under adverse climatic and environmental situations. All parts of *Jatropha curcas* have their own uses, from leaves, seeds,

latex, fruits and relations Kaushik *et al.*, 2007). The plant is used to control erosion in arid and semiarid regions, leaves are used as medicine, latex is used for healing, and other medicinal purposes. *J. curcas* seeds are utilized in therapeutic purposes and extraction of oil for industrial applications (such as soap, insecticide, medicine, and biofuel) (Ginwa *et al.*, 2005; Kaushik *et al.*, 2007).

Presently, the world has been in every crisis, coupled with increasing energy demand due to increasing population growth. Therefore, there is need to search for local, renewable, cheap, and available source of oil. The *J. curcas* is a good candidate to serve this purpose, considering its diverse traits such as ability to withstand harsh conditions in all places of the world (Augustus *et al.*, 2002).

The use of *Jatropha curcas* to produce oil for diverse industrial purposes could only be realized if its chemical analysis is carried out. Therefore, the present study presents the amino acids composition of the seed flour and fatty acids and physico-chemical analysis of *Jatropha curcas* oil in order to exploit its potential in food formulation. The aim of this study is to determine the chemical properties of *Jatropha curcas* seeds oil. The objectives of this research

work are to determine: Saponification value, Iodine value, Acid value, Peroxide value, and *Jatropha curcas* constituents

2. MATERIALS AND METHOD

MATERIAL

The material in this research is the seeds of *Jatropha curcas* obtained from Sokoto, a semiarid region in Nigeria.

SAMPLE COLLECTION AND PREPARATION

The sample was collected from the tree of *Jatropha curcas* which were also called physic nut.

EXTRACTION OF OIL

After the plants have been collected, then the seeds were dried under the sun for 3 to 4 days. The coats of the seeds were removed to obtain seeds. The seeds were also grinded and weighted using weighting balance for extraction.

The extraction was done using soxhlet apparatus method. 170g of grinded seeds were placed into a thimble and extracted using light petroleum ether (bp 40-60^o) in the soxhlet extraction for 6 hours. The oil was then removed by evaporating off the solvent using rotary evaporator and residual solvent was removed by drying on an ovum

at 60°C for 30 minutes.

3. CHEMICAL ANALYSIS

DETERMINATION OF SAPONIFICATION VALUE

PRINCIPLE

When oil is treated with excess KOH, the oil gets saponified and a definite amount of KOH is used up. The excess KOH left unused may then be found by titrating against 0.5MHCL.

PROCEDURE

Zero point five grams (0.5g) of *Jatropha curcasseed* oil was weighed in a quick-fit-reflux flask and 25ml alcoholic KOH was added. The oil was then reflux for minute so that it gets simmer. The flask containing the oil is used for titration.

The blank titration was also carrying out without the oil sample. And the titer value for both oil sample and blank were also recorded. Saponification value:

$$56.1 (b-a) \times N \text{ at HCL}$$

W

Where:

W= weight at sample (0.5g)

B= blank at titre

A= smpletitre

N= normality at HCL (0.5g)

4. DETERMINATION OF ACID VALUE

PRINCIPLE

Acid value of oil is determined by titration of a known weight of it against 0.25N NaOH using phenolphthalein as indicator.



PROCEDURE

One gram (1g) of extracted *Jatropha Curcasseeds* oil was weighted in a conical flask. Then 50ml of alcohols were added with shaken and 2 drops of phenolphthalein indicator was added. And the oil sample was titrated against 0.25N NaOH with vigorous shaking until permanent light pink color was obtained.

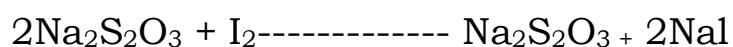
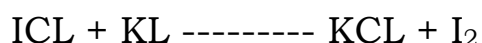
Acid value:

$$\frac{100 \times 2.82 \times V}{W \times 100 \times 4}$$

5. DETERMINATION OF IODINE VALUE

PRINCIPLE

The method is based on the treatment of known weight oil with a known volume of standard solution of iodine monochloride (ICL). Estimation of ICL by titrating iodine is liberated by adding excess of KI. The titration was done against $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ with starch as indicator.



PROCEDURE

Zero point three gram (0.3g) of *Jatropha curcas* seed oil weighted accurately, 10ml of CCl_4 was added, also 25ml of oils solution was added, the flask was shaken and allow to stand in a dark for 1 hour 15 ml of 10% potassium iodide and 100ml of distilled water was added, 1ml of starch solution equally was added. It was titrated against 0.1N $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$. If the blue color was disappearing it indicate end point.

The sample solution was also carried out without the oil sample. Iodine value

$$(b-a) \times N \text{ of } \text{Na}_2\text{S}_2\text{O}_3 \times 1.269 \times 100$$

W

Where:

B=blank at titre

A= sample titre

N= normality at thiosulphate

W= weight of sample.

6. DETERMINATION OF PEROXIDE VALUE

PROCEDURE

Two gram (2g) of *Jatropha curcasseeds* was weighted into a conical flask and 25ml of glacial acetic acid/chloroform were also added. The oil sample was then allowed to stand in a dark for 1 minute, so that the solution becomes straw yellow. 35ml of distilled water plus 5 to 10 drops of 1% starch indicator was added. The solution was titrated against 0.1N $N_2S_2O_3 \cdot 5H_2O$ till blue color was disappearing. The blank was also carrying out without the oil sample.

Peroxide value=

$$(V_1 - V_2) M \times 1000$$

W

Where:

V_1 = titre value of sample

V_2 = titre value of blank

M= Normality of phosphate

W= weight of sample

GC/MS procedure

THE GAS CHROMATOGRAPHY

Gas Chromatography was carried to determine fatty acids according to methods reported by Akbar *et al.*, (2009).

FTIR

Fourier Transform Infrared Spectrometer (FTIR) was carried out to determine the bonds and molecular structure of the compounds.

7. RESULTS

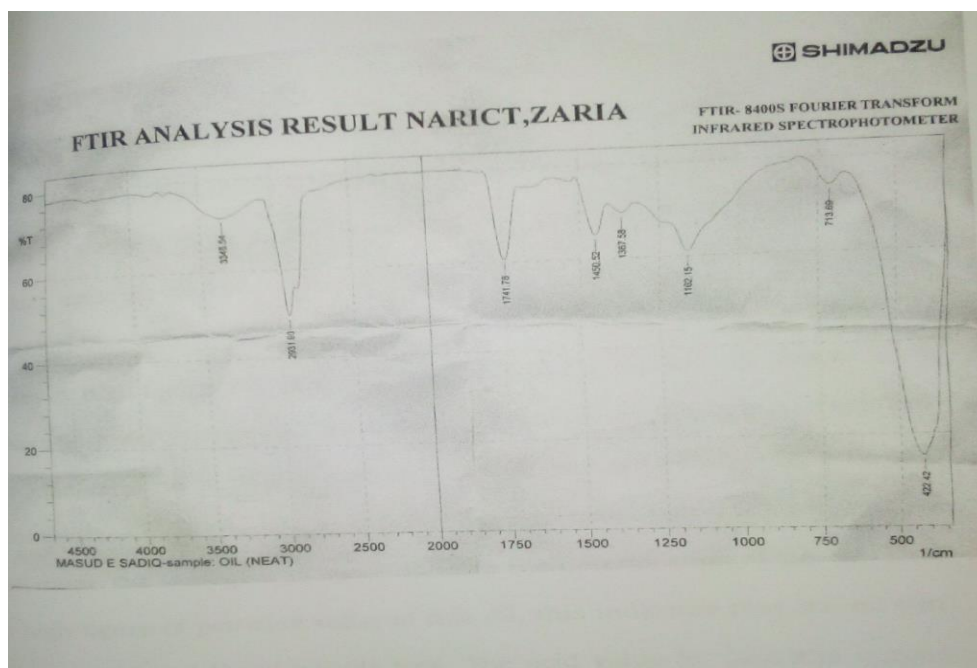
The results obtained from various analyses and determinations carried out on *Jatropha curcas* are shown below

Table 1: Result for the chemical analysis of *Jatropha curcas*

Parameters	Results
Saponification value	180mgKOH/g
Peroxide value	155
Iodine value	97(12/g)
Acid value	0.14mgKOH/g

Table 2: Results for GC/MS analysis of *Jatropha curcas*

Compound name	Molecular formula	Molecular weight	% composition
Benzenebutanoic acid	$C_{11}H_{14}O_2$	178	3.61
Palmitic acid(16:0)	$C_{16}H_{32}O_2$	256	3.52
Oleic acid (18:1)	$C_{18}H_{34}O_2$	282	16.10
Stearic acid (18:0)	$C_{18}H_{36}O_2$	284	3.12
Linoleic acid(18:2)	$C_{18}H_{32}O_2$	280	20.93



8. DISCUSSION

In table 1, the chemical analysis of *Jatropha curcas* show that the saponification value (SV) is high, and then the oil can be utilized by soap industry for soap making. Also, it is applicable in paint industry. The *Jatropha curcas* has high peroxide value (PV), therefore could not be stored for long without deterioration if adequate care was not taken. On the other hand, the *Jatropha curcas* show low acid value, indicating that it is not good for human consumption and contains triglyceride. The iodine value obtained is high, which indicates that it contains highly unsaturated fats and presence of double bond. The saponification value, iodine value (IV) and peroxide

value of this study were in agreement with findings from a Malaysian study by Akbar *et al.*, (2009). The SV, IV, are also similar to the results of a study from India (Nayak and Patel, 2010). But, the acid value (AV) is lower than the results of Nayak and Patel (2010). Another Indian study by Parthiban *et al.*, (2011) reported similar finding.

Jatropha curcas fatty acid (FA) content was studied using Gas Chromatography (table 2). It shows the major long chain fatty acids (FAs) present are 5, among which 2 are unsaturated (oleic and linoleic acids). The FTIR in the figure shows the information about the chemical bonds and molecular structure of the plant. The FAs determined in this study were found by Akbar *et al.*, (2009) from a Malaysian study, with the exception of Benzene butanoic acid. The % composition of Akbar *et al.*, (2009) was dissimilar to the findings of this study except in linoleic acid. Similarly, Nayak and Patel (2010), determined these FAs found in this study in an Indian study. These FAs in this study are very applicable in the formation of biodiesel and other industrial uses (Akbar *et al.*, 2009).

9. CONCLUSION

From the findings of this study, it is clear that *Jatropha curcas* can be used for production of oil for soap making, lubricants making, and relations, and for medicinal purposes; because its types of oils fall within the range of those used, I soap and paint making.

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13

SYNTHESIS OF SILVER NANOPARTICLES – AN OVERVIEW

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ABSTRACT

Silver nanoparticles are part of the emerging nanotechnology that has gained interest in the field of nanotechnology because of their unique properties. It is used for eclectic range of commercial reason to confine microbial growth. The increase in use of silver nanoparticles will pay their way to find in environmental systems. In this review, we discuss the synthesis of AgNPs using physical, chemical and biological approaches. More importantly, we extensively discuss about the properties and applications of AgNPs.

Keywords: Silver nanoparticles, nanotechnology and microbial growth.

1. INTRODUCTION

Nanotechnology is one of the utmost striking areas of research in material science (Kumar *et al.*, 2014 and Luna *et al.*, 2015). Their unique properties make these materials superior and essential in various areas of human activity (Mafiz *et al.*, 2015). Nanotechnology is evolving as a promptly growing field with its bid in science and technology for the determination of industrializing new materials at the nanoscale level (Albrecht *et al.*, 2006).

Currently, there have been astonishing determinations to develop clean, non toxic, reliable and eco-benign procedures for the synthesis and association of nanoparticles with desired sizes and morphologies to expand their biomedical applications. Nanobiotechnology dealing with metals nanoparticles has drawn increasing attention due to its cutting-edge nature and extensive application range in almost every field of science and technology containing biomedical sciences (Jyoti *et al.*, 2015).

In the recent years, there has been a significant devotion in the field of nanotechnology to improve reliable and favorable process for the synthesis and stabilization of metal nanoparticles, especially in metals such as silver, gold and platinum due to their potential applications in the several fields. But silver nanoparticles (AgNPs) have showed to be harmless and efficient bactericidal metal as it is non-toxic to animal cells and highly toxic to bacteria (Kluehet *al.*, 2000 and Jones and Hoek, 2010). Silver is soft, white, lustrous transition metal possessing high electrical and thermal conductivity which is used in many forms as coins, vessels, solutions, foils, sutures, and colloids as lotions, ointments, and so on. It has been

known extensive than the detailed history due to its medical and therapeutic aids before the understanding that microbes are mediators for infections (Firthouse and Lalitha, 2015).

Silver nanoparticles (AgNPs) are one of the most commonly used nanomaterials, since they are very small in size (<20nm), have high surface area and dispersion (Mathew and Kuriakose, 2013). AgNPs act as a safe inorganic antibacterial agent used for centuries and is capable of killing more than 500 types of disease-causing microorganisms. In addition to their medical uses, AgNPs are also used in clothing, food industry, paints, electronics and other fields (Cheng *et al.*, 2014).

For the past two decades, numerous methodologies have been formulated to synthesis silver nanoparticles with different sizes and controlled surface morphology. The size, shape and surface morphology play a vital role in controlling physical, chemical, optical and electronic properties of these nano-sized materials (Han *et al.*, 2001). Usually metal nanoparticles synthesis is carried out by various physical and chemical methods like laser ablation, lithography, chemical vapour deposition, sol-gel technique and

electro deposition, which are very expensive. In particular, the chemical synthesis of nanoparticles has several occupational exposure hazards like carcinogenicity, genotoxicity and general toxicity (Murphy, 2002).

Green synthesized silver nanoparticles are of great interest due to its small size and large surface to volume ratio, which lead to both chemical and physical differences in their properties when compared to bulk materials (Daniel, 2004). In general, therapeutic effects of silver particles (in suspension form) depend on important aspects, including particle size (surface area and energy), shape, concentration and charge (Yoon *et al.*, 2007). In this review, we provide a overview about synthesis and applications of silver nanoparticles.

2. SCENARIO ON NANOTECHNOLOGY

Nanotechnology is a developing field of science that comprises synthesis and development of various nanomaterials. “Nano” is derived from the Greek word “nanos”, meaning “dwarf, tiny, or very small” (Raiet *al.*, 2008). The application of nanotechnology for making nanoscale products in research and development divisions is

growing (Albrecht *et al.*, 2006). Nanotechnology can be used to produce a wide range of products applicable to an equally broad array of scientific sectors. “Creation,” “exploitation” and “synthesis” are terms associated with nanotechnology, which generally reflects materials that measure less than 1 mm.

Nanotechnology is generally classified as wet, dry, and computational technology. Wet nanotechnology is linked with living organisms such as enzymes, tissues, membranes, and other cellular components. Dry nanotechnology is correlated with physical chemistry and the production of inorganic items, such as silicon and carbon. Computational nanotechnology is related with simulations of nanometer-sized structures (Sinha *et al.*, 2005). These three extents (wet, dry, and computational) depend on each other for ideal functionality.

Nanotechnology supports diverse unique industries, such as electronics, pesticides, medicine and parasitological, and there by offers a platform for collaboration (Bhattacharyya *et al.*, 2010). Biologically synthesized nanoparticles with antimicrobial, antioxidant and anticancer properties are promising over the

collaboration of diverse natural science areas. These nanotechnologies may afford novel resources for the evaluation and development of newer, safer and effective drug formulations (Dipankar and Murugan, 2012).

3. SILVER NANOPARTICLES

Many researchers have widely used noble nanoparticles in various technological applications because of their unique properties. Among noble metal nanoparticles, silver nanoparticles (AgNPs) in particular are known for their versatile applications in medical (ointments to prevent infection of wounds and burns), food processing (Tankhiwale and Bajpai, 2010) and textile industries (Duran *et al.*, 2010), silver impregnated fabrics in consumer goods seems to be an efficient antimicrobial agent (Jiang *et al.*, 2004 and Raiet *et al.*, 2009).

Silver is the one of the most commercialized nano-material with five hundred tons of silver nanoparticles production per year and is estimated to increase in next few years (Larue *et al.*, 2014). Including its intense part in field of high sensitivity bimolecular detection, catalysis, biosensors and medicine, it is remained recognized to have

strong inhibitory and bactericidal effects along with the antifungal, anti-inflammatory and anti-angiogenesis activities (El-Chaghaby and Ahmad, 2011 and Veerasamy *et al.*, 2011).

Silver nanoparticles are being used in copious technologies and combined into a wide range of consumer products that take advantage of their required optical, conductive and antibacterial properties.

- ▶ **Diagnostic Applications:** Silver nanoparticles are used in biosensors and several analyses where the silver nanoparticles materials can be used as biological labels for quantitative detection.
- ▶ **Antibacterial Applications:** Silver nanoparticles are integrated in apparel, footwear, paints, wound dressings, appliances, cosmetics and plastics for their antibacterial properties.
- ▶ **Conductive Applications:** Silver nanoparticles are used in conductive inks and combined into composites to enrich thermal and electrical conductivity.
- ▶ **Optical Applications:** Silver nanoparticles are used to efficiently produce light and for improved optical spectroscopy including metal-

enhanced fluorescence (MEF) and surface-enhanced Raman scattering (SERS).

4. TYPES OF NANOPARTICLE SYNTHESIS

4.1 Physical approaches

Most significant physical approaches include evaporation-condensation and laser ablation. Several metal nanoparticles such as silver, gold, lead sulfide, cadmium sulfide and fullerene have before blended by the evaporation-condensation method. The lack of solvent contamination in the prepared thin films and the consistency of nanoparticles distribution are the benefits of physical approaches in comparison with chemical processes (Kruis and Rellighaus, 2000 and Magnusson *et al.*, 1999). It was established that silver nanoparticles could be synthesized viz, a small ceramic heater with a local heating source. The evaporated vapor can cool at appropriate rapid rate, since the temperature gradient in the vicinity of the heater surface is very steep in comparison with that of a tube furnace. This makes probable formation of small nanoparticles in high concentration. This physical method can be beneficial as a nanoparticle generator for long-term experiments for inhalation

toxicity studies, and as a calibration device for nanoparticle measurement equipment (Jung *et al.*, 2006).

Silver nanoparticles could be synthesized by laser ablation of metallic bulk materials in solution (Mafune *et al.*, 2001; Kabashin 2003; Dolgaev *et al.*, 2002; Sylvestre *et al.*, 2004). The ablation efficacy and the features of produced nanosilver particles depend upon many factors such as the wavelength of the laser imposing the metallic target, the duration of the laser pulses (in the femto-, pico- and nanosecond regime), the laser fluence, the ablation time duration and the effective liquid medium, with or without the existence of surfactants (Kim *et al.*, 2005; Link *et al.*, 2000; Kawasaki 2006; Tarasenko 2006). One main benefit of laser ablation technique related to other methods for production of metal colloids is the absence of chemical reagents in solutions. Therefore, pure and uncontaminated metal colloids for further applications can be prepared by this technique (Tsuji *et al.*, 2002).

4.2 Chemical approaches

The common method for synthesis of silver nanoparticles is chemical reduction by organic and inorganic reducing agents. The

reducing agents such as sodium citrate, ascorbate, sodium borohydride (NaBH_4), elemental hydrogen, polyol process, tollens reagent, N,N-dimethyl formamide (DMF) and poly (ethylene glycol) block copolymers are used as reduction of silver ions (Ag^+) in aqueous or non-aqueous solutions. The aforementioned reducing agents reduce silver ions (Ag^+) and form the metallic silver (Ag^0), which is monitored by agglomeration into oligomeric clusters. These clusters ultimately form the metallic colloidal silver particles (Wiley *et al.*, 2005; Evanoff 2004; Merga *et al.*, 2007). It is essential to use defensive agents to alleviate dispersive nanoparticles through the course of metal nanoparticle preparation and defend the nanoparticles that can be absorbed on or bind onto nanoparticle surfaces, evading their agglomeration (Oliveira *et al.*, 2005).

The existence of surfactants including functionalities (e.g., thiols, amines, acids, and alcohols) for interactions with particle surfaces can stabilize particle growth, and protect particles from sedimentation, agglomeration, or losing their surface properties. Recently, a simple one-step process, Tollens method, has been used for the separation of silver nanoparticles with a controlled size. In the

modified Tollens procedure, silver ions are reduced by saccharides in the occurrence of ammonia, yielding silver nanoparticle films (50-200 nm), silver hydrosols (20-50 nm) and silver nanoparticles of different shapes (Yin *et al.*, 2002).

4.3 Biological approaches

In current ages, the progression of green chemistry methods retaining natural reducing, capping, and stabilizing agents to concoct silver nanoparticles with desired morphology and size have become a major focus of researchers.

Biological methods can be used to synthesize silver nanoparticles without the use of any harsh, toxic and expensive chemical substances (Ahmad *et al.*, 2003 and Ankamwar *et al.*, 2005). The bioreduction of metal ions by combinations of biomolecules are formed in the extracts of certain organisms (e.g., enzymes/proteins, amino acids, polysaccharides and vitamins) is environmentally benevolent, however it is a chemically complex. Many studies have stated that effective synthesis of silver nanoparticle using organisms (microorganisms and biological systems) (Korbekandi and Abbasi, 2009 and Iravani, 2011).

5. GREEN SYNTHESIS OF SILVER NANOPARTICLES

Various procedures are existing for the synthesis of silver nanoparticles like ion sputtering, chemical reduction, sol gel, etc. (Bindhu and Umadevi, 2015; Mahdi *et al.*, 2015; Padalia *et al.*, 2014; Sreet *et al.*, 2015); unfortunately, many of the nanoparticle synthesis methods involve the use of hazardous chemicals or high energy requirements, which are rather difficult and includes wasteful purifications (Ahmed and Ikram, 2015). Thus, a scenario is that whatever the method followed, will always leads to the chemical contaminations during their synthesis procedures or in later applications with associated limitations. For example; “The Noble Silver Nanoparticles” are determined towards the edge-level efficacies in every characteristic of science and technology including the medical fields and thus cannot be neglected just because of their basis of generation.

Hence, it is becoming a responsibility to emphasis on an alternate as the synthetic route which is not only cost effective but should be environment friendly in parallel. Observance of aesthetic sense, the green synthesis is rendering them as key procedure and

showing their potential at the top. The techniques for procurement nanoparticles using naturally occurring reagents such as sugars, biodegradable polymers (chitosan, etc.), plant extracts and microorganisms as reductants and capping agents could be reflected an enchanting for nanotechnology (Ahmed *et al.*, 2014; Ahmed and Ikram, 2015; Kharissova *et al.*, 2013).

Green synthesis of nanoparticles also provides advancement over other methods as they are simple, one step, cost-effective, environment friendly, relatively reproducible and often results in more stable materials (Mittal *et al.*, 2014). Microorganisms can also be utilized to produce nanoparticles but the rates of synthesis are slow compared to routes involving plant mediated synthesis (Ahmed *et al.*, 2015). Though, the prospective of higher plants as source for this purpose is still largely unknown.

Recently, plant extracts of numerous plants such as marigold flower (Padalia *et al.*, 2014), *Ziziphora tenuior* (Sadeghi and Gholamhoseinpoor, 2015), *Abutilon indicum* (Ashokkumari *et al.*, 2013), *Solanum trilobatum* (Logeswari *et al.*, 2013), *Erythrina indica* (Sreeta *et al.*, 2015), beet root (Bindhu and Umadevi, 2015), mangosteen

(Veerasamy *et al.*, 2011), *Ocimum tenuiflorum* (Logeswari *et al.*, 2012),

Meliadubia (Ashokkumar *et al.*, 2013), olive (Khalil 2013), leaf extract of *Acalypha indica* (Krishnaraj *et al.*, 2010) and *Sesuvium portulacastrum* are reported in literature as a source for the synthesis of silver nano particles with size ranging from 5 to 20 nm and seems to be an alternate to the conservative methods (Nabikhan *et al.*, 2010)

6. BIOSYNTHESED SILVER NANOPARTICLES AS ANTIMICROBIAL AGENT

Silver has been used in many traditional medicines of Ayurveda and Roman times, therefore attracted attention as antimicrobial agent (Ashokkumar *et al.*, 2014).

Silver nanoparticles were proved to be more efficient in their antimicrobial activities against bacteria, fungi, viruses, and other eukaryotic microorganisms (Saravanan *et al.*, 2011 and Edgar *et al.*, 2014). Many researchers supported the use of metallic silver as well as silver nanoparticles can be exploited in the field of medicine, dental materials, textiles fabrics, water treatment etc., and retain less

toxicity to human cells, less volatility and high thermal stability (Duran *et al.*, 2007; Jeyarajet *al.*, 2013; Kumar *et al.*, 2013).

Human pathogens primarily bacteria have developed resistance against most of the antibiotics resulting their decreasing ability. To find out the solution of this problem is a challenge in medical science, therefore, we need to find environmentally benign biomaterial/bio resources in the synthesis of silver nanoparticles and their synergistic role with antibiotics. Silver nanoparticles can inhibit bacteria from growing on or observing to the surface. Synthesized silver nanoparticles can be especially useful in surgical settings where all surfaces in contact with the patient must be sterile. Interestingly, silver nanoparticles can be incorporated on many types of surfaces including metals, plastic, and glass (Prakashet *al.*, 2013).

However, the problem ascends when the procedure is over and a new one must be done. In the procedure, washing the instruments a large portion of the silver nano particles develop less effective due to the loss of silver ions. They are frequently used in skin grafts for burn victims as the silver nanoparticles entrenched with the graft provide better antimicrobial activity and result in significantly less

scarring of the victim. These new applications are direct corse of older practices that used silver nitrate to treat conditions such as skin ulcers. Now, silver nanoparticles are used in bandages and patches to help heal firm burns and wounds.

7. CONCLUSION

An interesting area which is worth pursuing is to study the application of nanoparticles which is well explored field in nanotechnology, reaching across many areas such as chemistry, physics and biology. However, this is a relatively new field still in development. The excellent properties of differently synthesized silver nanoparticles facilitate extensive application. Due to the overwhelming advantages of afore- said methods the silver nanoparticles may become a worthy source in biological, pharmacological, environmental, catalysis and nano absorbants.

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14

SYZYGIUM CUMINI: AN OVERVIEW OF TRADITIONAL AND THERAPEUTIC USES

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ABSTRACT:

Syzygium cumini (myrtaceae) is a medicinally traditional plants used in herbal medicines. In many countries they play a major role in primary healthcare as there *syzygium* cuminieutic remedies. In India, the various traditional medicines were practiced like unani, ayurveda and siddha. It is commonly known as 'jamun' and is widely distributed throughout world-wide. Each and every parts of the plant were used in different medicines. The present study describes about the botanical description, phytochemical constituents, traditional and medicinal uses. This study describes every part of *syzygium cumini* plays a significant role to treat various diseases like antioxidant, anti-inflammatory, anti-microbial, anti-bacterial, antihyperlipidemic, antihyperglycemic, antiplaque, gastroprotective, antihistamine, and antispasmodic activity of *syzygium cumini* plant.

Keywords: *syzygium cumini*, myrtaceae, phytochemistry, traditional uses, medicinal uses.

1. INTRODUCTION:

Syzygium cumini is the evergreen traditional medicinal plant. It belongs to the family myrtaceae. It is natives to the tropics,

predominantly to tropical America and Australia. This plant has a native range from Africa and Madagascar through southern Asia east through Pacific. The plant of this family is highly rich in volatile oils which are mainly used for medicines (Mahmoud *et al.*, 2001). Similarly, some of the fruits regarding to this family are highly edible and acts as traditional medicines in tropical and sub-tropical world (Reynertson *et al.*, 2005). The ripe fruit of this plant are used for jellies, wine etc. (Warrier *et al.*, 1996). The plants were used in several traditional system of medicines like unani, ayurveda, siddha and homeopathic system (Helmstadter, 2007). Hence, the edible species of this plants are used throughout the tropics worldwide (Ayyanar and Subash-Babu., 2012)

2. HISTORY AND DISTRIBUTION:

Syzygium cumini also called as *Syzygium jambolanum* and *Eugenia cumini*. The additional name of this plant is called as jambul, black plum, Java plum, Indian black berry, Jamblang, Jamun, Portuguese plum, Malabar plum, purple plum and Jamaica and Damson plum. It is one of the best-known species and it is often cultivated. The trees of this family are found through the Indian sub-

continent and many other closed regions like bangladesh, burma, pakistan, india, nepal, srilanka and indonesia. In southern Asia, the tree is respected by Buddhist's and it is planted near Hindu temples because it is considered as sacred to lord Krishna (mortonanddowling. 1987). Nowadays, the plants were successfully introduced into many other tropical countries such as west indies, east and west africa and also some sub regions include florida, algeria, california and israel (ross., 2003) similarly, the plants were utilized as a fruit producer in different places and also used as timber and ornamental plants (ayyanar and subash-babu.,2012)

3. BOTANICAL DESCRIPTION:

The plant species has grown up to the height of 30m and can live more than 100 years. It has dense foliage to provide shade and it has great ornamental value. The bark of the tree at the base is dark grey and rough and later it becomes lighter grey and smoother. The wood is high water resistant; hence it is used to make *chesyzygium cumini* furniture's and village dwellings. This is also used in railway sleepers. The leaves of this plant were pink when it is young; when they mature it changes to glossy dark green with a yellow midrib.

These leaves have highly nutritive value hence it is used as food for livestock. The flowers are greenish white, which are clustered in form contains 10-40 round or oblong *shsyzygium cuminie*. The funnel *shsyzygium cuminie* calyx is about 4 millimetres long. The petals are joined together as a small disk. The fruits of this plant are oblong in *shsyzygium cuminie* and it contains 1.5 - 3.5 centimetres long. The fruit is fleshy, edible, juicy and dark-purple or nearly black in colour. It also contains a large single seed (gamble et al., 1967 and hooker, 1890). The dark violet coloured ripen fruits is similar to the fruit of the olive tree because it has same weight and *shsyzygium cuminie* and have an acerbic taste (craveiro, 1983).

Scientific classification (Ramos and bandiola, 2017)

Domain: eukaryota

Kingdom: plantae

Phylum: spermatophyta

Subphylum: angiospermae

Class: dicotyledonae

Order: myrtales

Family: myrtaceae

Genus: syzygium

Species: syzygiumcumini

Vernacular names: (veeramanjali *et al.* 2017)

Latinname: syzgiumcumin

Englishname: java plum, black

Hindiname: jamun, jambol,

Bengaliname: kalajam

Punjabiname: jamalu

Teluguname: neredu, chettu

Kannadaname:nearlmalayalamname: naval

4. TRADITIONAL AND MEDICINAL USES:

Each and every part of the jambolan can be used medicinally and it contains a long tradition in an alternative medicine (reynertson *et al.*, 2005). It is considered as an ancient medicinal plant with a renowned medical history and has been the subject of classical reviews for above 100 years. It is commonly distributed throughout the India and ayurvedic medicine. The different parts of the plants were used by various traditional practitioners in india in the treatment of diabetes, blisters in mouth, cancer, colic, diarrhoea, digestive

complaints, dysentery, piles, pimples and stomachache(jainetal.,2010).

In unani medicine different parts of the jamun plant were acts as liver tonic, enrich blood, strengthen teeth and gums and form good lotion for removing ringworm infection of the head (sagrawat,2006).Though, the various part of the plant has different medicinal property, the bark is used to treat sore throat, bronchitis, asthma, thirst, biliousness, dysentery and ulcers. It is also used as a good blood purifier (nadkarni, 1996).

The fruits of this plant possess a very long history for various medicinal purposes and now it has a large market for the treatment of chronic diarrhea and other enteric disorders (veigas, 2007). The seed is good for diabetes. The ash of the leaves are mainly used to strengthening the teeth and gums. The ripened fruit juice is used to treat diuretic and spleen enlargement (kiritikar, and basu, 2000)

Different parts of this plant were also stated for its antioxidant, anti-inflammatory, neuropsychopharmacological, antimicrobial, antibacterial, anti-hiv, antileishmanial and antifungal, nitric oxide scavenging, free radical scavenging, anti-diarrheal, antifertility,

anorexigenic, gastro protective and anti-ulcerogenic and radio protective activities (sagrawat, 2006).

5. ANTIOXIDANT PROPERTY:

Antioxidants rich food plays a significant role in prevention of some cancers, cardiovascular diseases and alzheimer's diseases (cui *et al.*, 2004). The plant has numerous phytochemical constituents such as tannins, alkaloids, steroids, flavonoids, terpenoids, fatty acids, vitamins and also the seeds are rich in flavonoids which account for the scavenging of free radicals and a protective effect on antioxidant enzymes (ravier *et al.*, 2004). The fruits of antioxidant activity have also considered newly and the tannins extracted from this fruit revealed a very good dpph radical scavenging activity and ferric reducing/antioxidant property (benherlal and arumughan, 2007).

6. ANTI MICROBIAL PROPERTY:

The antibacterial property of jambolana leaves are mainly used to strengthen the teeth and gums (gowri and vasantha, 2010). So, the researchers turn their attention towards the herbal products of this jamun plant looking for new steps to develop better drug against

mdr microbe strains (braga *et al.*, 2005). The study states that the leaf extracts of *syzygium cumini* has the highest zone of inhibition in petroleum ether against *S. aureus* and *E. coli* and it was ranged from 8-22mm and 12-15mm respectively which was already similar with previous study (deepak *et al.*, 2004, yuvraj *et al.*, 2011, prasad *et al.*, 2013). Hence this is an effective alternative of antibiotics in the treatment of infectious diseases (imran *et al.*, 2017).

7. ANTI – INFLAMMATORY ACTIVITY:

The ethanolic extract of *syzygium cumini* bark was examined for anti-inflammatory, but in mice it does not show any sign of toxicity up to the dose of 10-125g / kg. Hence, the study states that the *s. cumini* bark has an effective anti-inflammatory activity against different phase of inflammation without any side effect to gastric mucosa. (muruganandan *et al.*, 2001). The leaf extracts of methanol and ethyl acetate (200 and 400mg/kg) reduced carrageenan – induced paw edema in rats (jain *et al.*, 2010). The seed of *s. cumini* extract of methanol is also reduced paw edema volume and leukocyte migration in rats with adjuvant induces arthritis (kumar *et al.*, 2008).

8. ANTIPLAQUE ACTIVITY:

The study reported that the *syzygiumcuminibark* possess extracts of aqueous, methanol, and aqueous – methanol (1:1) is able to suppress the plaque formation in vitro. Hence, these extracts were active against streptococcus mutants at 260,120 and 380µg / ml respectively (nambaet al., 1985).

9. ANTI-HYPERLIPIDEMIC ACTIVITY:

The flavonoid rich extract of *s. cuminiseed* (300mg/kg/day, 15days) was described to increase the hdl – cholesterol level as well as it also helps to reduce total cholesterol, ldl- cholesterol and triacylglycerol levels (sharmaet al., 2008b). The same results were found in fruits of aqueous extract, at the doses of 100and200mg/kg,(rekhaetal.,2008)and also for seed kernel of hydroalcoholic extract100mg/kg/day,30days (ravietal.,2005).The flavonoids present in *s.cuminih* has been described that this class of compounds increase the expression of camp-dependent phosphokinase, enzyme responsible for hmg-coa reductase inhibition. (Havsteen, 2002). Hence, this effect helps in increased free fatty acid and triacylglycerol clear acessubsequent to insulin as well

as it also helps in the reduction of intestinal absorption of cholesterol (Ravi *et al.* 2005, Birari *et al.* 2007, Sharma *et al.* 2012). Similarly, these *Cumin* leaf also inhibits both the activity and expression of hepatic microsomal triglyceride transfer protein, which is controlled by insulin signalling pathways.

However, quercetin has been shown to prevent *op9* mouse stromal cells differentiation into adipocytes by down regulation of adipogenic genes (Seo *et al.*, 2015).

10. GASTRO PROTECTIVE ACTIVITY:

The study states that the ethanolic extract of *S. cumini* seed is treated against gastric ulcers induced by 2h cold restraint stress; pylorus ligation-ethanol and aspirin induced gastric ulcers in rats. The ulcer defensive activity of this plant may be due to its effects on both offensive and aggressive factors. Hence, the antioxidant properties of *Jamun* contribute towards its activity (Chaturvedi *et al.*, 2007).

11. ANTI HYPERGLYCEMIC ACTIVITY:

In the worldwide, diabetes is a chronic metabolic disorder

affecting a major population. A reduction in hyperglycaemia will decrease the risk of developing micro vascular diseases and reduces their difficulties (Kim *et al.*, 2006). Since, more than 130 years the use of *Syzygium cumini* fight against diabetes has been studied by western medicine (Helmstadter, 2008). A various scientific study in animals have proved the role of jambul in the management of diabetes (Grover *et al.*, 2001). The ethanolic extracts of jamun seeds were decreased the blood and urine glucose level of streptozotocin-induced diabetic rats upon 30 days at the doses of 100mg/kg/day (Ravi *et al.*, 2003). In addition to that the flavonoid extract of seed lowers the blood glucose level and also shown to recover peripheral glucose tolerance in streptozotocin induced diabetic rats 500 mg/kg/day, 21 days (Sharma *et al.*, 2008a) and rats 300 mg/kg/day, 15 days (Sharma *et al.*, 2008b). The jamun leaf is rich in flavonoid extract is condensed by 50% the expression of aldose reductase in renal tissue of diabetic mice (Sharma *et al.*, 2008b), and this effect was previously described for phenolic compounds, such as myricetin, quercetin, kampferol, and ellagic acid (Haraguchi *et al.*, 1998). The study stated that the *S. cumini* bark revealed effective blood

glucose lowering property both in normal and diabetic rats. (Saravanan and leelavinothan, 2006). It is reported that *e. jambolana* contains is a clinically effective in the treatment of diabetes (karnic, 1991).

12. ANTI – HISTAMINE ACTIVITY:

The *s.Cumin* dried seeds of methanol extract managed in *trsygiumcuminieritoneally* to rats was active vs histamine induced pedal edema (mahsygiumcuminiatraet *al.*, 1986).

13. ANTISPASMODIC ACTIVITY:

The extract of ethanol – water (1:1) was the aerial parts were inactive in guinea pig ileum vs acetyl choline and histamine induced spasms (dhawanet *al.*, 2007). The study stated that the ethanol water (1:1) of dried bark of a concentration of 0.01gm/ml was active on guinea pig ileum (mokkhasmitet *al.*, 1971).

14. CONCLUSION

The demand of *syzygiumcumini* is greatly enlarged within the past few years for its overwhelming therapeutic potentials. Offered information on *syzygiumcumini* conjointly clearly expresses a broad spectrum of medical specialty properties of this plant. Because of

possessing intensive pharmacological activities, the *syzygiumcumini* is safely considered one of the trendy catholicons. However, the investigated pharmacological activities of *syzygiumcumini* would like validation through the clinical study. Even though many clinical studies were with success completed while not adverse effects or fatalities, most of them solely investigated higher tract infections for a range of conditions. Verification of the efficaciousness of other biological activities of *syzygiumcumini* together with medicament, anticancer, anti-inflammatory, and hepato protective activities, on human study subjects would bring the advantages for the largest population of the world. We have a tendency to assume that the *syzygium cumini* could be helpful as extreme therapeutic agents for a variety of disorders within the close to future to cure human diseases as well as some animal diseases. To satisfy this dream, the researchers may specialise in multiplication of this plant to meet industrial demand besides the medicine study. Tissue culture techniques might be a good alternative to make *syzygium cumini* offered for researches (i.e., medical specialty study and phytochemical study to seek out new bioactive compounds) as well

as conservation of this plant.

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Chapter–XV

15

TOOLS FOR DRUG DISCOVERY - INSILICO

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1. INTRODUCTION

Drug discovery is an important area in medicine and pharmacology where drugs are being identified and tested for their efficiency in curing several diseases and managing health issues. Bioinformatics and Cheminformatics paved way for rapid discovery of drugs by computational molecular docking techniques. This approach uses computational modeling of drugs and testing their interactions between the molecules (usually referred to as the target and ligands). This helps us to identify and describe the strength of interaction between the molecules in atomic level elucidating fundamental biochemical process. During docking, the binding affinity of the molecules are assessed using sampling methods and scoring schemes where binding affinity is taken into account based on geometry of ligand pose docked into the receptor structure. By characterizing different aspects of binding affinity data and target-ligand interaction, empirical functions are developed and used as scoring methods. Additionally, knowledge-based approach was also used where statistical analysis of structure and interaction frequencies is taken into account leaving the binding affinity. In order

to discover phytochemical based drugs, docking can be carried out with protein as target and phytochemical as ligand. Different software's are available to test the molecular binding affinity aiding drug discovery. The major steps followed by the tools and some of the important and well-known tools used are described in this chapter.

2. STEPS INVOLVED

The process of computational drug discovery starts from identification of target and ends with identification of best fit leads.

The following are the steps involved:

- **Identification of target**
- **Selection of target**
- **Ligand selection**
- **ADMET screening**
- **Molecular docking**
- **Scoring**

IDENTIFICATION OF TARGET

This is the first step in the process of drug discovery. The target

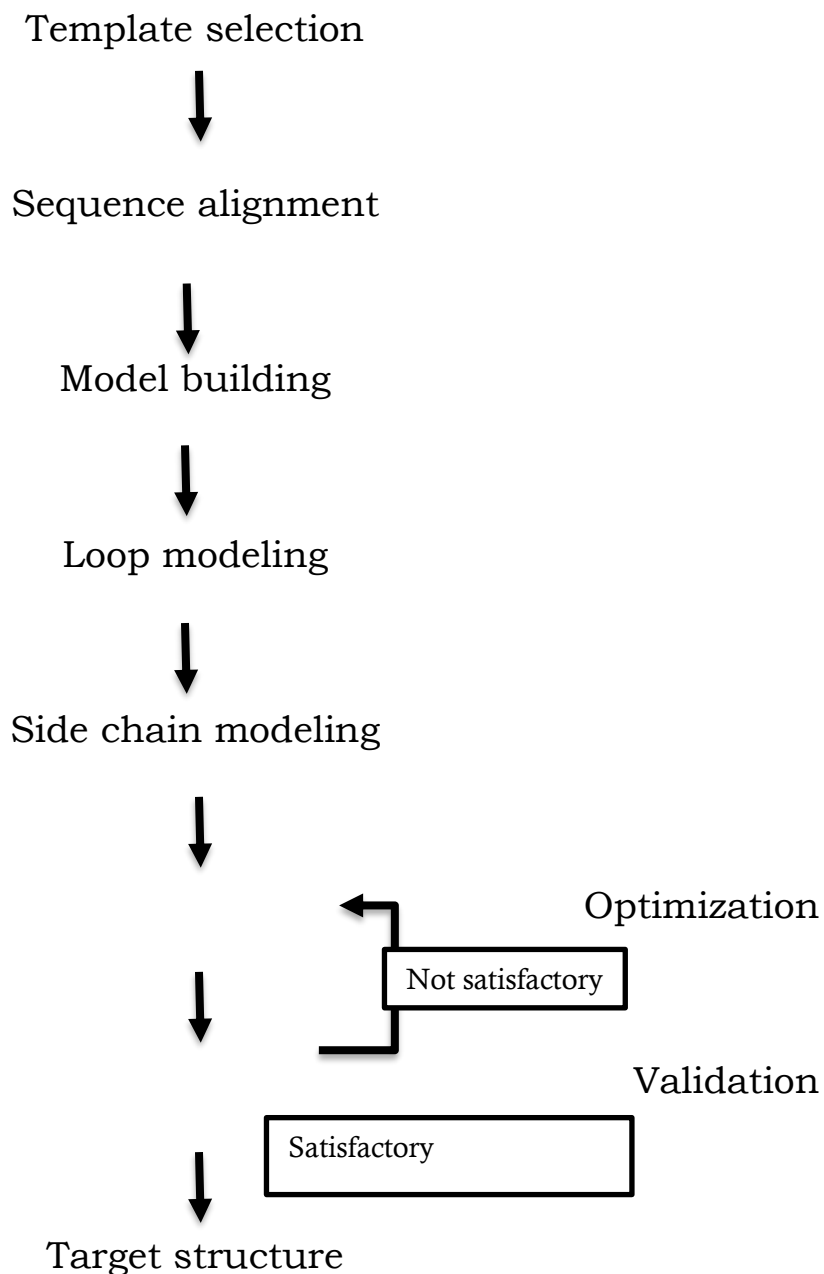
can be any of the biomolecular which usually are large like proteins, carbohydrates and even the genetic material. The prime and most important thing to keep in mind is choosing appropriate target for docking. It is essential to identify the molecules that are important to cause disease or the disease-causing agent to survive. It should also be taken into account that the selected target should be involved only in causing disease and are not holding essential cellular functions in the organism. But in some cases, the second criteria can be left.

SELECTION OF TARGET

After identification of the target, selection of the three-dimensional structure of the target is to be carried out. The “Protein Data Bank (PDB)” available at <https://www.rcsb.org/> is one of the most widely used and well-known servers for target selection and retrieval of their structure. A mere searching of the name of the target will give the user a list of all hits with the three-dimensional structure of the biomolecular along with its experimental details. Usually the structures solved by x ray and NMR are good for carrying out docking. The resolution of the structure also plays a major role in the process of docking.

HOMOLOGY MODELING

Homology modeling is carried out when the required three-dimensional structure of the target protein is not available in any database or the structure is not predicted. This is carried out with the available one-dimensional information of the gene or protein (that is the primary sequence information). This process starts with the selection of template based on the similarity of the sequence and the relationship between the target structures with other structures. The sequence alignment is then carried out and the most similar structure was choosing. Based on this structure, a model structure for the target is built along with their loops and side chains. After prediction of the structure, the structure is optimized by reducing its energy which ensures stability of the modeled structure. The structure is then validated. While validation if the energy of the structure is not satisfactory, optimization step is carried out until the desired structure is modeled.



LIGAND SELECTION

Until 18th century, the medicines were made as teas, poultices, tinctures, decoctions and other forms. During the early 19th century,

advances in organic chemistry and chemical analysis paved way for isolation, purification and characterization of these compounds from plants which accelerated the drug discovery process. During late 19th century and 20th century, several phytochemicals like quinine, aspirin, cocaine, morphine and many other plant-based compounds were introduced in the market with pharmaceutical and clinical potency. Among the drugs approved from 1981 to 2014, more than half of them were derived from natural products. Some plant-based compounds are being used for treating diseases like cancer. Though many compounds have been researched, countless phytochemical are yet to be studied. Hence phytochemical are major ligands. Apart from this compound from databases like drug bank, Pubchem etc., can also be used as ligands.

ADMET SCREENING

Before proceeding with molecular docking, prediction of the ADMET properties of drug is effective to identify the efficacy of the drug to be used for treatment as well as to predict the possible side effects of the compounds if administered. This allows the researcher to choose safe compounds as drugs. ADMET prediction helps us the

analyze the adsorption of the drug by body as soon as it is administered, how the drug is distributed to the site of action after administration of the drug, metabolism of the drug after binding with biomolecules available in the body and showing effectiveness against the disease, after its action the excretion of the drug and finally the toxicity of the drug can also be studied.

MOLECULAR DOCKING

During this process, based on the “lock and key” theory process or “induced fit” theory, the ligand molecules will be computationally docked to the target structure forming molecular complex. In order to carry out docking computers use several docking algorithms like CDOCKER, LibDock, LigandFit, and MCSS to help the procedure based on the software used. The CDOCKER uses CHARMn forcefield and random initial ligand placement strategy. Based on the features of binding site called “hotspots”, LibDock carries out the work. It is faster than the remaining algorithms. The LigandFit is based on matching of the initial shape match to active site. The final one, MCSS also use CHARMm force field and dock the ligand fragments using one of the most efficient Multiple Copy Simultaneous Search

algorithms.

SCORING

After docking, based on the energy of the complex formed, scores will be given for each ligand and target complex and their poses formed. The best scored complex will have the ligand with higher affinity for binding with the target.

3. MOLECULAR DYNAMIC SIMULATION

The CHARMM (Chemistry at HARvard Molecular Mechanics) is a dynamics and molecular mechanics program which performs a broad range of simulation and calculations like geometry, conformations, interactions, energy, rotation barriers, and dynamic behavior in time dependent manner, free energy and local minima (Momany and Rone, 1992). Delphi and ChemShell are the programs used for calculating the electrostatic energies, quantum mechanics and molecular mechanic forcefields by Discovery studio software for molecular dynamic simulation. Additionally, DMOL was also used as quantum server. Based on the software's, the simulation technique and its algorithm changes.

4. MOLECULAR FORCE FIELD

In molecular mechanics simulations, an essential step is to first assign a force field to the input molecule. CHARMM force field with automatic parameter estimation can be used to automatically assign complete force field parameters for almost any type of molecule. In addition, some other force fields, such as charmm19 or charmm27, do not have automatic parameter estimation capability built in, so you must create new residue and atom types for systems other than common biomolecular monomers. For these force fields, nonstandard residues may not be assigned force field parameters successfully, and manual customization of the residues is necessary to ensure complete force field assignment of the molecule.

5. EXPLICIT SALVATION MOLECULAR DYNAMIC SIMULATION

Molecular dynamics simulations can help in the study of protein stability and folding, molecular recognition, conformational changes, and other critical aspects of protein function that involve small- and large-scale atomic movements. Thus, a realistic model of a structure's motion, perform conformational searching, produce a time series analysis of structural and energetic properties, explore energy decay, and analyze solvent effects can be designed.

6. BINDING ENERGY BY STEERED MOLECULAR DYNAMICS

Steered Molecular dynamics (SMD) simulations can aid in the study of biophysical processes on a computationally feasible timescale. In SMD, processes such as protein unfolding, ligand unbinding, or conformational changes can be simulated by actively steering the event towards a chosen direction as opposed to passively waiting for the event to take place as in standard molecular dynamics simulations. Thus, biological events that occur on the milli-second or longer timescales can be simulated on the nanosecond timescale. The free energy of such a process can be calculated by analyzing the steering work done. Free energies calculated using this approach requires that the steering process take place in equilibrium. However, the Jarzynski's equality which is applicable to data generated in the non-equilibrium regime allows us to adopt rapid steering schedules, thereby further enhancing the efficiency of the SMD approach. In addition to free energy values, an analysis of SMD simulations can reveal atomic-level structural details into the biophysical process can also be investigated.

7. FORCE FIELDS

In molecular mechanics simulations, an essential step is to first assign a force field to the input molecule. Charm-style residue topology file (RTF) is a commonly used force field type to match a residue to its corresponding template in the force field. The match is performed by comparing the residue name and atom name from the input structure to the residue template in the RTF file. In the case of biopolymers which consist of well-defined monomers in a linear form, such as a protein or nucleic acid, this task is relatively straightforward.

However, residue names and atom names are much more variable for other types of molecules, including carbohydrates, lipids, and small molecule ligands. Additionally, each of the supported force fields may include some residue patches to allow variations of the residues. A typical example is the use of a patch to define the connection between different carbohydrate monomers to form either linear or branched connections. The client typing only allows a limited number of patches to be applied, such as those related to capping of the termini of protein chains or nucleic acid chains.

Other types of patching are not supported by the client typing methods. Force fields like charmm19, charmm22, and charmm27 mainly support the standard biopolymers and work well with the client typing mechanism. Additionally, the client can also automatically estimate atom types and parameters for CHARMM force fields where they are missing from the force field.

The charmm36 force field supports additional functional forms that are not suitable for the client typing method. To support these moieties, the Assign Force field Types (Prototype) protocol works by matching each residue to its template structurally. It also recognizes where residue patches need to be applied to match the structure and applies them automatically. The assigned force field types are saved in the molecule DSV format so that they are automatically used in subsequent simulation calculations.

8. MAESTRO SCHRODINGER

Maestro Schrodinger is the leading molecular docking tool used worldwide for the drug discovery studies. Schrödinger is one of the scientific leaders involved in developing several cheminformatics

tools enabling chemical simulation software for use in pharmaceutical, biotechnology, and materials science research. Maestro is the portal to all of Schrödinger's computational technology. This software runs in Linux, Windows and Mac. With complete re-imagined interface, it helps for model generation and aids in flexible visualization with three-dimensional realism. Quantitative structural analysis can be carried out using these software's even with scripts.

9. DISCOVERY STUDIO

Discovery Studio is a software suite molecular docking and simulation along with carrying out other pharmacokinetic and pharmacodynamics functions computationally. It is developed by Dassault Systemes BIOVIA (formerly Accelrys). With strong academic collaborations, they support scientific research using algorithms like CHARMM, MODELLER, DELPHI, ZDOCK, DMol3 and more.

10. Auto Dock

A most widely and commonly used freely available molecular docking software is Auto Dock. When compared with other software

the number of users is more probably for its open source available. Auto dock can perform protein-ligand docking most effectively. This is the most cited docking tool by research community. The accuracy and efficiency of this tool is improved by Auto Dock Vina available under Apache license. Scripps Research's Centre for Computational Structural Biology is currently maintaining these two platforms.

11. CONCLUSION

It is effective and efficient to use chemi. Informatics tools to start the drug discovery research which saves time and improves research. Additionally, it is important to conduct the ADMET screening of the drug to come up with drugs which cause no harm to humans and animals when administered.

Chapter–XVI

16

IMPACT OF COVID-19 PANDEMIC ON THE SOCIO- ECONOMIC STATUS OF THE FISHERY SECTOR

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ABSTRACT

The outbreak of the pandemic and the cascade of complete lockdown events in India greatly affected the livelihoods of fisherman across the country. However, the necessities of subsequent lockdowns were significant and they played vital role in control of the spread, arrested and prevented the infections to community level. On the other hand, governmental agencies and statutory fishery departments intervention was the need of the hour to mobilize the fresh catch of fishes as well as stored ones to minimize the disruptive effect on trade both locally and regionally.

Keywords: COVID-19, Economic downturn, Global Supply chain, Marketing, Livelihood.

1. INTRODUCTION

The pandemic COVID 19 begun at the end of 2019 and cause enormous loss to, global economy. As the pandemic spread, it impacted on the trade and customer demands almost across the entire sector. However, the origin of infection was speculated to be China, the world's largest producer, consumer, and exporter of seafood experienced severe downfall (FAO, 2019).

The declaration of global emergency was put forth by World Health Organization (WHO) (Sohrabi et al., 2020) on January 30, 2020. Since the disease is highly contagious several measures like self- quarantine, social/ physical distancing, global/domestic travel restrictions, closure of public facilities, transportation, even lockdown of the entire country was seen (Dev&Sengupta, 2020). However, the mitigation strategies to restore and streamline the functions of the seafood sector seem to be critical. Millions of people depend on seafood for their livelihood, business, culture, and nutrition security, series of lockdowns have negatively reflected on the manpower (FAO, 2018) including women, migrant workers and young people, and a large informal sector 9 that may not see direct aid from governments or financial institutions (Tendall et al., 2015).

The fishery sector in Indian sub-continent is an important exporter of fishes locally and globally. On an average, over nine million fishermen indulge as day laborers for their livelihood and most of them were reported to be small scale fishers (Shyam, 2016).

The overall industry is employed with 14 million people with of financial contribution of 1.1 % to the country's GDP.

The east coastal area covers four chief maritime states namely Tamil Nadu, Andhra Pradesh, Odisha and West Bengal and a couple of Pondicherry and Andaman and Nicobar Islands, the net production from these eastern coast accounts up to 25% of the total country's fish output. The fishing is primarily carried out with conventional catamarans, fuel and steam boats and small mechanized crafts.

However, the principal issues related to the small-scale fisherman include low pricing, cheap marketing and organization, since many of them are long term needs too. On the other hand, series of lockdowns has affected the earnings of fisherman in coastal landing areas and harbors. Amidst the pandemic, the small-scale fisheries handled the responsibility of delivering the caught fish at the low cost to the consumers which was a significant source of protein. This was significant for marginalized coastal community people whose livelihood was completely dependent upon the fish catch per day and the ruminant as their food for daily consumption. This had a considerable impact on the nutrition security of these people.

An array of difficulties including expenses for fuel for running vessels for fish catching, marketing in landing centers, fewer consumers in market places due to social distancing and stringent timings imposed by government has also affected the overall sales of the fishes. Notably, local women vendors were comparatively affected due to less fishing activity and limited boats for trailing. Ironically, the low catch had high demand in the landing centers where these local vendors have to bid for low price. Due to the panic of infection, common public step behind from purchasing fish from the street vendors. Thus, their income has been totally reduced and their families face crisis in managing their day-to-day expenses. Hence, the focal point of this review was to limelight the problems faced by the aquaculture industry and key points to for the revival of socio-economy and trade.

2. PRODUCTION AND LABOR DISRUPTIONS DURING LOCKDOWNS

Migratory workers in fish industry were severely affected. Most common migrants were from Kerala and Karnataka and even suffered for meal once in a day.

Generally, fisher folks are daily wages and they take advance amount from the boat owners and return after the catch, this phenomenon was also seriously affected as the owners even lacked the money due to lockdown in pandemic. The trawlers ventured for fishing before the imposition of lockdown faced severe financial loss after landing on shore after multiple days of fishing. Only the fishermen who were supported with storage faculties were able to store, preserve and sell fishes the harvested fish later and had possibilities of marketing. Contrastingly, the small-scale fisherman due to lack of storage facilities were drastically affected and trashed a large quantity of fish unsuitable for consumption.

This directly affected the income and livelihood of the families. The export market was withheld due to severe effect on the fish and its allied sectors like transportation, storage etc., Top put in a nutshell, the ice-plant workers, fuel industry and the man power associated with the entire local and global supply chain was disrupted, In addition, lockdown has also affected the allied fishing activities like net mending, boat and engine maintenance, re-construction of damaged boats etc.

On a concluding remark, most of the farmers faces untold crisis in running the family and most of them suffered to repay the loans taken from varied fishing purposes. There was a huge pressure on the fisher folks due to contagious fall, one the seasonal ban for fishing between April to June for nearly ninety days. Subsequently, the lockdowns also imposed additional stress due to unemployment among the fishers, local/market vendors and fishing laborers. The government and the fisheries board have supplemented the immediate relief packages as a compensation to support the life of fisher folks. Another scope of enlarging the work is fish drying, value addition and processing which can help the women vendors to fetch a minimum income.

3. EFFECT OF COVID-19 ON FISHERIES AND AQUACULTURE

The waves of COVID-19 on the aquaculture varied across places and the situation is still rapidly evolving. The Fish and fish products are the epitome of international trade for any country; this was affected adversely and early due to the pandemic crisis and lockdowns globally. The supply chains of the fresh fish, shell fish and the exported varieties like salmon, tuna, and prawns were severely

interrupted and it directly impacted on the restaurants and hotels. On the other hand, the processing sectors also faced closures due to reduced consumer demand.

Logistical difficulties were also experienced in several countries which directly influenced the seafood trade. Particularly, the export varieties of fishes e.g. Salmon and Tuna suffered from high air cargo charges and cancellation of flights across the countries. Other challenges included the shortage of seeds, feeds and medicines to local fish farms due to restriction of transportation and travel of professionals with knowledge on the aquaculture industry.

The live fish market had a major loss while the canned and preserved fish products had a hike in price and the respective industry profited during the pandemic crisis. However, there are many uncertainties in regard to the prolonging pandemic situation and this fluctuation may likely introduce new transformations in the fishing sector in future.

4. SAFETY CONCERNS ON THE CONSUMPTION OF FISH AND MARINE PRODUCTS

Fish and fish products are unanimously consumed for the rich protein source and healthy diet. However, some misleading perceptions posed in few countries have largely affected the consumption of the fish. Scientific evidences have reported that the corona virus cannot infect or transmit through fish consumption; therefore, it is highly safe for consumption. In addition, contamination of fish products during food packaging also imposed a huge threat on the aquaculture industry; hence it is more significant to ensure the hygiene and health of the individuals handling the food s in the packaging and processing industry to avoid the transmission of COVID 19 through food products.

5. INTERFERENCE OF LOCKDOWNS ON DOMESTIC AND GLOBAL SUPPLY CHAINS

Fish and fishery products are toppers of the most traded food products globally accounting about one third percent of the entire fish/seafood in the international trade. In parallel, fishing and aquaculture practices are important to local people for their sustenance and living as our country hosts rich coastal areas with surplus people belonging to fish-dependent communities,

Measures to conceal the spread of COVID-19 included the closure of food services like restaurants to street foods, termination of tourism, cessation of transport, stringent trade restrictions, etc., caused interference in local, regional, national and international supply chains. The preserved fish products accounted for about nearly half of the total fish consumed, hence delivery of these food materials was an additional challenging task to the logistics sectors. However, keeping the food supply chain live and open is fundamental to avoid a global food crisis for any country to avoid food scarcity and nutritional instability.

6. KEY IMPACTS AND CRISIS ON GLOBAL AND LOCAL SEAFOOD-DEPENDENT ECONOMY

It is still unclear about the bounce back of the entire world to the normal life. This new normal will experience the emergence and transformations to assist the pandemic situation. However, this sector will gain gradual recovery after the pandemic is over. Amidst, certain well-off seafood companies may accomplish or even take an advantage from the crisis, through a level of industrial consolidation.

This includes the re-sourcing. digital innovation, online trade, additional/accelerated shifts in the food processing sectors, web-based applications for improved product traceability and online services in contrast, local level transformations occur in adapting alternative fishing gears, catching more profitable fish species, establishing a direct trade deal with the consumers, etc. These alternatives will aid in the communities, especially women vendors who exclusively work in in the post-harvest sector and domestic markets In addition, other economic disruptions come in from the lack of manpower in direct landing sales to consumers, supply of bait, ice and gears for fishing, competition in grabbing source and transportation service and also interruption of cash flow in terms of delayed payment and orders.

7. IMPLICATIONS FOR THE MOST VULNERABLE SECTOR IN AQUACULTURE INDUSTRY

Certainly, the lockdown due to pandemic has created an unparalleled health and socio-economic crisis particularly with the susceptible groups viz., women, post -harvesters, food processors,

local market vendors, migrant fishers, fisherman folks in all levels of the respective domain workers.

The most desperate condition being many fisherman and labourers are non-registered and work under informal grounds.

Therefore, they devoid of the relief package aids and social protection offered by the government and market policies. Thus, these problems might aggravate the secondary effects of COVID-19, including poverty and hunger. The frontline employees engaged in fish catch, sorting and processing lack protective measures like clothing and inadequate masks which checks their vulnerability to the spreading infection. Proportionally, food wastage and loss due to inadequate storage and cold chain facilities also account to huge loss in the trade.

On the other hand, the fishing crew occupied in large industrial vessels like pelagic trawlers and purse seiners that were already on board faced critical problems. The alternation of shifts by crews were cut-off due to lack of labour supply from landing ports, extended time of shifts caused fatigue and stress and lack of rotations even lead to causalities and on-board accidents While, the problem was on a

different phase were, risk associated outbreaks of COVID-19 infected crew members while away at sea.

The spread of infection was rapid and severely contagious but medical assistance was not readily available and most of the harbours/ports denied access to extend medical aid to treat the fleet.

8. CONCLUSION

On a conclusive perspective, COVID-19 pandemic posed an unrivalled shock on the health system and economy for the Indian sub-continent and the entire world as well. Interference and disruption of essential agricultural food commodities chiefly fish products directly ceased the employment of several millions of people directly and indirectly associated with the aqua cultural sector globally. Thus, this review discussed and highlighted the magnitude of impact from the local fisherman folks to multi-national shipping companies in terms of production and marketing. However, the immediate and alternative multidirectional action plans of the government have helped in amelioration of this economic crisis and provided financial assistance to cope up with the loss in sector.

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CONFLICT OF INTEREST

The author declares no conflict of interest

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Chapter–XVII

17

MICROBIAL SURFACTANTS WITH MULTIFUNCTIONAL POTENTIAL

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ABSTRACT

Surfactants are derived either synthetically or biologically. The biologically derived surfactants called microbial surfactants because these are mainly produced from microorganisms such as *Bacillus*, *Pseudomonas*, *Candida*, and *Acinetobacter* etc. Microbial surfactants are amphiphilic compounds with hydrophobic and hydrophilic moieties which reduce the surface/interfacial tension at the surface and interphase respectively. They possess unique properties like high biodegradability, low toxicity, etc. Due to these, properties they have diverse applications such as environmental, agricultural, industrial applications mainly in pharmaceutical, food and chemical industries, in cosmetics etc. In this chapter the role of microbes in the synthesis of multifunctional surfactant molecules have been described.

Keywords: Microbial surfactants, amphiphilic compounds, biomedical, bioremediation, biocorrosion

1. INTRODUCTION

Surfactants are amphiphilic compounds having both hydrophobic and hydrophilic moieties they are distributed between two immiscible liquids with the effect of lowering down the

Interfacial/surface tension and causes the solubility of polar compounds in non-polar solvents.

Surfactants or surface-active agents that are classified into two groups: synthetic surfactants and microbial surfactants or biosurfactants. Synthetic surfactants are produced by chemical reactions whereas, microbial surfactants are naturally derived surfactants produced by the extracellular excretion of microbes (eg. fungi, bacteria and yeast) (Fenibo *et. al.* 2019).

They have many properties like less toxic, biodegradability, specificity, relative ease of preparation, active at higher temperature and pH which make them attractive to be used in diverse areas such as in agriculture, environment decontamination, food industries, pharmaceutical industries etc.

They may be used as emulsifiers, detergents, wetting agents, foaming agents and functional food ingredients. And due to their surface tension reducing ability they can also be used in oil recovery and bioremediation of heavy crude oil (Vijaykumar *et al.*, 2015).

2. MICROBES WITH THE POTENTIAL OF RELEASING SURFACTANTS

Biosurfactants are broadly grouped into two major groups on the basis of their biochemical nature: High molecular weight biosurfactants and low molecular weight biosurfactants and further subdivided into five groups on the basis of their chemical structure- lipopeptides, glycolipids, phospholipids, polymeric biosurfactant and particulate biosurfactant (Jin- Feng Liu *et al.*, 2015). Different microorganisms having potential to synthesize different kinds of surfactants have been isolated and studied so far which have been summarized in Table-1.

3. APPLICATIONS OF MICROBIAL SURFACTANTS

Enhancement of plant growth

The plant-microbe interactions in the rhizosphere are essential for the growth of plants. These interactions affect the availability of nutrients to the plants and thus affect the plants growth (Fenibo *et al.* 2019). Mechanisms that play a vital role in these interactions are microorganism motility, biofilm

Table1. Microorganisms with the potential of synthesis of DIFFERENT TYPES OF SURFACTANT MOLECULES

Group	Sub – group	Class	Microorganisms
Low molecular weight biosurfactants	Glycolipids	Rhamnolipids	<i>Pseudomonas</i>
		Sophrolipds	<i>Torulopsis</i>
		Trehalolipids	<i>Rhodococcus, Mycobacterium</i>
	Lipopeptides	Surfactin	<i>Bacillus subtilus</i>
		Lichenysin	<i>Bacillus licheniformis</i>
		Iturin	<i>Bacillus subtilus</i>
		Fengycin	<i>Bacillus subtilus</i>
		Viscosin	<i>Pseudomonas fluorescens</i>
		Phospholipids, fatty acids, neutral lipids	Phosphatidylethanol amine
		Spiculisporic acid	<i>Penicilliumspiculisporum</i>
High molecular weight biosurfactants	Polymeric biosurfactants	Emulsan	<i>A.calcoaceticus</i>
		Alasan	<i>Acinetobacter radioresistens</i>
		Biodispesan	<i>Acinetobactercalcoaceticus</i>
		Liposan	<i>Candida lipolytica</i>

Formation, the release of quorum sensing molecules, etc. Besides this, microbes release certain chemicals such as biosurfactants that act as mobilizing agents and increase the

solubility of insoluble hazardous compounds such as hydrophobic organic contaminants (Dhara *et al.* 2013). Biosurfactants are also helpful in hydrophilization of heavy metals and provide good wettability to soil and achieve the even distribution of fertilizers (Fakruddin, 2012).

Some biosurfactants also possess antimicrobial activity e.g., rhamnolipid biosurfactant due to which it is found to be effective against both gram-positive and gram-negative pathogenic bacteria. Rhamnolipids are also found to be useful in removing polyaromatic hydrocarbons and pentachlorophenol from soil which otherwise may influence the quality of soil (Chen *et al.* 2017, Dhara, *et al.* 2013). Surfactants also increase the antagonistic properties of microbes e.g.; they inhibit the aflatoxin production by *Aspergillus* sp. which infects the several types of crops. Thus, we biosurfactants promote the growth of plants in many ways.

4. ENVIRONMENTAL REMEDIATION

Due to increase in the production and use of organic compounds especially hydrocarbons and heavy metals, the soil and groundwater areas have been seriously contaminated by these

chemicals. The toxic effects of these chemicals have resulted in a negative influence on living organisms. So, it is necessary to clean-up the contaminated sites. Biosurfactants released by mainly rhizospheres and plant associative-microbes play a very important role in remediation of pollutants from the soil. Otherwise, these pollutants may influence the quality of the soil. Biosurfactants increase the process of hydrocarbon degradation by solubilization, emulsification and mobilization.

The action of mobilization takes place at concentration below the biosurfactant critical micelle concentration. At these concentrations biosurfactant decreases the surface and interfacial tension between soil/water and air/water system. By reducing interfacial force, connection of biosurfactant with soil/oil system enhance the contact angle and lower the capillary force holding soil and oil together.

In turn, solubilization occurs at concentration above the biosurfactant critical micelle concentration. At such concentrations biosurfactant molecules associate to form a micelle, which enhance the oil solubility (Usman *et al.* 2016). Thus, the essential task of

remediation of these pollutants for the up-gradation of soil quality and increasing the crop yield is performed by microbes.

Several mechanisms are involved by which rhizobacteria and plant-associated microbes remove the contaminants from the soil and increase the degradation of chemical insecticides that are present in the soil. Emulsification is a process in which biosurfactant assemble and forms liquid carrying tiny droplets of oil suspended in fluid usually, water. The high molecular weight of biosurfactants is efficient emulsifying agents. These are also used to stimulate bioremediation and removal of oil substances from the environment (Veraet *al.* 2014).

5. OIL RECOVERY

Biosurfactants are natural compounds which are used to upgrade the mobilization of hydrocarbons and enhancing the crude oil recovery.

It is a tertiary process where microorganisms and their metabolites are used to increase the recovery of residual oil (Silva *et al.* 2014). Microorganisms synthesize polymers and biosurfactants which lower oil-rock interfacial tension by reducing the capillary force

that prevents oil movement through rock pores. This process is applied by direct injection of nutrients with microorganisms that generates biosurfactants into the reservoir and spread in situ and this injection increases the growth of biosurfactants. The recovery of oil enhances 30-200% by these injections (Silva *et al.* 2014).

6. THERAPEUTIC APPLICATIONS

Biosurfactants are potentially useful for many therapeutic applications because of their diverse properties and structural versatility. Due to their surface activity, they cause the cell membrane disruption that leads to cell lysis through apoptosis pathway. Biosurfactants have strong antibacterial, antiviral, anti-fungal and anti-tumour activity, in addition to their anti-adhesive character to pathogens. So, they are useful in treatments of many diseases. Some diseases show strong resistance against traditional antibiotics so biosurfactants are the novel alternative to synthetic medicines and antimicrobial agents (Gudina *et al.* 2013, Frakuddin, 2012). Lipopeptides are the class of biosurfactants which is most widely reported for their antimicrobial activity. Surfactin, produced by *B. subtilis* is the well-known lipopeptide (Gudina *et al.* 2013)

Table 2. Biosurfactants applications in biomedical field

Microorganism	Biosurfactant type	Activity/ Application	Reference
<i>Bacillus licheniformis</i>	Lichenysin	Antibacterial activity and Chelating properties that may explain the membrane disrupting effects of lipopeptides.	Rodriguez, <i>et al.</i> 2010
<i>Bacillus subtilis</i>	Fusaricidin A, Iturin, Surfactin, Pumilacidin	Antifungal and antibacterial activity. Antiviral activity against herpes simplex virus 1 (HSV-1). Antitumor activity. Nonpyrogenic and non-toxic immunological adjuvants	Sil, <i>et al.</i> 2013
<i>Candida antartica</i>	Mannosylerythritol	Antimicrobial action against Gram positive bacteria	Banat, <i>et al.</i> 2010
<i>Wickerhamiel ladomercqiae</i>	Sophorolipid	Anticancer activity by inducing apoptosis in H7402 human liver cancer cells	Sil, <i>et al.</i> 2013
<i>Rhodococcus erythropolis</i>	Trehalose lipid	Antiviral activity against influenza virus	Rodriguez, <i>et al.</i> 2010
<i>Pseudomonas flocculosa</i>	Flocculosin	Antifungal activity against many pathogenic yeasts, associated with human mycoses	Banat, <i>et al.</i> 2010
<i>Streptococcus</i>	Not identified	Anti-adhesive activity	Sil, <i>et al.</i>

<i>mitis</i>		inhibits sorinus addition	streptococcus HG 1025	2013
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7. APPLICATIONS IN FOOD INDUSTRIES

The surfactants can have several other functions in food industries, apart from act as a agent which reduces the surface and interfacial tension, thus promoting the formation and stabilization of emulsion. For example, ability to control the clustering of fat globules, stabilize the aerated system, improve the texture and shelf-life of products containing starch, modifications of the rheological characteristics of wheat dough and get better consistency and texture of fat-based products. In bakery and ice-cream formulations, biosurfactants act controlling consistency, slowing staling and solubilizing flavour oils, they are also utilized as fat stabilizer, and act as an agent during cooking of fats and oils.

Rhamnolipids are used to improve the stability of dough, texture and conservation of bakery products. They are also used to enhance the properties of butter cream and frozen confectionery products (Vijaykumar, *et al.* 2015, Ribeiro, *et al.* 2020).

8. INHIBITION OF BIOCORROSION

Corrosion that is influenced by microbes and caused by association of biofilms is termed as biocorrosion. The damages of important infrastructure due to corrosion lead to large economic and environment problems. Synthetic chemical biocides are currently used to prevent corrosion, but most of them are not effective against biofilm, also they are toxic and not degradable. Chemical biocides easily kill corrosive bacteria, especially sulphate- reducing bacteria, and shown a great success.

However, they cause hazardous effects on environment and human health. Therefore, it is a need to find an alternative biocide with antimicrobial property and more environments friendly. The potential candidate is biosurfactants; they are biologically surface - active compounds, which possess environmentally friendly properties, such as low toxicity and high biodegradability.

Biosurfactants are proved to be one of the best eco - friendly and innovative biocide against corrosion (Astutiet *al.*, 2018, Zain *et al.* 2018).

9. CONCLUSION

Microbial surfactants are the chemicals that are produced by the extracellular excretion of fungi, yeast and bacteria. The synthetic surfactants are widely used in industrial application because of their availability in the market. But the biologically derived surfactants (Biosurfactants) have several unique properties such as specificity, low toxicity, stability, eco-friendliness and high biodegradability, these advantages make them a commercially promising alternative to synthetic surfactants in industrial application like bioremediation, agriculture, pharmaceuticals, inhibition of biocorrosion and food industry in nearest future. The use of these biosurfactants in different biotechnological application will decrease environmental pollution that is caused by synthetic surfactants.

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18

BIO-POTENTIAL OF A GREEN MARINE ALGAE

***Chaetomorpha antennina* (Bory de Saint-Vincent Kützing) ON THE LIFE CYCLE OF A POLYPHAGOUS INSECT *Spodopteralitura*(Fabricius)**

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ABSTRACT

Chaetomorpha antennina (Bory de Saint-Vincent) Kützinger green marine algae collected from the Pondicherry coast, India was investigated for its biological activity on a polyphagous pest *Spodopteralitura* Fabricius. The acetone, methanol and chloroform extracts of *C. antennina* @ 1, 3, 10, 30, 50, 70, 100 µl/ml concentrations were tested against the third instar homogeneous *S. litura* larva under completely randomized design and the effects were compared using a solvent extract and untreated control. The treated larvae were observed for larval mortality, pupal mortality, adult emergence, repellent and antifeedant effect and the collected data were documented. Studies on the larvicidal action of acetone, methanol and chloroform extract of *C. antennina* attributed no effect up to 24 hours of treatment. The *C. antennina* acetone extract exhibited higher mortality (66.67%) of larva in all the periods of observation followed by methanol and chloroform. Even though the larval mortality was gradual among the treatments, pupation was at variable level among the treatments and the pupal to adult conversion was comparatively lower in all the treatments. Adult

emergence data on the three-solvent effect of *C. antennina* (10%) exhibited pupal: adult conversion ratio of 1:0.54, 1:0.40 and 1:0.50 by acetone, methanol and chloroform extracts respectively whereas in control and solvent control the ratio was 1:0.92.

Keywords: *Chaetomorpha antennina* – solvent extracts – *Spodopteralitura* – Bio-potential

1. INTRODUCTION

Marine algae were extensively spread all through the inter-tidal and deep regions of marine ecosystem and accounted for an approximate population of 844 species under 271 genera (Sahayaraj et al., 2014) and have been asserted to have bactericidal (Gerasimenko et al. (2014) and Ibraheem et al. (2017); fungicida 1 (Corato et al., 2017) and Ramkissoon et al 2017) and insecticidal properties (Gowthish and Kannan (2019) and Sahayaraj and Mary Jeeva, 2012). *Chaetomorpha antennina* (Bory de Saint-Vincent) Kützinger green marine algae, categorized by unbranched filaments, shaped in to a clade which aboded in a paraphyletic assemblage of branched *Cladophora* species as evidenced from molecular phylogenetic data (Hanyuda et al., 2002).

Tobacco cut worm was a polyphagous pest and reported to attack more than 112 plant species of 44 families and caused enormous losses Vashisth (2012). Indiscriminate use of insecticides for the management during the past three decades generated immeasurable detrimental effects *viz.*, resistance, resurgence, residues, health hazards, global warming, green house effect *etc.* In view of combating these perilous factors of pesticides, the scientists and researchers are urged to quest for alternatives (WasidAktar, 2009). Among different alternatives, marine algae offered a novel approach for future pest management research (Hamed et al., 2018). In this context, the present study aimed at evaluation of solvent extracts of *C. antennina* against *S. liturawas* carried out.

2. MATERIALS AND METHODS

Seaweed belonged to chlorophyta, green algae *C. antenninawas* collected from the intertidal and inundated bedrock of Puducherry beach, India. Collected sea algae were immediately washed in fresh seawater and carefully washed thoroughly three times with tap water to remove the excess salt, sand and epiphytes. Cleaned algae was air-dried under shade (Asha et al. 2012) and stored at 4⁰ C. The host

insect *S. litura* was mass cultured using the natural diet castor leaves under laboratory conditions in sterilized plastic buckets and the required stage of the insects was obtained from the culture (Kannan and Bharathkumar, 2016).

3. PREPARATION OF SEAWEED SOLVENT EXTRACTS

Partially powdered seaweeds of *C. antennina* 30g (in three packets of 10g each) was packed in Soxhlet apparatus and refluxed with different solvents of increasing polarity viz., chloroform, acetone and methanol individually for 12 hours continuously until the extract was clear. Extracted solvent was evaporated and dried in desiccators under vacuum.

The final extract was elucidated with corresponding solvent, stored at -20°C and used for the bio-assay experiments⁹. Prepared *C. antennina* solvent (acetone, methanol and chloroform) extracts @ 1, 3, 10, 30, 50, 70 and 100 µl/ml concentrations were treated to the uniform aged third instar larva of *S. litura* using leaf dip method. Corresponding solvent control was maintained to compare the efficacy on the larva along with untreated control.

Castor leaf discs (5cm dia) were dipped for 10 minutes in the corresponding treatments and were shade dried and placed in Petri plates. In each Petri plate, five leaf discs were placed and four hours starved, third instars larvae (homogenous population) were allowed. The treatments were replicated thrice with five larvae per replication under completely randomized design. The larvae were allowed to feed on the treated leaves and the data on mortality, pupation and adult emergence were recorded periodically (Kannan and Bharathkumar, 2016). Observations on malformation of pupa and adults was ascertained and documented and analyzed statistically (Gomez and Gomez, 1984).

4. RESULTS AND DISCUSSION

Investigations on the *C. antennina*'s solvent extracts insecticidal action, revealed no effect up to 24 hours of treatment. In other periods of observation from 1 to 6 days of experiment, even though the data showed a general increase in larval mortality, inconsistent results were noticed in two periods. The records pertaining to larval mortality exhibited an increased trend at 1, 3, 5 and 6th day of treatment over their preceding day's casualty.

Whereas in 2nd and 4th day of treatment, decreased level of mortality was established over their preceding day's casualty. The mortality data on the 7th day specified that the maximum larval mortality was exhibited by *C. antennina* 100µl/ml solvent concentrations which were 73.33, 60.00 and 53.33 per cent in acetone, methanol and chloroform extracts respectively followed by 100µl/ml concentration which were 53.33, 46.67 and 40.00 per cent mortality respectively. In the same period, in solvent control (T₈) the observed mortality was 26.67, 26.67 and 13.33 per cent respectively whereas the exhibited larval mortality in control was 13.33 per cent in all the three experiments (Table 1).

Comparing the larval mortality executed by the three solvents, acetone extract influenced higher level of larval mortality over the methanol and chloroform extracts. These studies are in line with the investigations carried out in 2012(Asha et al., 2012) wherein they have tested the methanol extract of *U. fasciata* and *U. lactuca* and stated that the methanol extracts caused highest nymphal mortality against *D. cingulatus*. The green algal seaweeds *U. fasciata* and *U. lactuca* reduced the relative growth rate, adult longevity, fecundity

and hatchability of *D. cingulatus*.

The experiment continued up to adult emergence of treated and untreated insects. The seaweed extracts' influence on the pupation exhibited varied results. The pupation data exhibited significant differences between the treatments and control. The observed data exhibited that *C. antennina* 100 μ l.ml solvent concentration (T7) exhibited minimum pupation in all the three experiments wherein the acetone, methanol and chloroform extracts exerted 26.67, 46.67 and 33.33 per cent respectively whereas the pupation was at the maximum in control (86.67%). Among the treatments chloroform extract influenced reduced level of pupation (60.00%) in the lowest dose (1 μ l/ml) compared to other acetone (73.33%) and methanol extracts (80.00%) in the compared to acetone and methanol extracts even though the acetone influenced the lowest pupation compared to chloroform extract at the highest concentration (Fig. 1).

The adult emergence data collected for the remaining pupa survived, revealed that the highest concentration influenced the lowest value and vice versa.

The adult emergence was 13.33, 13.33 and 20.00 per cent in

acetone, methanol and chloroform extract treatment @ 100µl/ml solvent extract concentration (T7) and the pupation in other solvent doses was in an increased trend which notched up to 33.33, 40.00 and 40.00 per cent respectively in the lowest dose of each solvent extract (1µl/ml-T1) which were comparatively very low than their corresponding control values. Comparing the three solvent extract's effect on pupation, the treatment at 100µl/ml concentration exerted the lowest pupation over their control and other treatments.

Among the three solvents the lowest pupation was exhibited by methanol extract (13.33%) followed by acetone (26.67%) and chloroform (46.67%) extracts. Comparatively acetone extract at different concentration proved to be superior to methanol and chloroform extract in subverting the adult emergence wherein acetone extract did not allow more than 50 per cent emergence in any concentration but in others the lowest concentrations allowed more than 50 per cent adult emergence (Fig. 2).

Adult emergence data on the three solvent effects at *C. antennina* (100µl/ml-T7) exhibited pupal: adult conversion ratio of 1:0.50, 1:0.40 and 1:0.42 by acetone, methanol and chloroform

extracts respectively and were lesser than in the control. The data observed demonstrated varied effect in different concentrations owing to larval and pupal mortality in the preceding periods. The lowest pupal to adult conversion ratio was demonstrated at 70 $\mu\text{l/ml}$ concentration (T6) of acetone and chloroform extract, which were 1:0.28 and 1:0.33 respectively, whereas in methanol extract experiment the lowest pupal to adult conversion ratio of 1:0.40 was exhibited by 100 $\mu\text{l/ml}$ concentration (T7). In all the three solvent extracts, adult emergence data showed significant difference among the treatments and control. Interestingly the pupa to adult conversion was very less compared to larva to pupa transformation (Table 2).

Similar investigations on many seaweeds against different insects confirmed the presence of insecticidal activity as in *Eupatorium triplinerve* leaf extract against *S. liturabrown* algal seaweed, *Ascophyllum nodosum* against thrips and Persian mite colonies in Avocado (Holden and Ross, 2014); ethanol and chloroform extracts of green alga, *U. lactuca* against *S. littoralis* (Abbassy et al., 2014); ethanol and chloroform solvent extracts of *Ulva lactuca*

against *S. littoralis* (Moustafa *et al.*, 2014); *Colpomeniasinuosa* towards *Oryzaephilusmercator* and *T. castaneum* (Pasdaran *et al.*, 2016); *U. fasciata* against *S. litura* (Kannan and Bharathkumar, 2016); red algae *Laurencia nidifica* and *L. intricate* against maize weevil, *Sitophilus zeamais* (Ishii *et al.*, 2018); *Liagoraceranoides* against *S. litura* (Kannan and DharaniPriya, 2019).

Previous studies have shown evidences that seaweeds' potentiality against insects are attributed to chemicals present as evidenced in many seaweeds inside *viz.*, Saponin in *Padina pavonica* and *Zonariasp* (Sahayaraj and Kalidas, 2011); phlorotannins, terpenoids or unsaturated fatty acids in brown algae (Zubia *et al.*, 2008); alcohols, amides, phenols, phosphorus and halogen compounds in red alga, *Gracilaria dura* (Devi and Paul, 2014); saponins, tannin, steroids, terpenoids, phenolic groups and flavonoids in brown alga, *S. tenerrimum* (Azhaguraj *et al.*, 2015); Pulegone and Carvone in red alga, *Laurencia dendroidea* (Oliveira *et al.*, 2015); terpenoids, steroids, phenols, flavanoids alkaloids, steroids, coumarin and quinone in brown algae, *D. dichotoma* (Deyabet *et al.*, 2016); Nonadecane, E-9-Tetradecenoic acid,

2-Hexadecanol, Oleic acid, 3,7,11,15-Tetramethyl-2-hexadecen-1-ol, Z,Z-2,5-Pentadecadien-1-ol, in *L. ceranoides* (Kannan and Dharani Priya, 2019); cytotoxic oxysterol in *Sargassum tenerrimum* (Sahayaraj and Mary Jeeva, 2012). Similar properties in *C. antennina* might be attempted to explore the presence of plant defense chemicals.

5. CONCLUSION

Chaetomorpha antennina exhibited greater influence on the adult emergence rather than larval and pupal mortality which may be due to IGR activity on insects and this factor needs a thorough investigation for future prospects.

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Table 1. Effect of Chaetomorpha antennina's solvent extracts on larval mortality of Spodopteralitura

Treatments	Mean larval mortality % by		
	Acetone extract	Methanol extract	Chloroform extract
T ₁	26.67 ^c (30.78)	26.67 ^d (30.78)	20.00 ^{cd} (22.36)

T ₂	26.67 ^c (30.78)	26.67 ^c (30.78)	26.67 ^{bc} (30.78)
T ₃	33.33 ^c (34.63)	26.67 ^c (30.78)	26.67 ^{bc} (30.78)
T ₄	46.67 ^b (43.07)	40.00 ^b (39.23)	33.33 ^b (34.63)
T ₅	46.67 ^b (43.07)	46.67 ^a (43.07)	40.00 ^a (39.23)
T ₆	53.33 ^a (46.92)	46.67 ^a (43.07)	40.00 ^a (39.23)
T ₇	73.33 ^a (59.21)	60.00 ^a (50.77)	53.33 ^a (46.92)
T ₈	26.67 ^c (30.78)	26.67 ^c (30.78)	13.33 ^{de} (18.13)
T ₉	13.33 ^d (18.13)	13.33 ^d (18.13)	13.33 ^{de} (18.13)
Sed	7.4805	3.9731	4.8712
CD (=0.5)	15.7161	8.3472	9.7845

Each value is an average of three replicates; figures enclosed in parentheses are arc sine tr

ansformed values; means followed by a common alphabet are not significantly different at 5% level by LSD

Chapter–XIX

19

THE COST OF OPEN DEFECATION IN NIGERIA

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ABSTRACT

Health determinants are factors that influence our health either positively or negatively. Forsooth, open defecation (OD) is a health determinant that has environmental and social affiliations. OD has many repercussions, it releases methane (a potent greenhouse gas), it leads to malnutrition, it facilitates faecal-oral transmission of many diseases (like trachoma, polio, diarrhoea), it subjects women or girls to harassment and embarrassment, it affects education of children and girls, among others. This paper describes, the meaning of open defecation, impacts of open defecation, problems of open defecation, benefits of sanitation, and ways of tackling open defecation in Nigeria. Awareness should be created and non-governmental organisations, governments; wealthy individuals should contribute to curb OD in urban and rural areas.

Keywords: Open defecation, health determinants, toilet, illiteracy, poverty, public health

1. INTRODUCTION

Open defecation is a situation when human stool is disposed of in fields, forests, bushes, open water bodies, beaches, solid waste, or other open spaces. The practice is hazardous to public health and has many costs. It is widely done by people with poor education and poverty. OD is the lowest and most dangerous level on the sanitation ladder. The second step is the "unimproved sanitation facilities or levels". It is a situation where there is no hygienic separation of human faeces from human contact. It includes unimproved pit latrine (pit latrine without a slab or platform, hanging latrine, and bucket latrine). The third step in the OD ladder is the "shared sanitation facilities". It is a toilet shared among many (excluding public toilet). The fourth step is the "improved sanitation facilities". Here, there is certainly hygienic separation of human excreta from human contact. Parable, flush toilet, pitlatrine with slab, ventilated pit latrine, composting toilet etc. (Sarkingobiret *al.*, 2017; Federal Ministry of Water Resources, 2019).

In Nigeria, access to toilet is still very low. 18% used improved sanitation (IS), over 56% used traditional pitlatrines, and 26% had no access toilet at all. In rural places about 1/3 are practising OD. The state with lowest OD is Abia (1.2%), and the highest was Kogi (65.8). The states with higher OD are Ekiti, Plateau, Oyo, Cross River, Benue, Taraba, Nasarawa, Kwara, Enugu, Jigawa, Ondo, Niger, Ebonyi, Osun, and Kebbi. It appears that, use of IS is strongly related with the socioeconomic level of an individual (FMWR, 2019).

OD has devastating impacts to the public health. Faeces contaminate environment and remain the leading cause of child mortality, morbidity, undernutrition, stunting, and causes poor cognitive development. It barricades against education, economic opportunity and make women and girls vulnerable to consequences (UNICEF, 2018).

Poor sanitation, a synonym of OD cost the world USD222.9 billion in 2010, and USD40 billion in 2015, showing a difference that is above the Gross Domestic Product (GDP) of Portugal, Greece, or Vietnam (Lixil, 2016; World Toilet Day, 2018). The breakdown of the cost is shown in the table below:

Table 1: Cost of Open Defecation Around the World

Section	Cost in monetary terms	Cost in true terms
Mortality	USD122.8billion	Diarrhoea disease Emotional trauma Economic strain from deaths on family and country at large
Productivity	USD16.5billion	Diseases caused by microbes in waste minimize economic productivity
Healthcare	USD56.6billion	Treatment of sanitation related diseases
Access to sanitation	USD27.8billion	Time spent on OD, or lack of toilet cause negative economic output

Source: Created from data in Lixil, 2018; FMWR, 2019

2. IMPACTS OF OPEN DEFECATION/ POOR SANITATION IN NIGERIA

OD or poor sanitation cost #455 billion annually, equivalent to

USD 3billion. The breakdown is shown in the table below:

Table 2:

Sector	Monetary cost	True cost
Accessibility	USD 243 million lost in access time	Each person spends about 2.5days looking for place to defecate every year
Premature deaths	USD 2.5billion	Death of adults and children
Productivity	USD 13 million every year	Absenteeism from work, while seeking for health, or caring for relatives
Healthcare cost	USD 191million	Malnutrition care, health seeking expenditure egtransport, consultation, etc

There are some costs that were not calculated because it is very difficult, but they are significant. They include: funeral costs water pollution (treatment of waste water), tourism cost(reduction in tourists), cognitive impairment, reuse(benefits lost from reusing excreta such as source of phosphate), and epidemic outbreak costs(Lixil, 2016).

3. HOW OD IS A PROBLEM?

A person who defecates in the open, eat his stool and cause others to eat his shit. Pathogens travel from the hand to mouth because of OD. Microbes are shuttle through fingers, flies, fields, fluids, to the food and ultimately mouth (Sarkingobir and Sarkingobir, 2017). All these dates can be scuttled through personal hygiene, which is part of improved sanitation (toilet) (Sarkingobiret *al.*, 2019). Ultimately ascariasis, cholera, dysentery, typhoid, trachoma, filariasis (about excreta related insect vectors), schistosomiasis, chlonorchiasis, diphyllbothriasis, fascioliasis and paragonimiasis (pertaining water contamination by faeces), trichuriasis hookworm, teniasis strongyloidiasis (soil contaminated by faeces), are all due to OD (Adeoye, 2001).

Faecal-oral transmission results in cholera, shigellosis, *E.coli* infection, enteric fever, paratyphoid, enteritis and comylobacter. Poliomyelitis, hepatitis A, rotavirus diarrhoea, giardiasis, amoebic dysentery, balantidiasis, enterobiasis, can be resulted due to faecal contamination (Adeoye, 2001). Undernutrition, stunting are also

caused by OD(Sarkingobir and Sarkingobir, 2017).On women,OD causes risk of shame, diseases, harassment,and even attacks (Singh *et al.*, 2013; USAID, 2015). Organic pollutants, water pollutants (in ground, surface) are siphoned into our environment due to OD. OD destroy the aesthetic nature of places, thereby reducing the tourism attraction; and releases methane, carbon dioxide; thus, contributing to climate change (Singh *et al.*, 2013; Sarkingobiret *al.*, 2019).

4. BENEFITS INCURRED FROM IMPROVED TOILET/AVOIDING OD

Sanitation economics is an evolving field, which is trying to elucidate the negative costs incurred because of OD in monetary facts and figures. It also describes the benefits that can be obtained through properly handling faeces, and the prices that have to be paid to have improved toilet. One of the fields in the sanitation economics is the sanitation economy. Sanitation economy is a robust marketplace of products and services, renewable resources flows, data and information that could change future cities, communities, and businesses. It is smart, sustainable, innovative, cost saving, and revenue rewarding (Toilet Board Coalition, 2017).

There is a clear business case for building toilets and keeping them secure and well-maintained and economic incentives are drawn. It involved an interaction of buyers and sellers on commodities. Container toilets, biotoilets, toilet shelter, toilet blocks, portable toilets, female care products are commodities that are needing economic interactions and conferring benefits to cleaners, labourers, workers, producers and sellers. Products can be produced from faeces such as fertilizers, animal feed, biofuels etc (TBC, 2017).

5. WAYS OF TACKLING OD CRISIS

It is pertinent to tackle OD so as to halt its devastating consequences. Some suggestions and solutions that were drawn based on past studies and experience was listed below:

6. INNOVATION

Some existing toilets policies are unsuitable for many contexts especially in the rural settings. Parable, western-styled toilets require much cost on the poor, and much water (about 13litres per day) therefore they are unsuitable for many rural places. We need to make new toilet alternatives that condone the culture and settings of rural people (Water, Engineering and Development Centre, Loughborough

University, 2012; WHO/UNICEF, 2015; Sing *et al.*, 2013; Lixil, 2016; Sarkingobir and Sarkingobir, 2017).

7. POLITICAL PRIORITIZATION

Political officers need to take OD and sanitation among their priorities. This would help in making good policies, laws, and implementation (WPS, 2012; Sing *et al.*, 2013; UNICEF, 2018).

8. COLLABORATION AND COORDINATION

The issue of OD and sanitation is not one-man business. It requires multisectoral collaborative efforts in an organized and systematic fashion. Government from all tiers, ministries of water, health, environment, agriculture and quasi, nongovernmental organizations, shall come on deck to contribute quotas towards achieving OD free society (UNICEF, 2018).

9. PUBLIC AWARENESS

People tend to practice positive things when they are knowledgeable. More campaigns, advocacy, via local and nonlocal media platforms are required to keep people abreast on OD. Experts (public health workers, health workers, environmentalists, human rights activists) shall take OD campaigns to doorsteps of the people

especially the rural dwellers (id21 highlights, 2008; Singet *al.*, 2013; WHO, 2015; Culley, 2018; WHO/UNICEF, 2019).

10. COMMUNITY-BASED INITIATIVES

In some cases, people refused to patronise toilets even if they are available. Studies have shown that community participation in toilet interventions is good in ensuring compliance and improved sanitation use (WHO/UK Health Protection Agency and Partners, 2011; WHO, 2015; UNICEF, 2018).

11. DELIBERATE TOILET BUILDING AND RESOURCES POOLING

More resources should be specified, pooled, and allocated to building of toilets in workplaces, schools, Communities etc by NGOs, government, companies, Development Partners and relations (Adeoye, 2001; UNICEF, 2017).

12. WALK OF SHAME

Some people walk around the surroundings and provoke residents with statements that could force them to act in providing or using toilets to avoid OD. This has been tested as useful strategy that cause people to acquire and use improved sanitation (Patino and Jones, 2019).

13. CONCLUSION

Open defecation has so many costs in Nigeria, both in monetary and nonmonetary forms.

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20

Survey of Expert Systems and Cognitive Approaches to Effective Tutoring

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ABSTRACT:

The Survey of Expert Tutoring looks at ways to advance teaching pedagogy it addresses the potential flaws and alternate methods for creating an expert method, and provides some strategies for coping with them. The cognitive tutoring framework details, undefined domains, and case-based design methodologies describe the problem. Systems to Development (CAD), Domain-Specific Tutoring Systems (DSTS), Cognitive Developmental Methods (DAT)

Keywords: Expert Systems, Cognitive Approaches Tutoring System

1. INTRODUCTION

Designing a cognitive tutoring system is a frustrating challenge, for a good variety of it such as machine learning, comprehensive knowledge base is vital. While artificial intelligence is still relatively new, these methods fall under the umbrella of it. For more than half a century, researchers have hardly worked in this area. But even after 50 years of investigation, they have yet to succeed in devising a device that does all these things well in the real world. The reason behind this disaster is the traditional structures used to build it. In these methods, generating means creating something creative.

2. LAYOUT OF A CONVENTIONAL ETS SYSTEM

Over the past decade, E-Systems have gained widespread acceptance and are extensively used by students and teachers. Many ETS programmes have been created to teach different forms of mathematics, basic physics, programming, modeling techniques, as well as games. When you have an understanding of all the pieces of an ETS, you'll be able to comprehend the whole. An expert tutoring method is a system that comprises the following abstract concepts:

2.1 Knowledge Base

An effective AI system is the product of an expert system combined with a great knowledge base. It stores historical information, which is utilized for inferences. It differs because it is all about doing things, not just information. Also, it is important to be extremely thorough when creating a knowledge base. It should be transparent and has to be index able.

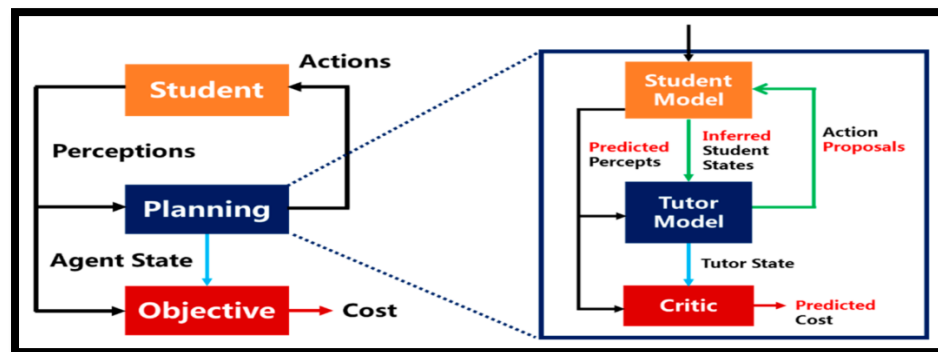
2.2 Student Module

Each ETS framework Students should have their own module. Since students can learn new ideas and ask questions, this module is particularly good for them. The required level of abstraction should

be user-friendly. A student module is related to the knowledge base and the teacher's inference module.

2.3 Teacher Module

Similar to the knowledge base this module is also an ETS system's main component. It describes methods for the construction of a robust knowledge base. An ETS teacher here teaches through various techniques (such as pictures, videos or references) that effectively teach a specific concept. In this case, a human teacher renders a number of extracted features. Storesthey are in the knowledge base and often describe which steps to take when a similar problem arises.



2.4 Output Module OR Access Module

It is an ETS machine front end. It acts as an interface that allows users to access the device. It combines all modules and provides a suitable abstraction level to make an ETS framework user-

friendly. It offers a system input module and a system output module. Every type of input and output to and from the device, such as multimedia, graphics, texts, etc.

3. DIFFERENT EXPERT SYSTEMS FOR ASSISTING AND IMPROVING TEACHING PEDAGOGY

Many expert programs have been established for the advancement of educational pedagogy in the last two decades. This paper provides an examination of these expert systems. In 1979, Tim o she a [51] suggested an expert teaching method to improve itself. He suggested that it would be an efficient way to make better comprehension of the matter if a system has more than one curriculum to teach the same concept. As teachers often do, they use various examples to teach the same thing. He used various alternative programs in his system to achieve this feature. Gerhard et al. [16] suggested in 1984 the "Active Aid System" online assistance system. In their paper they suggested that a device becomes more difficult to deal with as the complexity increases. So a support module is required. The passive support system inside any complex user-guiding system is much less useful because of its increased

complexity.

They therefore suggested a good online support system for users, which can solve the issue. Willamette al. [9] also suggested a method for debugging PROLOG programs in 1984. They demonstrated how the preventive manner in which a bug free program is developed plays an important role. They suggested some debugging tips for instilling this programming style into PROLOG programmers. These strategies can help to write a bug-free program for a PROLOG programmer. In 1986, NiganBayazit [4] proposed to students of Istanbul Technical University a concept for teaching the techniques of CAD (ITU).

This model is for students and workers. Gallanti et al. defined the value of an intelligent decision support system in their paper in the year 1986. They used an example of a thermal power plant and explained the expert system approach as part of their discussion about performance. In the year 1987, R. S. Perez et al. [45] put forward a training programme that helped members of the military succeed.

Given the programme can be used in almost any personal

computer; the costs were, in certain respects, smaller. It did not require any extra hardware for this form of training. By doing this type of training, it was determined that it was more effective, as it was consistent and favored by the participants. Over the past decade, researchers have put in more effort developing CAIs (Computerized Instructional Systems) than ITTs (Interactive Tutorial Systems). Also, systems like TRIO, SOPIE, and STEAMER helped to train students in a variety of areas, including plant operation and electronic troubleshooting, were discovered to be very effective and efficient.

They believed in the value of CAI (computer-assisted instruction) in the year of 1987 and, EmrahOrhun [53] said so. While CAI is an alternative teaching method, it's more cost-effective, efficient, and provides students with more attention than the traditional approach. NLU (Natural Language Understanding) was suggested by J. G. Neal et al. in the year 1987.

The aim of this project was to teach "natural" languages to native and non-native speakers alike. To assist in creative endeavors, they relied on AI software that is rule-based and an information database. This approach provides NL users with an outstanding

understanding of the creative process. L. Nawrocki created an INMA (computer-assisted maintenance training) for providing training for the 1987. This training method was developed by industrial and personal service departments with cooperation from each other.

Automatic Output assessment in the year of 1987 by Brebner et al. [2] describes the proposal for a computer-based instruction terminal (Caiter). This instruction system envisioned that trainees would benefit from using digital strategies. A CBI (computer-based instruction system) was proposed by the U.S. Navy in 1987. It was instituted to supplement the current CBI scheme and support the military personnel. Even, as their soldiers would expend much time and money on preparation. They discovered that this practical breakthrough allowed CBI training to be successful and useful.

The ICSAI (Intelligent Computer-Supported Instructional Method for Development of Knowledge and Skills for Acquiring) was proposed in 1987 by Kazuhisa Kawai and his associates [26] the framework consisted of two main modules: science and creativity. They employed inferential induction in the course and both courses employed PROLOG.

The two modules were developed separately, so they were free from external influence, like two unicorns in a parking lot in the year 1987, the study of Computer Aided Design and knowledge-based expert systems in machine design processes was demonstrated by David G. Ullman et al. These methods can also be used in the creation of future mechanical devices. We built the system based on an expert verbalization so that it could assist with other projects. On the contrary, in the year 1988, Joachim Wedek [59] claimed that modeling activities, not simulation, are key to having kids involved in 3D printing. For all practical purposes, it can be considered to be a detailed model. You may have all kinds of issues in a virtual computer without harming the actual hardware. D. clarified two methods for constructing intelligent systems:

The Symbolic and this and an approach If current definitions are incomplete, expert systems will not be useful for two decades, according to the authors of [Randall et al.,] in [56] in the year 1988, the current definitions don't sufficiently describe their functionality. They came up with electronic systems as a way of exchanging data and tried to figure out the impacts on system applicability in order to

reduce data loss. It became clear to Dario in the year 1988 that a strong and expressive programming language like LISP (a prototype programming language) was necessary for building large and complex applications.

Over the past decade, LISP systems have out-performed conventional programming languages in terms of efficiency. Dario explained in a case study using LISP, the systems required less development time than other programming languages. It didn't take three weeks for him to build a simplified Chinese language learning method to prove this. This instructional support framework used two primary modules (students and textbooks) with additional components (knowledge-base) and programming languages (LISP and open source) to develop the data structures.

An ITS match game was proposed by Nakhoon, et al. [in the year 1989. Systems to describe how the circulatory physiology and satiated blood pressure are interrelated It's a test to eliminate myths to introduce students to multiple flaws and show how things fail in the real world. The animation of the device produces an immersive teaching tool for students during the diagnosis we ask students to

enter bug reports in the form of natural languages. DPTut (Patho-Physiology Trainer), Joel et al. (1989) created a PPT (Patho-Physiology Tutor) by creating a teacher model in which the material is introduced by using this tutor. The Prolog-based database was created using turbo PROLOG language and rules were employed for knowledge-base architecture. The instructional design supports straightforward feedback and displays step-by-by-step procedures on what to do with results.

In the year 1989, Mohammed and his colleagues developed a Rule-Based Knowledge Generation System (RBG), which was intended to aid instructors and their colleagues in generating rule-based knowledge databases. There are two main components of TPT: (translating text to PROLOG) (Tutoring Rule Editor).

This rule editor (PROLOG) was used to build the rules and with the aid of the module. In the early 1980s, Marun et al. [32] devised a graphical equation graphing calculator method called the Quadratic Grapher. In the year 1989, MATHERT was first revealed as a method to teach trigonometry and algebraic principles to elementary school students. Through explaining how this device produces explanations

and error messages to him, he went on to explain why it produces errors. When the solution given by the user did not match the solution stored in the knowledge base, errors were created. These ideas, published in the book "Knowledge Base Management Principles and its Function in an Integrated Firm," were developed in 1989 by Janis et al. model for Middle Middleware, to allow firms to share intellectual property as electronically as he could be possible at the time (Modified Computer Assisted Language Instruction).

Rather than employing artificial intelligence techniques to develop this sophisticated software, he advised using natural language processing (NLP).

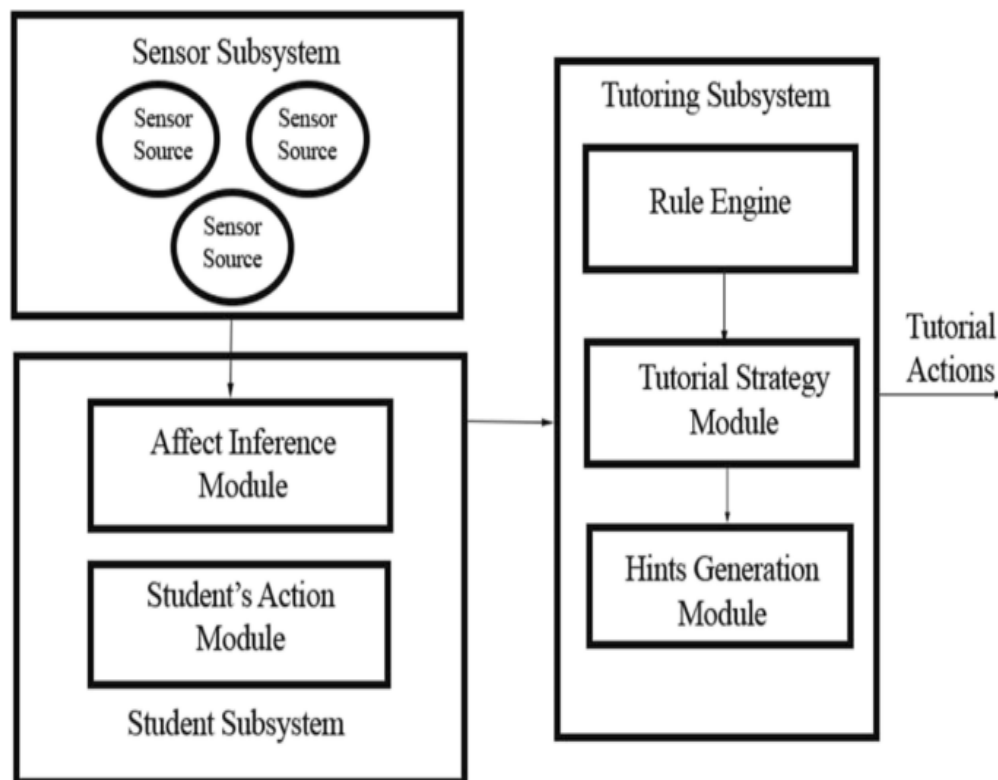
Circuit-avoiding the theorem was developed to teach basic trigonometric concepts to college students in the year 1990 by Parvati Rajan et al. In the year 1990 Gill et al. [24] put out a survey on ITS (Interactive Word Structure) applications designed to teach words. They also suggested an "IT'S" structure which they called "WORD-TOWER". The authors proposed a guide for and ITS method in the year 1990, A. Bensane et al. [6] put forward a teaching strategy.

This module will function as a table of contents. The utility of

this module to an IT'S was that students could now review the contents of the list. Fifty years ago, Dan M. developed the idea of a method named after Alexander, called "Alexandria", which aimed to help teachers get students interested in the third century B.C. The Yoon Hee et al. (1994) developed a spelling and proofreading method for the IT'S that was targeted towards medical students in 1991. the aim was to enhance the inferr's ability to check and correct inflection, as it could correct typos, it would add characters and words as they are entered, and perform substitutions In order for an ITS device to obtain context-sensitive information, it must work the way we have created it. RADES was firstly described in the year 1991 by H. Kindler et al. [28]

M. Quao et al. presented a model for the mining engineering students in the year 1991. This application offers a novel teaching method for exploration drillings simulation with moving environments. It was written in C++. Luigia et al. proposed multi-agents ITS method in the year 1991 they used first-order calculus for information representation of what they were learning in reality, there is no knowledge base that extends to all agents. To know if a

reasoning agent is maintaining its knowledge base as well as others (a societal way of solving problems). These 11 researchers offered the programmed in the year 1992, suggesting that programming be taught as a part of the ACT [Albert et al. (1992)]. It has hundreds of steps and uses the students as its guinea pigs. The student's report will be given as an input for teacher improvement. The internet, in the year 1992, Eric developed a machine called "SIFT" (self improving fractions tutor). Our primary goal in creating this technology was to make IT'S more efficient. The SIFT tutor also is empowered by training and exchanging ideas with students.



The evidence generated by Dempster & Shafer uses both information theory of evidence and creativity for creating a database of up-to-to-date information in the year 1992, the three writers built an interactive teaching method known as ITSACE, in which they worked with NYN Science and Technology to use COOL Language with it. Finally, the designers described that bringing the device from the lab to the classroom was an annoying and onerous activity. In 1993, it was suggested by Haider et al. [48] that an ITSCOVER strategy could be used for teaching programming concepts it was designed in order to assess student success in addition to artistic achievements.

A computerized instructional system was developed by Vijay et al. in 1993, called "Turbinia". The concept was built on Apple computers running the Mac OS Here Vy was an informative mentor who often acted as a perfect model. In 1993, R. Macura et al. proposed an IT'S for diagnosis to include multiple imaging scenarios. Here, they proposed a database combining different types of imaging principles. Whenever photos need to be added to the database, the radiologist must first learn what he knows about relevant images on

the internet, and then apply it to locating and saving images from the archive. As a result, databases can be improved, that will improve radiology education.

The method is comprised of three sub-applications, including Case Resolution, Teach Me, and Financial Expert. Learning environments could be automated by using an intelligent tool like the one developed by M. Joao in 1993 called ITSLABEL.

The underlying intention was to make an educational contribution as well as scientific breakthrough. The "Rules for an Effective Instructional System Creation" (ISD) in the year 1994 proposed by Robert et al. [55] as machine learning and cognitive science-based techniques have evolved, the overall aim of this research was to boost the design of traditional ISD systems. DISRADE, which translates as "debate/dispute" which was based on the Forth gains that circulated in the high school yearbook in 1974. This framework contains all the information needed to create an efficient multimedia simulation design.

It is a major shortcoming of traditional simulators that they are offering standardized simulations as well as demonstrating

performance. Students have a lot of difficulty comprehending the modules as a result this proposed an independent module climate. The pedagogical design strategy results can be stored in the knowledge base.

The fourth-generation systems arrived in 1995 when Robert commented in 1995; Jen et al. [57] presented a "FILM" (Fuzzy Logic Modeling) instructional task assignment methodology that has since been implemented in ITSCO (ICTS). This paper explains the CASCO architecture and complex assignment development process in detail. Michael et al. devised a traditional pedagogical method for supporting teachers in the year 1996.

This item will include step-by-step instructions, images, and visual depictions of the items. In a 1997 article, Jon et al. proposed a CBR "case-based reasoning" ITS creation strategy some have also argued that and ITS proposal used case-based instructional planner has been proposed in combination with traditional systems. So that teachers will be able to formulate instructional strategies for it as well. WORDMATH had been planned to educate 9-12 year-year-old Singaporean primary school children in simple word concepts in the

year of 1996 When it comes to convincing people to say things, sometimes we will win and sometimes we will lose, but either way, we are destined to succeed.

In 1998, Mary et al. [38] put forward some new approaches for helping people with algebra Albert published an "Algebra II cognitive tutor" case study in the year 2000" Eva et al. reported on a web-based trainer "TAPLI" that had been constructed for teaching linear programming principles in 2004. The principle of multi-agent modeling was first developed by Carbó, et al. in the year 2005. They came up with four types of roles based on their function: CLA (tutor), AA (assistant), and AA (Orientate Agent). TAs is designed to do specific tasks, while OAs aid in understanding the learner's mental states. Xin et al. [34] conducted a comparative investigation and demonstrated the greater value of expert systems over non-expert systems by presenting several details.

A knowledgeable student can speak to a knowledgeable teacher in natural language, which makes these structures more approachable for learners the year 2010 found that the present systems are in a difficult situation because of the incorrect

requirements being applied. He used a hybrid method to increase the effectiveness of his tutoring. It provided a well-defined dataset for the purposes of the study and started to apply the latest ideas of data mining to it.

An on-line simulation of virtual lab was developed by D.K. Chaturvedi [28 years ago] in the year 2012. This simulation environment helps with the students learn electrical principles in a simulated way. Ivanova developed the theory of face and gesture recognition as part of a thesis on IT'S in the year 2013. These methods function in a similar manner to that of a human teacher. A good teacher will look at a student's posture and facial expression to see if they understand the content. From this research, the following conclusions can be drawn: This methodology can produce successful tutoring systems. In 2014, their argument was that cognitive therapy is an efficient tool for coping with stress issues was put forward, to wit: Steif et al. [invented] suggested structural cognitive tutors for the year ahead they said that with conventional teaching, students are expected to send in work for grades, which lets everyone know how they're doing. But this "traditional" approach is not feasible as

assignment checking can only be done on an individual basis.

Since the students now have a variety of ways to deal with this IT'S, they proposed the problem-solving scheme, which often keeps a range of solutions at hand. This teacher had an evaluative feed-back system in mind. In 2014, Malick and his colleagues developed a game called "car2o carocaró" (Caro Tuteurocio) to help kids with motor skills. Can be enhanced with the addition of ALTPATH this was developed using the help of BLENDER, we can make it better with the application of ALTP (3-D animation suite). Moreover, they provided a case study of carom (an on-line game), and showed that their tutoring programmed offers easy-to-to-understand instructions and abundant options to keep advancing. LIME was based on a new rule introduced by Corbi et al. [12] for the database of the PSLC cognitive tutor (Pittsburgh Science Learning Centre) in 2015, and Carnegie Mellon offered prompt, free feedback on that system's use.

An unconventional solution to a problem designing a robust cognitive tutor needs an approach which follows parts. Features of a complex and effective cognitive learning. A domain can be broken down into two [15] general classes: ill-defined and well-defined

domains. Plato, Nietzsche, and others had offered several conceptions of these categories. Artificial intelligence generally can be understood as the analysis of common-sense decisions. Artificial intelligence is used in describing these domains in this article. [According to the authors] A well-defined domain is like a well-defined knowledge base, which deals with basic and complicated problems alike. Generally speaking, well-defined domains are quantitative. For coming up with these domain knowledge-based tutoring tools should be self-identifying because they infuse in to the discussion, rather than subjective.

Owing to this, most of the tutoring programmes, the nature of the subject areas appears to be vague. A word yawning typical of the reasons for unclear solutions to our problems and an unintelligent base of information is usually serves as an excuse. That is totally uncoincidental. For well-defined domains, it is important to know these followings: It should employ strong approaches to coping with the creation of new Objects.

4. METHOD TO CASE-BASED REASONS (A CBR APPROACH)

This methodology is used to develop learning techniques and to

provide every ITS method with reasoning skills. It is an incremental (adaptive) way of learning that is used for inference. This method of solving problems is similar to the way humans do. Based on their experiences, they develop their learning and use it to solve new problems. Similarly, a CBR framework considers each problem as a case and stores these cases in its knowledge base in order to create a solution room for inference. A CBR is a sub-field of machine learning and offers a cyclical way to solve problems. The new problem is analyzed, similar cases are found in its knowledge base, the solution is combined, the outcome generated and the database is updated.

—Recovery. —Reuse. —Review. —Restore.

According to Agnar [1] some words similar to the CBR method are presented below.

- (1) Example based reasoning: a collection of related examples constructs a space for a solution.
- (2) Reasoning based on the instance: it is a specialization of example-based reasoning.
- (3) Memory-based reasoning: here cases (past problems) are stored

in memory, and related cases are checked for inference and reasoning.

(4) **An analogy-based rationale:** it is a sort of mapping between objects for unknown objects, according to Dedre [19]. Assuming that an analogy exists "Any A is (like) B" it describes a relationship between A and B. Here, A is the objective object (unknown object) and B is the base object (known object). Thus, an analogy is a way to make a simple understanding of unknown subjects with unknown objects.

5. COGNITIVE PROCESS

To be an intelligent machine, it needs little recognition and decision-making. But to be better in the real world or to be a cognitive machine. It should have a number of additional capabilities. Some properties that a cognitive system should have are provided below.

POWER OF IDENTIFICATION Recognizing something is part of the extraction function and a correct sequence should follow.

- (1) Perceptual perception.
- (2) Extraction function.
- (3) Footnote 3.

(4) Categorization and apprenticeships.

(5) Behavior. Action.

WILLINGNESS TO MAKE CHOICES. It is directly proportional to the learning, and an agent will use the learning to determine which alternative he should choose from.

6. CAPACITY FOR PERCEPTION AND EVALUATION OF SITUATION.

In any environmental situation, a cognitive agent should be able to correctly extract the collection of features of an entity. It should use robust techniques for the processing of sensory information, as external noises are disruptive in the perception of items.

CAPACITY PREDICTION AND TRACKING. This is almost of intelligence on the human level. As a good driver, he can foresee that his car will need refueling after a few kilometers. Good monitoring systems and expertise can only achieve this type of ability.

CAPABILITY FOR REASONING. Cognitive agents should be able to reason for more reliable outcomes. To achieve this, an agent should be able to create connections between the stored data in its knowledge base. It can employ techniques such as first-order logic,

rules of development, the neural networks to create connections between objects and it can be heuristic to know reasoning. This has to do with studying. Using these strategies, agents can make and store new decisions in the knowledge base, or they can even modify previous beliefs.

CAPACITY FOR INTERACTION AND CONTACT. The cognitive agents can work in society. As in a group, the work is carried out by consulting other members of society. The agents can also interact with each other for the best performance. Memory is also required to recognize any object in a real word environment. The contact with or between agents may take the form of question messages, audio files and video files.

ROOM FOR LEARNING AND REFLECTION.

A cognitive agent should be able to extract and store features of an item in the proper format in its knowledge base to generate learning. This helps them to consult their knowledge base if some object is to be recognized.

7. CONCLUSION

Finally, this paper presents an ETS framework survey intended

to enhance teaching or to help pedagogy. It speaks of the ill-defined domains and also suggests the idea of well-defined domains, from which one can construct robust ETS systems (that are better able to function in the real world). This analysis of the CBR method reveals the concept behind how to provide intelligence and logic in an ETS environment. Finally, cognitive approach is the key component of this article. It proposes fundamental techniques for the design of an ETS method. A cognitive ETS system is much higher than an intelligent system, as it consists of knowledge base, and agents learn in the real world instead of abstraction.7.

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Chapter –XXI

21

THE DATA MINING AND INFORMATION SECURITY

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ABSTRACT

This Book chapter deals with the issues around data mining and security. Data-storing and data-searching, for fun and profit. Also, in the military, which relies on discipline and routines to a greater degree, maintaining a stable operational security is a challenge for mining machines. The level of vulnerability affects the likelihood of a security attacks. The security mechanism and type of data mining will differ, since there are no fixed standards in the realm of creativity.

Keywords: security and vulnerability are a critical part of a search engine optimization strategy

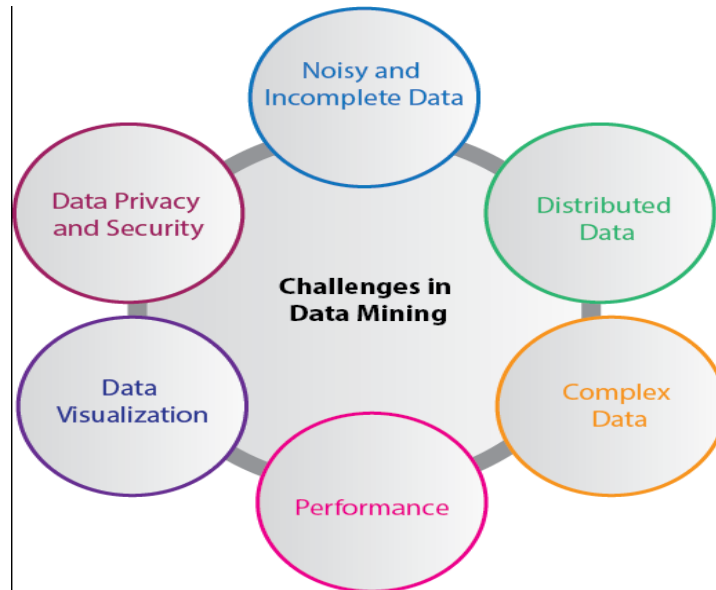
1. INTRODUCTION

Even if you don't know the meaning, the data mining method still differs according to Han et al., who found that information is extracted or mined from large quantities of data. (Berr and Linoff, 2000) For years, engineers, media relations officers, and representatives of various private interests have existed side by side, oblivious to one another, with no interaction, in separate towers of ivory skyscrapers. Automatic and semi-automated discovery of trends and laws Researchers mine data from various sources to gain

a deeper understanding of human behavior. Whatever the term you choose, data analysis it must be.

2. LITERATURE REVIEW

Although the scale of data mining research widens because of constant improvements, the diversity of algorithms increases as well. Most of the research in the data mining sector is about increasing productivity and accuracy for one use case, less resource is dedicated to solving how to use them. complexity increases, the greater the distance exists between application and users (Moore et al., 2001) After figuring out the relevant characteristics of their concepts and characters, data mining applications proposed a model to pick a complex data mining solution for each one. Information exploration in databases can be both challenging and exciting. Knowledge obtained from related data sets of information can be mined and checked for regularities.



3. EXTRACTING DATA FROM CONFIDENTIAL SOURCES

Anand. et. al., (1997) defined the method of data mining as set out in the following sets.

1. We cannot classify the resource precisely at this point, but we assume it is in the "human world."
2. Specification of problem
3. Prospecting data
4. Information domain elicitation.
5. Identification of methodology.
6. Pre-processing data.
7. Discovery pattern.
8. Post Processing Knowledge

Fayadet.al.,proposed the steps below: Returning the huge database results, Choosing the appropriate subset to function inside, Deciding the best system for sampling, Cleaning of data and retention of old data, dealing with missing files, the transformation must be applied and the dimension projection improved, Adapting models to pre-processed data.

4. DATA MINING CATEGORISING

Centered on data storage it includes classification, regression, clustering, summarization, dependency modeling, link analysis, sequence analysis (Fayyad.Et.al., 1996), sequence analysis (Han.et. al. 1996) category of Association, Generalization, Clustering, Quest for Similarity, Traverse Direction. Pattern Pattern(Berry 1997) proposed the grouping, estimate, prediction, clustering, affinity groups, definition. In a case study of the Motorola Semiconductor "Dex," a two-dimensional topology known relationship was found that best preserves the original geometric results. In this chapter, we're taking a closer look at the methodological problems that exist in our research and the ways that we've overcome those Cabena et al. 1997. 1997.

Data mining is the method by which data from large databases is extracted previously unknown, accurate and feasible and then used to make key business decisions. Essentially, data mining is characterized by the fact that it aims to find facts, without a hypothesis that has previously been formulated. The data mining area (Mitchell, 1999) proposed addresses the issue of how to better exploit historical data in order to detect general regularities and to enhance the decision-making process.

5. THE EXTRACTION OF INFORMATION BY PROSPECTING

Data mining is the practice of sending out different questions to find specific data for extracting lots of information from the database there are several techniques that could be used in data mining: different techniques used to tackle database security problems. Data mining methods can also be used to trigger security issues.

Here examines all Give us one of your aspects, and we'll use it to get even better relations with others. These methods, among others, are generally referred to as 'rough arrays,' 'inductive programming,' and 'neural networks.'

Essentially, a certain hypothesis comes from examples and patterns which are the information derived. These trends can be seen by asking a number of queries; the results from each question will depend on the prior results. Intrusion detection and audit databases collecting all the audit data for this would be a huge undertaking. Irregular trends in data can be revealed by software that specializes in data mining. Suppose, for example, and then, an employee regularly travels abroad. Does the employee have any joint venture agreements with other parties in the universe? If the results of the employee's actions meet the test, the conduct of the employee is checked.

Data mining technologies may be used to look for strange behavior in data, but this example shows that they can also alert us to possible hazards. Let's imagine you are talking to someone who has data mining expertise. It is possible that this consumer will formulate various questions and try to divine hidden meanings. That is, in other words, there is the problem of inference. It's important to deal with this problem in different ways. Similar solutions have been attempted before.

Determine whether sensitive information can be discovered in publicly available data by analyzing a particular dataset. If that is the case, then there is a fault in reasoning. This strategy has some problems. One is that we only use one method. In fact, the consumer may have a number of resources. In addition, all forms that the inference problem can arise cannot be covered.

Another solution is to create an inference controller that operates during runtime. Since the user uses data mining software, the inference controller can evaluate the user's questions and the answers and decide the response types for each question to be released to the user.

The problems involved in constructing such a degree controller must be identified. In short, data mining is a fast-growing field. There are not only several prototypes, but also consumer goods. You need to use certain resources to handle those security issues. These tools, on the other hand, may also trigger security problems. Therefore, steps to detect/prevent certain problems need to be taken.



6. MECHANISMS OF SECURITY AND OBSERVATIONS

Brachman et al. (1996) distinguished checked and unreviewed data mining: and exploratory mining. Trends in the system. Discovery involves forecasting and future forecasting. (Chris Clifton,2001) proposed that data mining be regarded as data mining when discovering new and fascinating patterns in data sets, although the safety of these data mining should be included. (Jiaxi et.al.,2003) are two separate types of evaluation of cyber security. The first approach is an evaluation of probabilism.

In this way, the likelihood of events as well as the probability of an The cyber system risk index is used to assess accidents. The second is a comprehensive approach.

The first threats to cyber security classified according to severity into five distinct groups. The likelihoods of a risk in a group are then allocated. The degree of cyber security risk can be obtained using this knowledge and a formula. Based on the priority of the risk, the attack and the intrusion into the system are based on the priorities. Aleksandra Garvick et.al.,(2003) says security procedures and mechanisms are not flawless, and increasing numbers of companies are exposed to data-warehouse threats and attacks. This reflects reluctantly in data mining, although security problems arise.

This can be corrected on the basis of the mechanism and the strategy. (Gerhard Puub et al., 2007) says malware and other risks should be incurred rather than threats prevented, as databases attacked while data sets were mined.

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Chapter –XXII

22

MACHINE LEARNINGALGORITHMS

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ABSTRACT

Artificial intelligence (AI) is mostly a computerized thinking area, and has always been a key part of digitization, capturing significant eyes in the computerized world. In the paper creator aims to carry out a short audit of the different AI calculations which are used most everywhere and are therefore the most relevant mainstream. In order to help educated basic leadership choose the appropriate learning calculation to satisfy the specific needs of an application, the creator expects to incorporate the advantages and defects of the AI computations from its application point of view. Assuring the complicated model is a difficult matter to address PC vision problems using small Boltzmann machines (RBMs). Many estimates for learning include relying on cross-approval or observational methods to upgrade the number of highlights. The study proposes a learning equation to find the ideal model complicated for RBMs by increasing the covered layer.

Keywords: Artificial Neural Network, Back Propagation Algorithm, Decision Tree, Support Vector Machine.

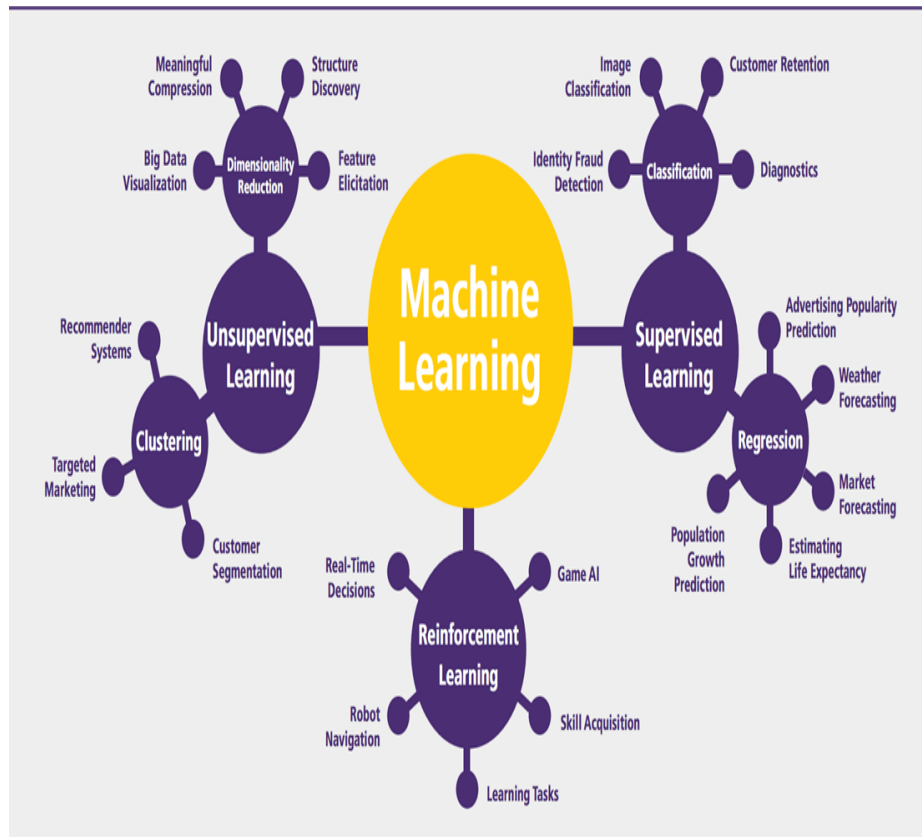
1. INTRODUCTION

The key concept of machine learning is a good starting point for this article. It concludes that the system has gained from past experience if quantifiable execution of these commands is enhanced as it has acquired and is more involved in executing these commands. The computer therefore has options and fulfills expectations or decides knowledge based on them. Take the PC software to see how malignant growth can be distinguished or anticipated from patient restore reports.

This would increase performance because it accumulates greater comprehension by dissecting restaurant test results in a larger population of different patients. Machine learning now takes place in days like the Wild West: there are endless possibilities and thrills, and doubt and chaos [1]. It is a presentation that is evaluated in the light of correct projections and findings of malignant growth as approved by an experienced oncologist AI is used in a wide range of areas specific to these applications: mechanical autonomy, virtual individual collaborators (such as Google), computer games, design accreditation, normal language preparedness, information mining,

traffic expectations, web transport scheme (such as top-height flood cost appraisal), article suggestion, share advertising expectation, therapeutic finding, etc. Deep-seated neural networks (including recurrent ones) have won multiple pattern recognition and machine learning contests in recent years [2].

AI and wide arrangements with three basic problems: characterization, relapse, bunching. Under the condition that numerous information individual preparing classifications are available, they will have to choose between accessible systems such as "administered development," "solo growth," "semi-regulated growth" and "fortification growth" in the application of the appropriate learning machines. After scarcely any section, the most widely used absolute AI calculations will be tested. In a few decades, robots and computers could exceed the millions of years of perception and intellect that have created us. The scope of our paper is to present the perspectives of robotic development and the future of AI in many fields[3].



2. ALGORITHM FOR GRADIENT DESCENT

It is a recurring tactic aimed at reducing costs. In the figure of fractional subordinate power, it must be conceivable that is inclined at another angle. The reported coefficients for every emphasis are duplicated by subsidiary by the non-positive subsidiary and decreased for each coefficient by a rate of learning (step size), so neighborhood limits are achieved in a few cycles. Thus, in the long term, the cycles stop when they merge with the least estimated costs, after which no decrease takes place.

There are three different types of the technique: "Stochastic Descent Gradient" (SGD), "Group Gradient Decent" (GGD) and "Batch Gradient Descent Smaller than normal" (MBGD). Increasingly, parallel machine learning is an increasingly pressing issue with the available data [4]. The movement of features from manually designed machine learning was very effective. Even with this, optimization algorithms are constructed by hand. The paper has shown how the architecture of the optimization algorithm can be a learning problem and thus allowed the algorithm to automatically learn how to make use of the structure of issues of interest [5]. In BGD blunder is processed in the data set for each model, but the model is simply refreshed after evaluation of all preparation models has been completed.

The main advantage of the measurement of BGD is numerical efficiency. It produces a constant bias and a stable mix. However, the estimation hinders the fact that the steady error tendency can produce a combination condition which is not the best one the model can achieve. The calculation also requires the whole collection of data to be stored and available to it.

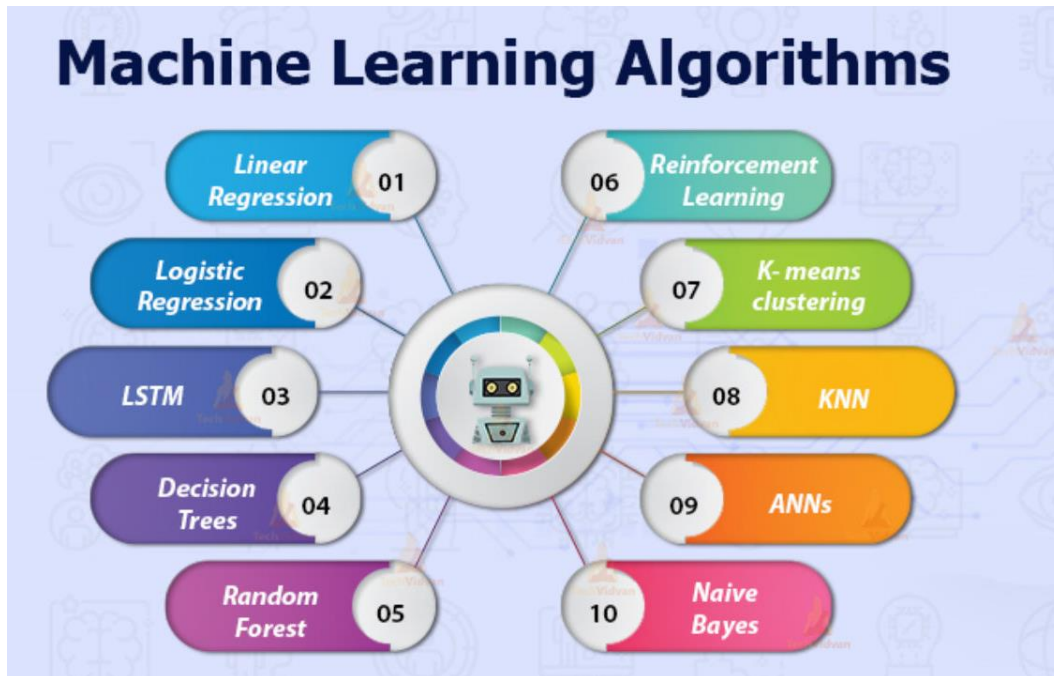
For each preparation model in the parameters the error is calculated and data sets are refreshed for each preparation model. This leads to SGD in particular for faster parameters than BGD. It has the leeway to achieve a smooth rate of growth with successive refreshments. However, visit refreshments are all the more computationally expensive in comparison to BGD's approach. The recurring employees in the association who help to make a representative storyline. Techniques for Techniques Rebooting is popular in optimization and is gradient-free when dealing with multimodal functions.

Popularity in the Partial warm restarts are generated by gradient optimization to improve the convergence rate in gradient, which accelerates schemes in malfunctions[6]. The MBGD approach is developed by joining BGD and SGD concepts. In the preparation of the technique, data in small clusters is prepared and updates for each cluster are made. Then harmonizes the vigor of SGD with the competence of BGD.

The calculation is used in the preparation of a neural system, so a deep upgrade is usually used for the calculation.

The technique of gradient rationalization plummet is used to calculate back propagation, in which the tendency due to malaise can be seen in the weight of the change-neuron. Calculating the slope reduction has the corresponding impediment: if the learning rate is too fast for pitch fall, this time genuine neighborhood would be avoided for upgradation. If it is too moderate, the slope drop can never combine sinking and makes a good attempt to locate a nearby less accurate. The learning rate will affect what is less and how quickly it is accomplished.

A decent practice is to have a changing rate of learning which is accompanied by the decrease in the mistake. The VAPS algorithm, which can be instanced to produce a large array of new reinforcement learning algorithms, is a basic learning law. These algorithms resolve a number of open issues, identify a number of new approaches to strengthening learning and unify different approaches to strengthening learning with one theory [7].



3. ALGORITHM FOR LINEAR REGRESSION

Relapse is a guided update technique. It seeks to use constant variables and to fulfill expectations. Instances using straight recurrence calculations include: expectation of cost of property, anticipation of deals, expectation of test scores of students, anticipation of stock stock production costs. In hindsight, the named data sets and the value of the yield variable are determined by the attributes of the input variable such that the method of learning is direct. Most essential form recurrence is direct relapse, where the effort is made to change the data in a straight line and is conceivable when the relation between the data set factors is straight.

Using a simple definition, the patterns of a single object class are a linear subspace. A linear model depicting a probe picture has been created as a linear combination of class-specific galleries [8]. Direct recovery has the leeway to understand anything but complicated and it is also easy to maintain a strategic distance from regularization. Similarly, the technique will be used to update direct models with new details.

The direct form of regression is a solid match to the possibility of a straight relation between co and variable reactions. It will shift the center to display observable details and pre-processing. Straight regression is useful to determine the mechanism of inquiry. For most common sense implementations, this is anything but a prescribed approach because it distorts true problems.

The impediment of linear relapse is, if one has to handle non-direct relations, that it is everything but a solid match. It is difficult to take care of complicated examples. In addition, it is difficult to properly use the right polynomials in the model. Straight retreat rearranges several genuine problems. The covariates and reaction factors usually have no straight relationship.

Therefore, the use of OLS is expected to give the line a high RSS train. In genuine problems there may be no link between autonomous factors that predict straight recession. The algorithm in machine learning and statistics are well understood and established. In this paper one can see the algorithm; it works and is best used for computer projects. [9].

4. REGRESSION ANALYSIS OF MULTIVARIATE

The basic model for a direct recurrence would have a dependent variable, led by a solitary independent variable. However, the problems of life are gradually uncertain. A ward variable is largely based on several components.

The cost of a house depends, for example, on a large number of components that are identical to the location in, zone, room number, related offices, separation of the closest air terminal, and separation of the nearest area from it, etc.

A coordinated relation between the info variable and the yield variable is found to describe the simple direct recurrence. Be that as it may, in a separate recurrence, there remains a large number of free and one subordinate relationship. Including a variety of info

variables, the recurrence would not produce higher performance or better predictions.

Different basic direct recurrences have a variety of cases and are not predominant. Often even more info variables will make it more awful because it leads to over fitting. It allows correlations between them because more info variables are included. So only information variables can be associated with the yield variable, and can also be identified with each other, it is referred to as multilinearity. Ideal situation is the whole of the info variables to be linked to the yield variable.

The accompanying benefits are provided by multivariate method: it will provide a deep understanding of the relationship between the arrangements of autonomous factors and ward factors. It also provides information about the relationship between autonomous variables. This is achieved through different recurrence, organizational processes, and a half-way relation. It shows the complex real-world problems down to earth and in realistic terms.

The corresponding negative marks of the multivariate approach are strong: the unpredictability of this system is high and

needs details, knowledge of observable methods and factual demonstration. The size of the example should be wide to achieve a higher degree of certainty of examination results. In addition, it is also very difficult to even accept a major analysis and interpretation of the performance of the factual model. In property evaluation, car assessment, power consumption estimation, quality management, streamlining processes, quality confirmation, control processes, and therapeutic determination and so on, this regression analysis system, including different factors can be used.

5. LOGISTICS RECLASSIFICATION

Calculated recurrence is used to negotiate a characterization problem. It gives binomial results, since it gives the chance that an occasion will occur or not (as far as 1 and 0) because of the qualities of info variables. For example, it should be anticipated that a tumor is threatening, generous, or an e-mail is known as spam or some other case as a result of logistic regression. The logistic regression can also lead multinomially to the forecasting of favorite cooking types: Mexican, Italian, Mexican and so on. Also, the outcome may be ordinal: item evaluation one to five and so on.

Thus, measured regression performs the prediction of a clear-cut target variable. In clinical personality studies, logistic regression probably was under-utilized because it has developed quite recently (dictated by the need for computer programs to obtain full probability estimates) and has been mostly concentrated on biostatistics, epidemiology and economics [10]. Although Linear Regression handles forecasts of constant variable estimates, for example a forecast of land costs over a period of 3 years.

Strategic regression has the following advantageous circumstances: ease of use, computational productivity, preparatory efficiency and regulatory simplicity. Scaling input highlights are not needed.

This equation is used transcendently to deal with problems of business size. Since the result measured regression is a probability score that is used for the management of buses, redid execution measurements must be indicated so as to obtain a cut-off that can be used to group the goal. Similarly, strategic retrogression is not affected by little clamor on knowledge and multi-linearity. Strategic regression has the accompanying weaknesses: the inability to deal

with the non-direct problem because its surface of choice is direct, inclined to fit over, will not function well even when each individual free factor is established. Some examples of earth use of logistic regression are: predicting the hazards of developing a given illness, concluding malignancy, forecasting mortality of harmed patients and the prediction of a probability of a guaranteed treatment, frameworks or object deception.

6. DECISION TREE

It is a method of machine learning, which is supervised to deal with grouping and reoccurring problems by continuously dividing knowledge based on a particular parameter. Choices are in leave and hubs provide details. For Tree a selection variable is transparent and the selection variable is non-stop in Regression. The first has the following issues of interest:

Reasonable for a relapse simply for classification, easy to explain, straightforward and quantitative quality management, equipped to meet the missing values in properties with the most plausible value, higher performance due to the competence of the estimation of the tree. It can experience the issue of extra fitting, for

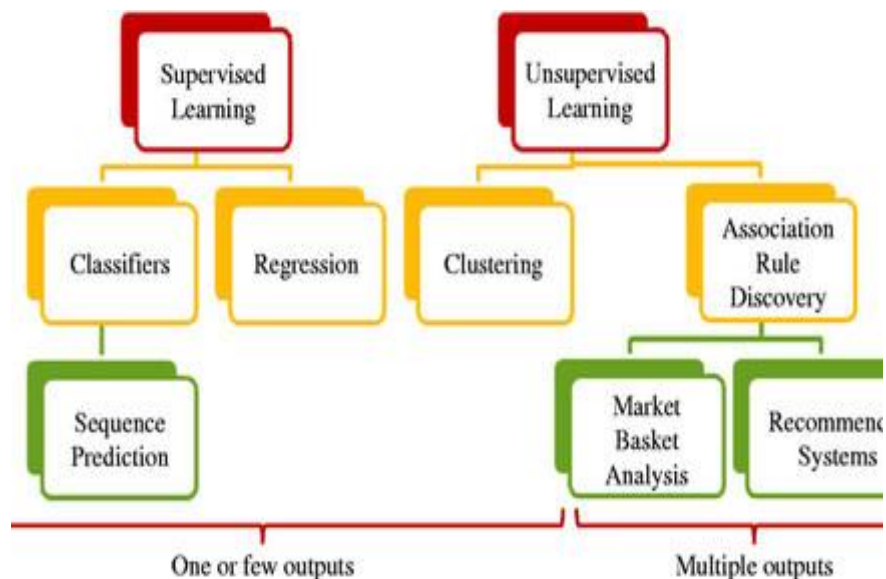
which Random Forest is the arrangement which depends on how soldiers display the tree's size. It may be inclined to test errors and it gives a local ideal arrangement which is not uniformly ideal. Option Trees can be used for applications including predicting potential use of library books and tumor conjecture problems.

7. VECTOR MACHINE FOR SUPPORT

These can address classification and relapse problems. In the technical hyperplane, an option limit should be characterized. If there are several items of different groups, then it is expected that the option plane isolates them. The papers could probably be divisible directly, in which complex scientific skills such as portion are required to separate individuals from different groups. SVM focuses on the correct arrangement of the objects based on templates in the knowledge index preparation.

Given SVM's preferences, it has the capacity to handle both semi-ordered and organized information and can deal with complex capacity to assess appropriate part capacity. Since speculation is taken up by SVM, the probability is reduced. If dimensional information is strong, it can increase.

This doesn't stay in goodness nearby. Due to the extension of the planning period, the presentation will go down to massive information collection. It is difficult to find fitting part job. When the data set is boisterous, SVM does not function admirably. It does not provide measurements of probability. Understanding the last SVM is troubling. Bolster Machine discovers that it is used on earth in the search for malignant development, extortion locations, recognition of penalty, face discovery and content order, etc. SVM and the decision tree are the main way to deal with an effort that can be the strategic solution to the relapse of a logistic recurrence. Decision trees can also be attempted to verify if crucial progress is needed. At this stage, when the number of impressions is higher, then SVM can shoot it.



8. BAYESIAN LEARNING

In Bayesian learning, earlier distribution of probabilities is chosen and then refreshed, such that a re-appropriation can be used later with accessibility of new perceptions. Bayesian framework can address deficient data sets. The strategy will prevent information from fitting. No good cause to evacuate knowledge inconsistencies. It has the accompanying weaknesses: it is difficult to choose sooner.

Before an extraordinary degree, back dissemination may be affected. If the previous one is not correct, it will prompt wrong expectations. It can be very well concentrated. This lesson can be used in applications like medicinal research and fiasco wounded person proof.

9. K IMPLIES CLUSTERING ALGORITHM

K implies that the clustering algorithm is used again and again to clarify the problem. This is a form of individual learning. This has the corresponding focal points: it is more proficient than different levels when the variables are enormous. It creates tighter groups than radical groupings with global bunch and little k. The fascination of this equation is simplicity of use and interpretation of grouping

results. The demand for calculation unpredictability is computationally efficient. K Clustering calculations can also be used for record order, client separation, rideshare information investigation, expected grouping of IT cautions, investigation of subtleties of records and identification of defensive extorting.

10. ALGORITHM BACK PROPAGATION

This equation provides an extremely simple and efficient approach to processing the angle in the neural system and one can use it in conjunction with a very straightforward stochastic slope decrease. These are gradually unpredictable "Semi Newton" methods that boost a size and tilting measurement, but will not do better than support and SGD. This is used in deep learning.

The Neural Network (NN) has specific applications for different industrial fragments and has more, negative characteristics. Places where there are several guidelines or rules to find a response to NN are beneficial. It gives the arrangement, but it is difficult to explain how the arrangement is made, so it resembles a black box. NN discovers its application for the FICO evaluation of advertising elements in the financial sector.

Here is a portion of the NN uses in the promotion section: In item order, for example, in characterizing client parts which customers would like to and purchase those goods, searching for a new explicit item class market, in partner connections between clients and friends. NN is instrumental in expanding the revenue of a company, expanding the reaction level in coordination showcase presentation. NN discovers its application for mailing of letters/packages according to region/postal code between post offices.

Due to the benefits of NN, it is usually used for industrial fragments as mentioned: easy adaptation to new circumstances, tolerance of issues, ability to handle disruptive information. The algorithm works to reduce the error by altering the loads, so the "Neighbor Minima" occurs. However, if the blunder is a major factor in an even wider fall, it will "stuck" (as it cannot tough) and the blunder will stop diminishing. When the loads are acclimated to high qualities, these huge loads may constrain the vast majority of units to operate in an area in which the initiation is not very large, leading to a network paralysis.

ANN with multilayer requires multiple re-hosted info designs, where we have to change the loads to achieve an ideal arrangement with the device adjustment.

11. CONCLUSION

This chapter attempted to audit AI calculations used all the time to understand classification, recurrence and bunching problems. The points of concern, shortcomings and various calculations have been discussed (at any opportunity) as far as implementation, learning rates, and so forth. In addition, cases of feasible use of these equations were discussed. There have been some kinds of AI procedures for unique managed learning, solo enhancing and semi-regulated enhacnig. It is common for users to know how to make a trained choice in the recognition of accessible choices in AI calculation and then choose the appropriate machine learning calculation, especially critical thinking environment. In AI, numerous learning equations were suggested for managing large-scale data sets. Help vector machines (SVMs) are recognized as one of the most powerful models of discrimination.

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Chapter –XXIII

23

BIOINFORMATICS IN BIOMEDICALIMAGING

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ABSTRACT

Bioinformatics is essentially the way biological data are stored, organized, retrieved and analysed. Organisms' protein sequences are stored in libraries and can be retrieved on demand. This paper explores bioinformatics in depth with the definition of different research approaches and its significance. Any time a new virus is present discovered, it's from the analysis of DNA to the finding of DNA, DNA content is referred to as genetic knowledge available. The protein sequence needed for curing can be defined based on the comparison of results. On the basis of this finding it is prescribed the necessary medication. The data contained in the databases was modified to detect new protein sequences. For its fast retrieval, therefore, it is important to make sure that the information in the database be stored in the most compact and intelligible format

Keywords: Compressive evaluation, genomics research and the protein sequence Biomedical imaging.

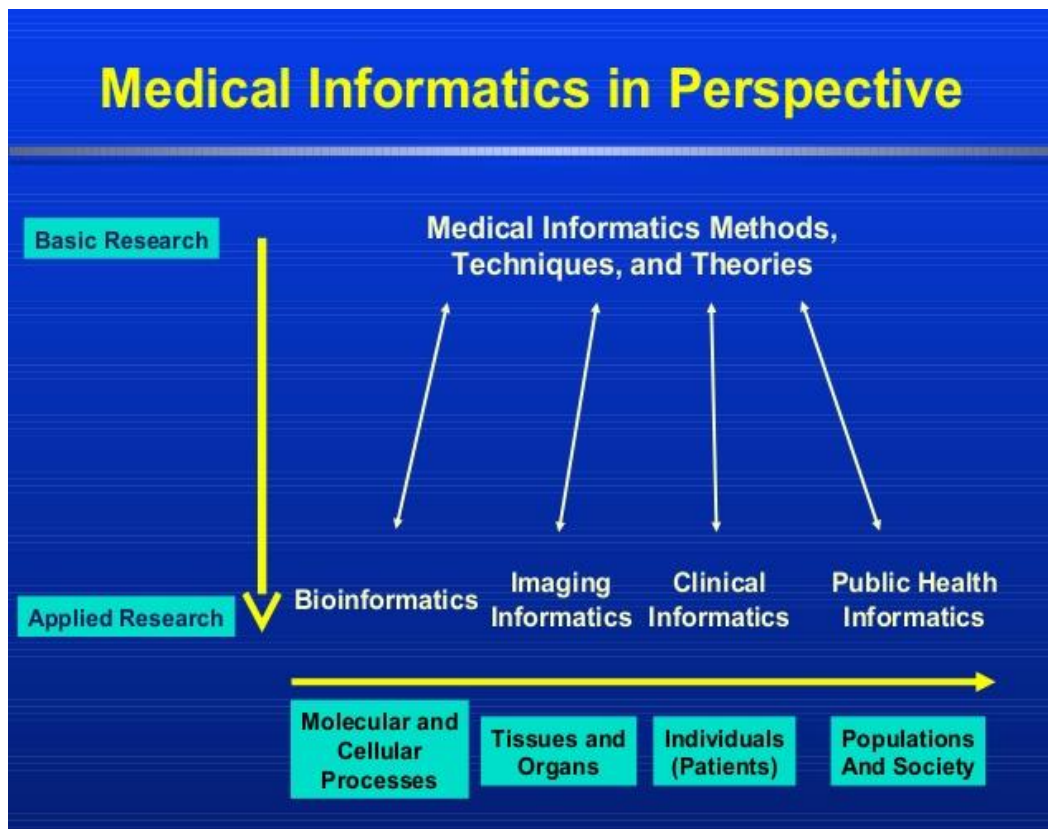
1. INTRODUCTION

Biological knowledge is produced at a fantastic pace. As of the year 2000, for example, the SWISS-PROT had 88,166 protein

database sequences and the Gen Bank had 8,214,000 nucleic acid sequences. When these scenarios are typically observed, databases are expanded twice every 15 months []. Moreover, full database sequences have been published for more than 4 species, ranging from 50 to 100,000 genes. The data from the countless related gene expression-based projects indicate the protein often includes genes, revealing how the products interact with each other as well.

This broadens our understanding of information-processing abilities. Overindentation results in the need for biological science. The introduction of a computer to the system is an optimal solution since the computer can handle a large number of data and solve complex problems easily. The topic of the current review, bioinformatics, is also described as an interdisciplinary area of science, with various techniques for the store, collection, organization, and analysis of biological data. Life itself is focused on information technology [2, 23]. The psychology of an organism is primarily associated with its genes, which can be viewed as digital knowledge in its primitive form. At the same time as bioinformatics emerges, advanced improvements have been made Processing data is

important in the technologies that provide the raw material. Kerala conducted a recent study; an experimental laboratory has been able to easily generate data of more than 100 gigabytes in one day [9, 14, 32]. The machine used should be able to deal with the data with enormous processing powers in order to match the extremely large data. The more data processing, the more computational problems are. The machine used should have high performance and greater disk capacity, allow for faster computation and should be programmed to the maximum.

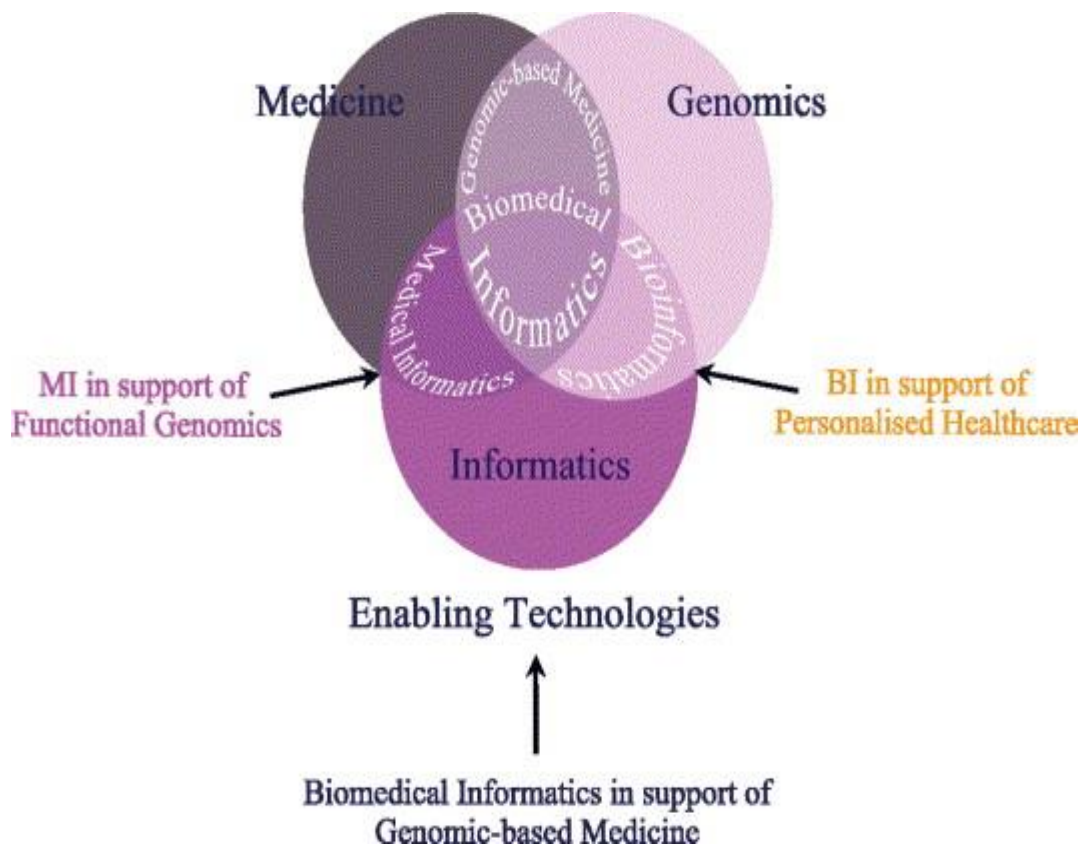


2. AIMS OF BIOINFORMATICS

Bioinformatics has a basic objective that can be tripled. Firstly, bioinformatics can organize and refine the data so that it is easy for researchers to access and new data entries can be easily made [6, 7 and 11]. Though data processing is the data in the databases must be evaluated before it is useful. Bioinformatics thus advances. The second goal of bioinformatics is to develop and use new techniques and tools for the analysis of data. For example, if any protein sequence is detected, it is in the interest of the researchers to compare it with the previously characterized protein sequences. FASTA and PSI-BLAST are involved in this quest sequences considerably.

Therefore, the creation of resources calls for computational knowledge and a comprehensive understanding of biology and its related terminology. Third, bioinformatics' goal To use the instruments given for data analysis and for biologically understandable interpretation of the results [23]. Studies on biology typically examine the subject in greater detail and compare the data collected with the relevant data characterized previously. In

bioinformatics, we are now able to compare the database globally, which has revealed general concepts that may apply across different current systems and helps to emphasize the new characteristics. The biological data collected during the examination process passes through several processing phases including informatics, statistical analysis, statistics and engineering.



3. HISTORY

PaulienHogeweg discovered in 1978 the concept of bioinformatics Data storage, data accumulation, and data processing

are critical in biological systems. This term means the analysis of data processes in biotic systems [3]. This field is related to biochemistry or biophysics because of its description. Data collection and management through the use of basic behavioral rules in models of prebiotic evolution and social interaction mechanisms are important examples of bioinformatics-related knowledge processes that have been previously studied [5]. Elvin A. Kabat contributed to the bioinformatics of Tai Te Wu between 1980 and 1991 with his comprehensive volumes of antibody sequences. Another important leader in this area, Margaret Oakley Dayhoff, hailed as the 'mother and father of bioinformatics' by David Lipman, head of the National Center for Biotechnology Information [16, 20, 27].

At the beginning of the "genomic revolution," the term bioinformatics was reinvented in order to create and maintain a database for store biological data, such as amino acid sequences and nucleotide sequences [8, 10]. This type of database had not only design issues, but also required the development of basic, but complex user interfaces to allow researchers to retrieve or add new information.

4. GOALS

The cellular data was pooled to research changes in the physical properties of biological function the following topics come under the category of bioinformatics: proteomics, sequences of amino acids, nucleotides, and folded proteinstructure that have arisen in this area, so that the understanding and analysis of different data types are now included. The current term for data analysis and interpretation is referred to as computational biology [31, 33]. • Implementation and advancement of instruments that approaches can assist in efficient accessibility and control of various forms of statistics for accessing interaction between members of large data sets; For example, in families of similar sequences, protein structure and/or functions and protein cluster sequences are predicted to locate a gene in a series.

Bioinformatics' initial aim is to increase knowledge of biological processes. Its emphasis on developing and using computer-intensive methods to accomplish this objective differs this area she learned several techniques she could apply from her other idols: Mae West, Liberace, and Bob Hope.

Related entities include: data mining, pattern recognition, and machine learning algorithms. Another word for structural study in this equates to genetic identification, design of drugs, sequencing of drugs, drug discovery, design of proteins, gene expression, genome association, protein prediction, and the prediction of changes in structure, and protein form, and evolutionary models [18]. Bioinformatics [29] needs the creation and production of algorithms, databases, statistical and computational methods, in order to resolve practical and formal problems arising from analysis and management of biological knowledge.

The combination of continuous production of IT and genomics and other molecular technology [14] has led to a wide variety of molecular biology data. The name given to these mathematical and computational methods is therefore "bioinformatics" for biological processes understanding.

5. BASIC TECHNIQUES

The mapping and alignment of multiple protein sequences with their respective DNA sequence results in the design and visualization of protein models are the common bioinformatics activities.

The two ways to model a biological system, for example, are living cells:

1) Static: sequences - Nucleic acid and protein peptides the relationship between these entities, including metabolites, microarray and protein networks

2) Dynamic: Nucleic acids, proteins, peptides and ligands structures
System biology requires variable metabolite concentrations and reaction streams under this category

6. BEST RESEARCH AREAS

Bioinformatics and computer biology, genetics and genomics and, lastly, system biology are the key areas of study in bioinformatics. Bioinformatics has been an integral part of several biological areas [33]. Many imaging techniques and signal processing techniques are combined in experimental biology at the start stage to Carving out significant insights from a vast body of unprocessed information.

Genetic engineering has been heavily implicated in bioinformatics and genomes in which genomes are sequenced and interpreted[14], and their transformations are simultaneously

tracked. It plays an important role in recording the collected data and arranging them sequentially in databases. In the study of genes and protein sequences, it plays a significant role. In the field of biology systems, it helps to model and simulate many microscopic levels such as RNA, DNA [23, 25] and protein structures, as well as their molecular interactions.

7. SEQUENCE ANALYSIS

Sequence analysis is primarily a procedure in which a broader variety of methods is exposed to protein sequence, DNA or RNA examining subjects to achieve a thorough understanding of their characteristics. When we talk about peptide sequence characteristics we talk about its characteristics, functions, structure and growth. Order alignment [12, 32] and sequence-comparison biological databases comparison are the analytical approaches used. The sequence analysis of the functions involves a variety of related subjects:

- comparing sequences with biological databases to detect their similarity and determine if they are homologous [14, 22].
- Sequence intrinsic characteristics are defined through sequence analysis.

- Genetic labeling based on biological sequence variations and differences is used to distinguish signals.
- In the event of comparing the new sequence to the old one, we make it known whether and, and how, the old sequence or organism developed.

Without series, one can't grasp the molecular structure of the body. It is particularly noted for characteristics such as post-translational modifications, active sites, and non-coding, such as read frames and exotic, non-genetic components.

The sequence analyses are orderly. If the sequence has been established, a comparison of the profile is done. After synchronizing, you can make sure the new sequence is in the same place as the old to compare it. If you have finished making a profile comparison, the next stage is sequence assemblies and the gene forecast.

8. ANNOTATION GENOME

In a single cell of organism, the genome can be identified as a complete collection of DNAs. Owen White developed the first software framework to describe the genome in 1995. He studied and sequenced the first bacterium *Hemophilus influenza* genome with his

colleagues. Gens are known as genomic sequence fragments [6, 8] encoding the protein within. Owen White then develops a program to find genes, pass RNA and even assign initial functions to the genes.

As the progress is enormous in the computer world, the programs now available are advanced, modified and enhanced in their own way.

9. EVOLUTIONARY BIOLOGY COMPUTATIONAL

Evolution biology is known for studying the origin of a species, its descent and the transition over time [3]. Simply put, the sense of evolutionary biology can be judged by the name itself, i.e. the study of species evolution. The advent of bioinformatics in evolutionary biology allowed scientists to track the decline of a myriad of organisms.

Bioinformatics have also helped research the evolution of more complex organisms including gene duplication [2, 10], horizontal Pass of gene, etc. The effects of any population have also been estimated over time. Biological computers are used primarily to monitor and share the data of a large number of species and organisms.

10. ANALYSIS LITERATURE

If the number of researchers grows, the number of published papers increases enormously [1, 5]. Therefore, literature review is needed to enter the expanding library of textual resources. The aim of literature review is to use different for this review, machine and statistical linguistics. For this purpose, abbreviation, identification of the object and protein interaction is used. In the abbreviation the abbreviated biological words are absolutely formed [18, 20]. It recognizes other biological terms such as gene names, etc., whereas it identifies which protein interacts with which protein from the given text in the interaction with protein-protein.

15. BIOLOGY and NETWORK

Network analysis understands the connection between biological networks like the metabolic network or the network of proteins. Network biology seldom includes various types of data such as small molecules, proteins[31], gene expression data, and several other types that can be physically or / and functionally related. A single gene or molecular biological network may be created but the data types listed above often seek to be integrated[19].

15.2. Biology of Systems

The computer simulation of cellular subsystems is used to simulate and analyze the dynamic relations in cellular processes. A metabolic system, gene regulators and signal transduction pathways of a network of enzymes and metabolites constitutes the cellular subsystem [23]. The simulated evolution also known as artificial life seeks, through the simple (artificial) stimulation of machine life, to understand evolutionary processes[9].

	Omics	Biomedical imaging	Biomedical signal processing
	Research topics	Research topics	Research topics
Deep neural networks	Protein structure Gene expression regulation Protein classification Anomaly classification	Anomaly classification Segmentation Recognition Brain decoding	Brain decoding Anomaly classification
Convolutional neural networks	Gene expression regulation	Anomaly classification Segmentation Recognition	Brain decoding Anomaly classification
Recurrent neural networks	Protein structure Gene expression regulation Protein classification	-	Brain decoding Anomaly classification
Emergent architectures	Protein structure	Segmentation	Brain decoding

16. THROUGHPOWER IMAGE ANALYSIS

The biomedical imagery contains a lot of detail. The complete analysis of these images involves computer technology that

accelerates the encoding, analysis[22] and quantification of the vast quantities of data contained in biological images in turn, or often completely automates them. The analytics system has enhanced the observer's ability to calculate from greater distances and has also improved precision, speed or objectivity in modern times. Any of the new fully developed analytical systems have eliminated the observer entirely. These improved systems [29] contribute not just to biomedical imaging. Biomedical imaging is nowadays useful both for study and for diagnostics.

17. FOR AND WORKINGS

Several bioinformatics software tools differ from basic command line tools. More complicated graphic systems. In addition, bioinformatics applications and methods are divided into the following:

17.1. Bioinformatics Open-Source Applications

Since the 1980s, there have existed and continue to develop many free and open source software resources. Regardless of the funding arrangements, partnerships of a number of free open source bases, silicon innovation[6, 27] and the need to new algorithms to

analyze emerging types of biological readings have contributed to the diversified open source applications as well as bioinformatics in all research classes. These open source resources also serve as a breeding ground for innovations or plug-ins funded by the community in commercial applications [25.28]. Open source titles include BioPerl, BioJava, Taverna workbench, Bioconductor, UGENE [31], Biopython, BioRuby, EMBOSS, .NET Bio, and Bioclipseapplications. Since 2000, the annual Bioinformatics Open Source Conference (BOSC), sponsored by the Open Bioinformatics Foundation (OBF), has created more opportunities to sustain this tradition.

17.2. Bioinformatics Web Services

Several interfaces based on SOAP and REST [16, 17] were created for a wide variety of applications in bioinformatics. This allows an application to run on a computer in an area of the world in order to use servers from other areas of the world with information, algorithms and computer resources. The key benefit the use of bioinformatics web resources is the end users do not have to deal with overhead and software maintenance in the database. In

addition, EBI subdivides the fundamental bioinformatics resources into three categories:

- 1) BSA BSABSA (Biological Sequence Analysis)
- 2) SSS (Sequence Search Services)
- 3) MSA (Multiple Alignment Sequence)

The availability of these services-oriented bioinformatic tools, which range from an assembly of standalones with a shared knowledge pattern in one web-based interface,[28] to distributed, integrative and comprehensible bioinformatics workflow management systems, demonstrates the applicability of online bioinformatics solutions.

17.3. PROCESS MANAGEMENT SYSTEMS FOR BIOINFORMATICS

We use the Bioinformatics process management toolkit since it is recognised as a particular type of process management framework. It is to design and implement a computational or bioinformatics algorithm. This framework lets scientists develop their own workflows [11, 19], providing them with an easy to use environment. It also

provides you with different collaborative tools to implement your Pour a cup of water into a test tube and observe the colour change in real time. This approach allows several researchers to use and/reuse workflows easily. It also empowers scientists to keep tabs on workflow processes and output processes. Currently, four sources endorse the Freegalize: Galaxy, Kepler, Anyaya, and TavernaAndur.

18. PRACTICAL APPLICATIONS

18.1. Homologues Finding

The quest for correlations between bimolecular and other sources is one of the driving forces behind bioinformatics. The identification of protein homologs, apart from the systematic organization[22, 24] of details, has some direct practical uses for bioinformatics. The most important application is the transfer of information between associated proteins. For example, homologues can be better understood and some information can also be applied in comparison to the malfunctioning protein issued.

The theoretically-resolved structures of close equivalents, in particular structural data, are typically based on theoretical protectin models.

The process for fold identification is the same as that, in which the predictions of tertiary structures depend on remote homologues for search structures [26,30] and it is then tested whether or not the prediction is energy-sensitive. Where structural and biochemical knowledge is insufficient, studies can be carried out in low-level organisms such as leaf, and the findings can be transferred to high-level species such as humans, with more complex experiments.

A suitable approach is also employed in genomics. The primary purpose of homologous finding is to validate coding regions in newly sequenced genomes and functional information is repetitively passed on to annotate individual genes[31].

Simple genomes are simplified by studying simple organisms and then applying the same technology to highly complicated organisms. This applies in a broad way and is one of the explanations for the *Mycoplasma genitalium* early structural genomics projects[17]. Ironically, this same principle can be implemented vice versa as well.

Through testing the missing microbial proteins in humans, the possible drug targets can be discovered easily. Drug molecules can

be engineered to a limited extent by exploiting structural protein differences that specifically bind to one but not to the other another structure.

18.2. Development of rational drugs

Ethical drug design has been one of the earliest medical applications in bioinformatics aid. The widely cited method as an example of a drug target is the use of the MLH1 gene [14]. MLH1 is a human gene that codes a flawed repair protein (mmr) located on a short chromosome arm [1, 5].

After the linkage study, it was found that the MLH1 gene was identical in mice, the mmr genes and hence the gene were now involved in nonpolyposis of colorectal cancer. Translation software can be used to determine the possible amino acid sequence of the encoded protein if a nucleotide is given. The method of sequence search is first used to find counterparts in model organisms and then the structure of the human protein is based on experimentally characterized structures on the basis of the sequence's similarity [22, 23]. Finally, molecules are constructed using docking algorithms to bind the model structure

18.3. Large censuses

The bioinformatics database can store all information and sequences on the expression and structure of the protein, genomes and data sets [29].

However, it is necessary to condense this information in an understandable way by the user. The Large Generalization helps to define issues and areas of interest for further research [2,4] and a thorough review and helps to make new results an appropriate location. This sorting helps the consumer to determine if the material is unique in some way. The large-scale surveys will raise a range of issues related to bioinformatics. Questions such as whether the protein fold is linked to a specific phylogenetic group? How are the different folds typical in a particular organism? What are the common percentages of folds among similar organisms? We also have data on protein functions combined.

We know that the specific biochemical functions are caused by certain protein folds. In reality, the sharing of folds by an organism follows the phylogenetic classification routine [6, 11]. A question also arises whether the deprived relationship comes from the conventional

evolutionary trees in parallel? The most electrifying and recent source of genomic information are expression results.

The issue of the high presence of protein fold in the genome, after combining the expression details with the functional and structural classification of the protein, reveals higher expressive levels. In broader surveys the sub cellular location [22] of the protein and its interactions are included for genomic data. Together with the union of structural data, all the protein-protein interactions within an organism can be mapped first.

18.4. More medical uses

The latest application in the biomedical sciences is covered by the study of gene expression. The compiled cell expression data for any disease, such as cancer, etc., is compared with normal expression levels for the unaffected cells in the identification of biomedical disease. The cell gene expressed gives us the cause of the disease and thus suggests different potential therapies for it using advanced drugs [23]. In the event of lead agent, microarray tests can then be useful for determining responses to the pharmacological action, helping to predict the toxicity [26, 29] of the medication used

and encouraging early test results. It is expected that the integration of experimental genomics and bioinformatics will bring a future revolution in the healthcare sector. For a patient with post-natal genotypes, a distinctive scenario may be used to determine immunity to such diseases and conditions.

In order to minimize health care costs, a separate combination of vaccines can also be recommended to save the needless procedures and to expect the infestation of diseases later in life.

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24

RESOURCE ALLOCATION TECHNIQUES IN CLOUD COMPUTING

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ABSTRACT

A great leap forward in customer loyalty has been made due to advances in real-time technology like cloud computing. Inexpensive storage has drastically reduced the cost of data storage, and resulting in more effective data management. On-the-the-the-fly demand, customers have varying needs with finite resources, it is difficult to meet all of the requests. More providers have to ensure that their cloud services meet the criteria so that customers can use them effectively and use them correctly, while conserving resources. Therefore, the distribution of resources is important. A lot of attention is given to how resources are allocated, and also a comparison is made of all the available techniques is included in the final portion of the report.

Keywords: Cloud computing, Resource allocation.

1. INTRODUCTION

1.1. Cloud Computing [1][2]

Cloud computing is based on the basic, efficient concept of sharing resources. We essentially share resources on the Internet in cloud computing, i.e. store data into the cloud and access it through the internet through a community of organizations. Cloud computing means a group of systems connected to each other in a network to provide a different infrastructure, in size or scale that can be implemented by data and software systems [2].

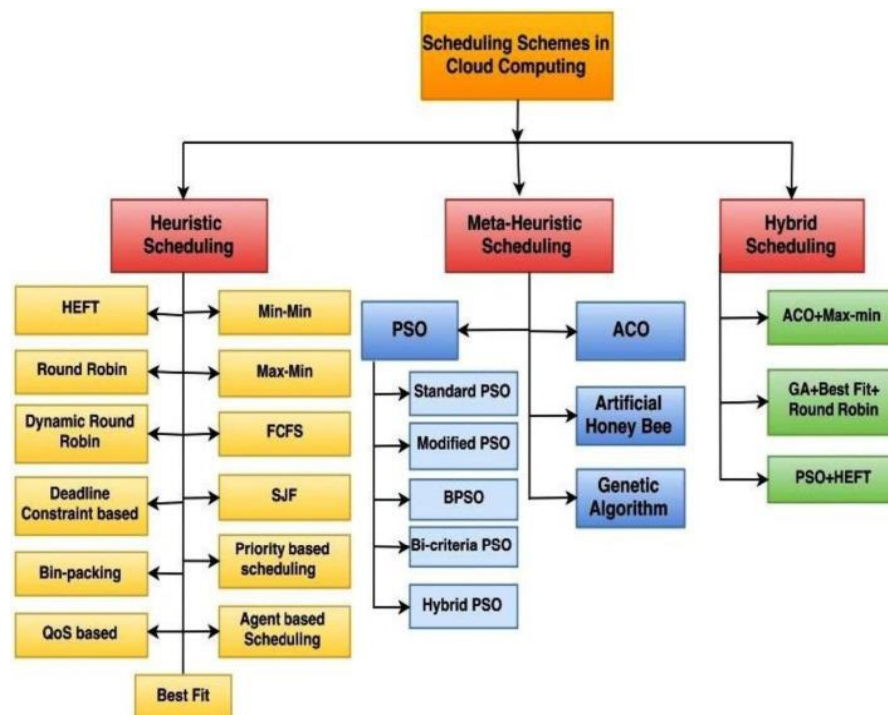
There are two frameworks for cloud computing. One is a model deployment and the other is a model service.

1.1.1 Deployment Model [1]

Model deployment describes how to reach the cloud. Four distinct cloud types are defined:

- Public Cloud [1]: enables users to conveniently access both the services and the device. It can be owned, run and operated by corporations, academics or governmental bodies or it can be combined. Amazon, Google, and Microsoft are some examples.

- Private Cloud [1]: Allows users to access the organization's resources and systems. The company itself can be owned, run and controlled, or the third party can get into the picture. IBM, Sun, Oracle is examples.
- Community Cloud [1]: offers services to a variety of entities that are owned, run and controlled by or third parties. Examples include the cloud group of Microsoft Government.
- Hybrid Cloud [1]: It is a combination of private cloud and public cloud that performs demanding activities using private clouds while non-critical or demanding activities take place through public clouds. Examples: Azure Windows, Cloud Windows.



1.1.2. Service Model

Three categories of service models are:

- SAAS [1]: SAAS or on-demand Software as ASS. End users can use the software applications by Service. It is a service that can be accessed globally until you have an internet and a computer. Gmail, Yahoo mail, are examples.

PAAS offers an operating system for the development and deployment of applications. PAAS provides the most advanced platform as service (PAAS)[1]. It's free of charge. The developers will build and run their applications on this platform. Examples are: Windows Azure, Salesforce.com.

- Network Infrastructure [1]: Service that can be leased, as a trial version for a limited time, is known as IAAS. We access resources like virtual computers, virtual storage, physical machines, etc. with this service. For instance, Amazon EC2.

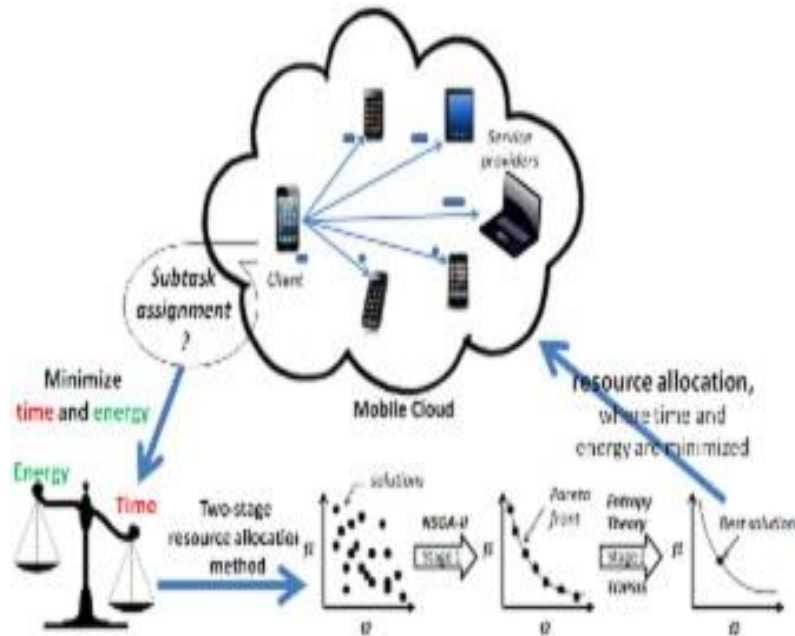
1.1. Resource Allocation in Cloud Computing

Online allocation is concerned with allocating computing resources to various cloud applications. In a real-time cloud environment, all the different resources are made available to the

applications at the same time, since they're dynamically allocated. The resource allocation techniques are used on each unit for effective resource utilization

Resource allocation incorporates cloud services that fulfill the criteria of an application. The application should be given the resources required to complete the task fully. Additionally, we need the distribution of resources and the order of their arrival. The following factors should be avoided: [13]

- The conflict over resources occurs when two applications seek to access the resources at the same time.
- The resource scarcity situation occurs when there are insufficient resources.
- The mutilation of resources is a condition that occurs if resources, despite the availability of resources, are not granted to applications.
- Small amount of money only in the situation of underprovision that occurs when the application is awarded.
- The situation of over-supply occurs when the application receives the surplus resources needed.



2. RELATED WORK

Pandaba Pradhan, Prafullu Ku. Behera & BNB ray [11] an amended round-robin algorithm has been proposed for allocating resources in the cloud environment in real-time. Two records have been used in this algorithm:

SR - Used to store the explosion time for processes left on the queue

AR - We have to take the following steps to measure AR:

- Achieve the value of the SR
- Select the total number of requests in a queue. Now divide the value found in step 1 by the amount found in step 2 to compute and store the Avg. value for explosion time.

After the procedure is executed, the SR & AR will be revoked when the burst time has been ended, otherwise, the SR & AR will be changed at the end of the queue.

Weiwei Lin, James z. wang, Cheng Liang & Deyu Qi [10] Using the concept of water conservation to regulate water use has been suggested in a real-time cloud setting. The best use of resources in this strategy is to foresee and maximize the resources required for the application. This programme incorporates two crucial procedures. The first is known as the broker, who is maintained on the computer itself, and the second, which operates in the datacenter, is known as the Meta system controller. When extra services are required, the datacenter waits for the client to ask for them. The more money you have, the fewer resources you have.

Lixia Liu, Hong Mei¹, Bing Xie proposed MQLB-RAM [6] At the heart of it, the software is multiple resource distribution. In this paper, workload distribution and resource allocation are carried out on several machines, networks, or in a virtual real-time cloud environment. An important point to remember is that by combining requirements from clients and cloud service providers, it can provide

multi-QOS indexes. Minimal system requirements, low system cost, high system efficiency, and good network reliability are satisfied by load balancing. As the algorithm is doing this, it calculates the weight of each peer, but uses resources and money effectively as well to balance the entire indexes.

Chandrasekhar S. Pawar and Rajnikant B. Wagh[9] pip has suggested dynamic resource allocation of real-time priority in the cloud There is a dynamic distribution of resources in dynamic workloads. Digital machines are then delegated or allocated and migrated to the required amount of resources It's lucrative because of course. To best accommodate changing workload, the algorithm dynamically shifts lower-priority work to higher-priority tasks as required. Digital machines are built when the two tasks are at the same priority.

As proposed by Marwa Hashim eawna, Salma Hamdy Mohammed & El-Sayed M. El-Horbaty[5] To begin with, the key issue was the question of supply and demand. the percentage of time and resources needed to satisfy the customer must be cut down An improved particle swarm optimization heuristic was given by Suraj

Pandey and his colleagues The calculations required to run each application were completed on various resources and sequenced in the order of their total cost. This paper proposes the use of simulated annealing for cloud computing resource scheduling this system cools and crystallizes metal with minimal energy T acts as a starting point, and after that, a cost-to-benefit analysis is performed, a new and different variable (CNA) is added to it. As soon as the calculated NG is less than or equal to the current gain, the solution is deemed accepted.

As proposed by Hwa Min Lee·Young-SikJeong·HaengJin Jan [7], the resources available on each virtual machine are managed by the VM scheduler. This algorithm consists of Round Robin and First Fit Greedy algorithms. The operators in the Greedy algorithm are chosen when a VM is discovered. One last thing to know about Open Nebula is that it offers cloud services across different hardware platforms. It can be public, private, or a combination of both. Virtual Scheduler (also known as the Matchmaking Scheduler) uses the Virtual Machine Scheduler. When a resource number is selected from the Requirements and Priorities combo box, the virtual machine is

called the output. In such cases, all virtual machine requests that fail to meet the specific specifications are dismissed by the scheduler.

Anthony Thomas, Krishnalal, Jagathy Raj [3] in a real-time cloud setting, resource scheduling parameters have been described as two elements of great importance. The aim of the paper is to make users happy while conserving resources. When looking at two variables when choosing tasks, the primary consideration is how long it should take, and the secondary consideration is what kind of task it is.

Every job is given a credit based on two factors: time and output the credit given to tasks is based on the average (av) duration (TD) of the tasks (T) plus by measuring the variance (T). Choose tasks that are comparable to a set of conditions and give a credit to each one that is roughly equal to the required size of the conditions for the completion. Credit allocated to a mission is a priority divided by a divisibility factor Consider - for example a two- If a device has a two-digit priority, the divisibility factor will be equal to 100, and even numbers will be handled the same. A priority assignment is equal to a task credit.

The credit of a project gets is proportional to the size of the job multiplied by the priority of the project. Billing is done in this way: The task's budget is proportional to the total amount of money, time, time, and resources they have contributed.

Narander Kumar, Swati Saxena [8] here's how we can assign resources, separate them into two steps: deciding which customers are going to need which resource first, and then allocating those resources in accordance with the requirements of those customers' individual tasks. By design, a market-driven bidding mechanism encourages trust and offers fair opportunities while still taking advantage of service providers.

The other thing to note is that a preference-driven payment scheme is used to ensure that the resource is given to the winner, and that they will end up paying less than the value of the offered bid. The first step is dichotomized into two parts: identifying a plausible theory and making a case for it. In the first stage, before an auction, the service provider would initially purchase each VM instance by calculating the average of all prior purchases for that VM instance.

This model has to have an auction that provides all of services and welcomes all bidders who want to participate and those whose bid is equal to or more than the initial offer. Mean total price from all the bidders.

Winning bidders whose TBP is equal to or higher than Mean-Based bidding have the first half's capital assigned to them. In the second half, the bidding proceeds in the same way as the first, except only the losers from the previous round get the necessary resources this time. In the second stage, determining how much the winner has to pay, we've already calculated the odds. This is based on their requirements in three factors: Deadline (constrained/lent/immediate), service time (complete/in progress), and VM possession (full-time/limited). The reward money paid to a winner comes from his or her personal budget. Dynamic VM allocation (a form of VM resource scheduling) has been proposed by Saraswati Kala and Dr.Kashriam have helped aid this In this article, workers are prioritized according to their deadlines. The current VMs get the work they are capable of handling.

When a higher-priority task preempts lower-level tasks, resources become free for the lower ones to begin.

When no virtual machine is available to use causes the algorithm to pause and allocates its resources to assign to the job with the greatest need. Non-terminable jobs have lease types such as Cancellable, Suspend, and Non-preempt able. It increases resource usage by preventing new virtual machines from being generated as you launch new applications, which results in higher utilization overall and lower VM costs.

3. RESOURCE ALLOCATION TECHNIQUE

3.1. Round Robin Algorithm

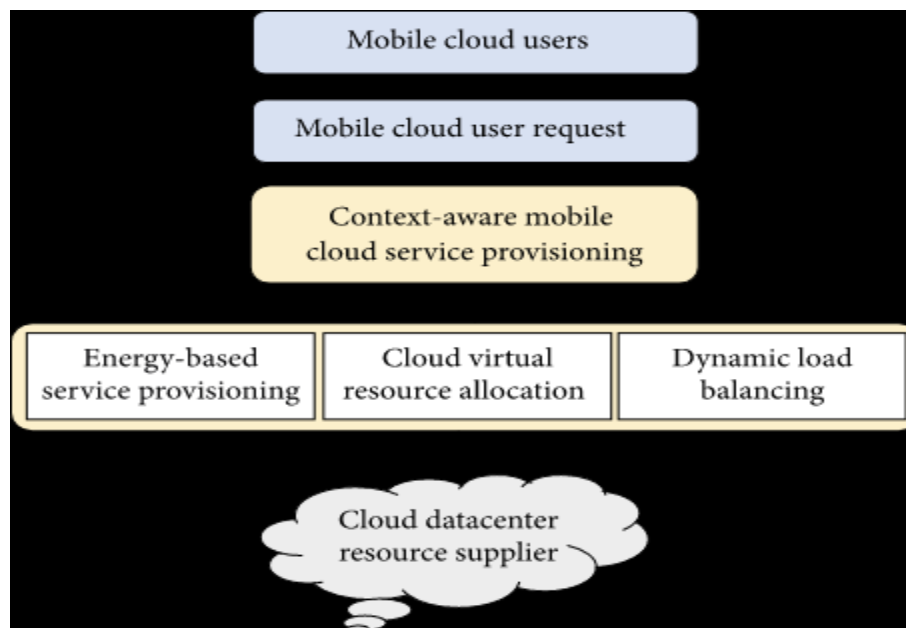
A round-robin algorithm is constructed primarily for shared-processing systems. This algorithm is incredibly simple and has been around for many years. We accept that it is valuable. A round-robin algorithm has a circular queue of ready processes waiting processes known as a fixed unit of time known as a quantum. at the back of the job queueIn a round-robin algorithm, the first resource is devoted to the first process and after that, it's over, the remaining CPU cycles are shared among the remaining processes.

It will be removed from the process queue if the process is not finished by that time; otherwise, it will be placed at the end of the queue. The operation will complete as soon as the computation is finished if the CPU execution time is less than one quantum.

3.2. Shortest Job First Algorithm

According to CPU First, the operation with the shortest name would be done first. The FCFS (First-Come, First-served) algorithm is similar to the default algorithm except for which method to choose.

In terms of the order of the amount of time that it takes to complete the processes are placed in the queue. Only after their task has been placed in the ready queue is they are each given Processor time to process their process fully [11].



3.3. Load balancing Technique

Load balance is the process by spreading workload between different processors to increase the efficiency of a cloud environment. It means that no computer is heavily loaded, partially loaded or idle, and thus the load distribution is uniform. The number of cloud users has increased every day and the workload on the machines is therefore growing. Failure to do so can lead to poor system efficiency, wastage of resources and customer dissatisfaction [7].

A good load balance mechanism should therefore be employed to improve stability, flexibility, efficiency and optimize use of resources.

3.4. Priority-based resource allocation Algorithm

Priority-based scheduling is based on the priority scheduling approach. Every process is given priority and the process is performed first with higher priority. If two tasks have the same priority, they will be conducted according to the first-coming or round robin basis.

The two forms [10] could be:

- Pre-emptive: if the processes of new arrival have higher priority than the current ones, the CPU would be pre-empted.

- Non-prevention: the CPU will not be pre-empted if a new process arrives but it will be put atop the ready list.

3.5. Hybrid Resource Allocation Algorithm

This method is used in the provision of services and is called the Hybrid Algorithm. This is a Metaheuristic strategy for allocating resources in a multi-level programme in cloud computing. Here Particle Swarm Optimization is used to search locally, choose the locally best spot, LBest and Simulated Annealing is used to search globally, and then choose the most global location known as GBest. Simulated Annealing uses the world-wide search technique to find the best and to search for the best one around GBest [5]. This is the algorithm [5]:

- Phase 1 – Begin with initial pace and initial population generation.
- Step2- Measure the value of the objective function using the following equations:

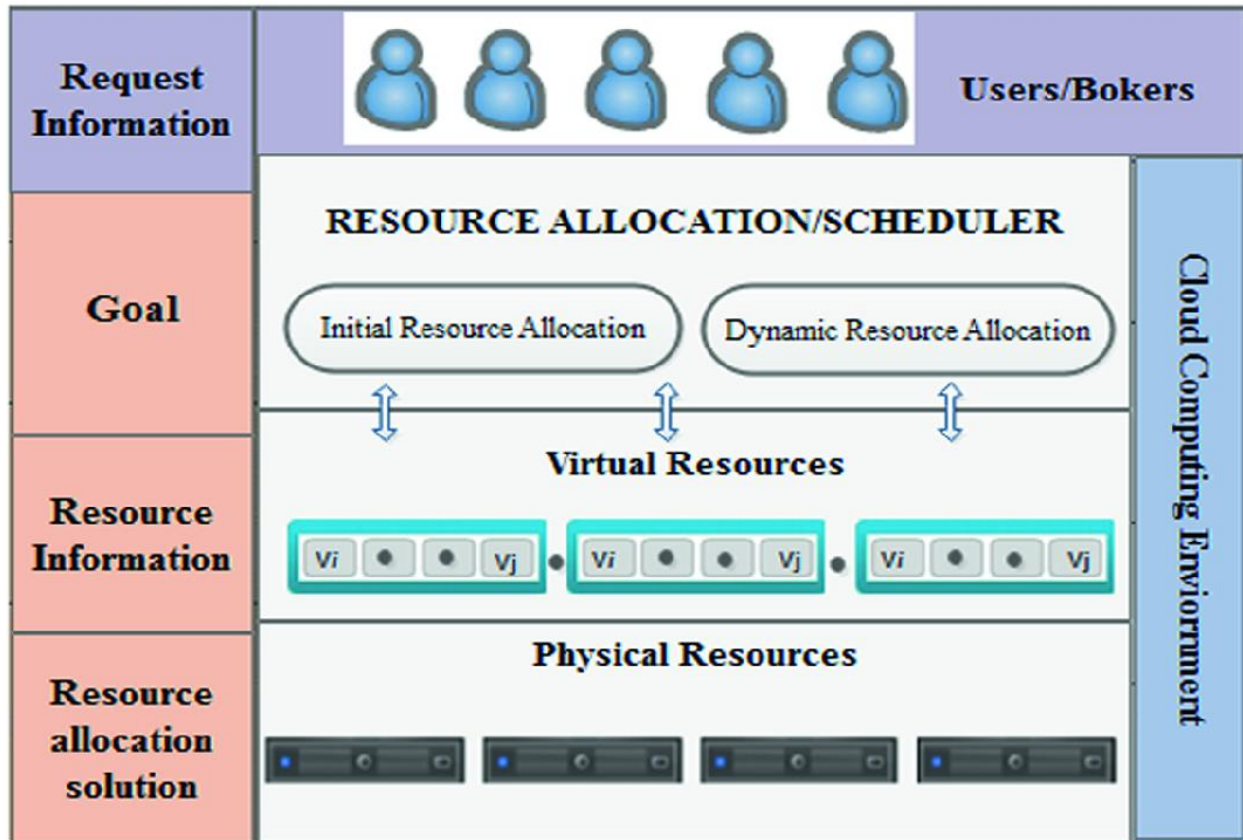
(If ST is specified as fist time, ECT implies expected completion time, DU means length, EET means estimated time of execution and FT termination time)

$$ECT = ST + DU + EET$$

$$EET = (ST - FT) + DU$$

Step3– Now identify the initial population based on objective feature values

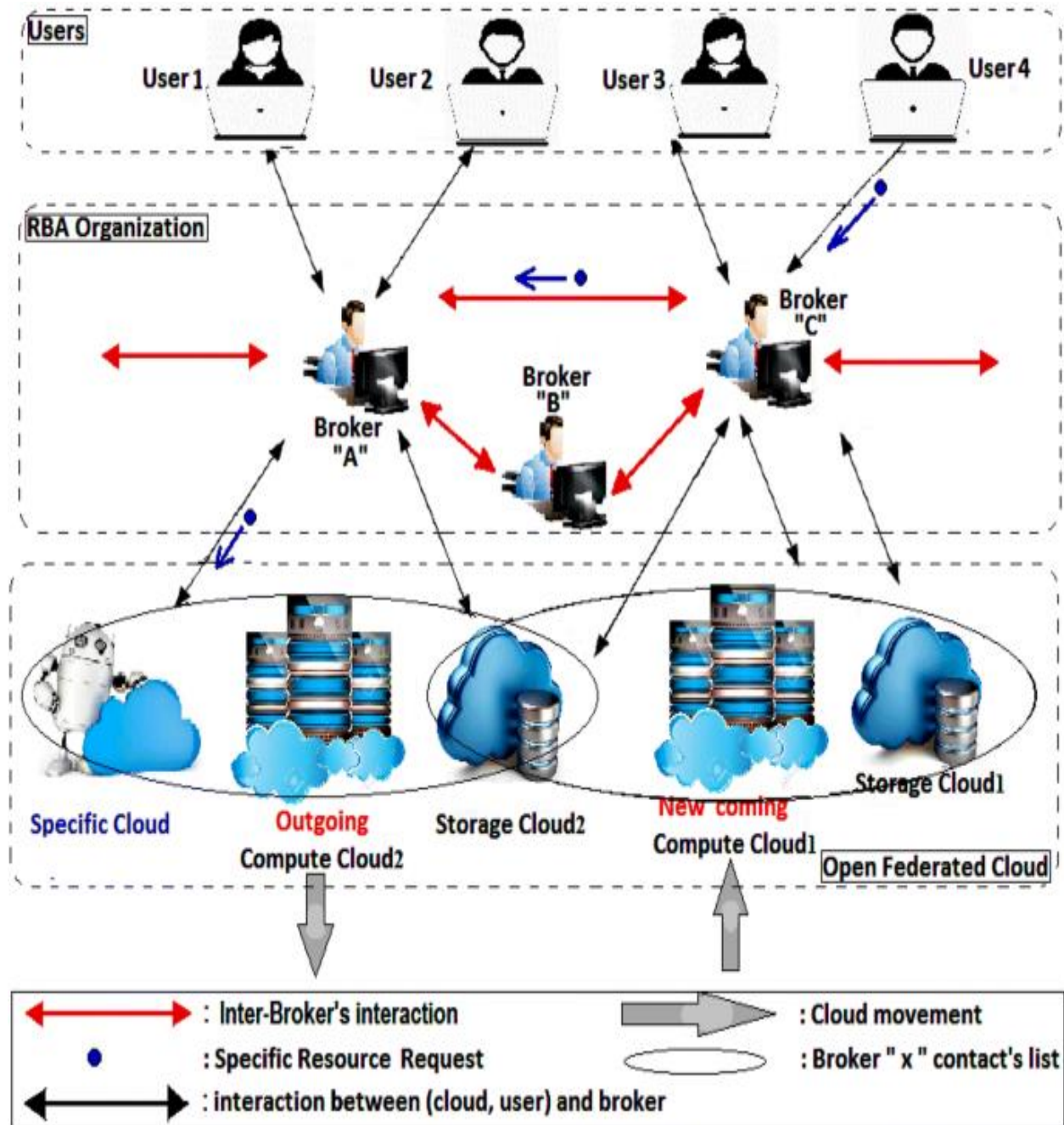
- Step4– Now choose the local best location or LBest
- Step5- Now picks the best GB
- Step6- Put SA to look for the best.
- Step7- When we have the algorithm $i=i+1$ as the latest iteration, return to step4
- Step8- Check if we need to move the best and thus get the output
- . • Step9- Check if there is a need to move the best one.



3.6. Performance-based Algorithm

A resource allocation strategy based on efficiency is used for the consistent and structured allocation of VMs in the cloud environment. The framework comprises a VM Control Manager and a Node Performance Analyzer. Each provider has a programme to schedule operations at its data center [8]. The correspondence takes place between the schedulers. The decisions may be made accordingly, with the knowledge of the current status of VMs. The aim is to evaluate and use the calculation capability of each node.

The efficiency of a node is measured using two parameters. One is the saved memory performance and the CPU measurement time. We can get the inverse matrix with the LU decomposition [8]:



In the algorithm for the allocation of resources, the work is divided into different subtasks by the scheduler when a cloud is assigned a job. Based on the information gathered from other schedulers, the scheduler now assigns a specific task to each cloud.

This request is sent to the cloud service provider via the internet. These requests are sent to various virtual machines that can perform the necessary process. The VMs are now created with specific tools. The system details are sent to the virtual planner.

3.7. Min-Min Algorithm

This algorithm is a load balancing algorithm [3] which distributes the load among the available resources, depending on the task dimensions. It operates on a list of tasks with certain tools for all tasks. The algorithm focuses on choosing the resources and assigning them to the task with the least time. After a task is done, the task list is deleted. This algorithm continues until the completion of all the tasks in the set.

3.8. Dynamic resource allocation technique

The workload for applications continues to fluctuate for a period of time. The application may have worsened in the static

resource allocation scheme due to lack of resources or often not use of any resource and is thus wasted [4].

This is why users tend to use dynamic allocation technology to better assign resources to applications according to their needs and thereby help to allow proper use of resources.

4. CONCLUSIONS

Cloud computing revolutionized the computing era by increasing accessibility, collaboration, security and cost and infrastructure reduction. Since the cloud, customers are growing over time and so their needs are dynamically evolving, optimal and optimum use of the available finite resources is needed. When proper resource allocation strategies are used carefully, great data management and processing can lead to high customer satisfaction and the best use of limited resources. This paper addressed various available resource allocation methods, comparisons and solutions suggested by various authors.

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Chapter –XXV

25

CLOUD COMPUTING

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ABSTRACT

Research in cloud computing fundamentals and terminology the intention is to give internet users as well as organizations insight into the capabilities that are made available through the definition of the cloud. Since the resources we use (servers, applications, and infrastructure) to run our IT operations can be more efficiently used, cloud computing increases the degree of performance and optimized resource utilization. The cloud is essentially a strategy of distributing applications to a common point so that they can be accessed by several users. Cloud computing is a discipline that has significant advantages such as improved services, increased reusability, and options, and in costs, and system and organizational flexibility, all of which favour users.

Keywords: Software as a Service, Platform as a Service, License to OperatePaaS, SaaS

1. INTRODUCTION

In the 1970s, IBM developed a new operating system called Virtual Machine, which may be referred to as Grid computing in the literature at the time the onset, the computing model was referred to

as "Group Computing". J. in 1960 defined the idea of Cloud Computing as "The Cloud", or "the Cloud" by J.R.Lickler. The word 'computing' was coined for the first time in 1997 by Professor Ramnath Chellappa. After that, they got noticed by Cloud and the majors began meeting customers' business requirements in the cloud. In 1999, "Sales force" was the first company to produce a cloud for creative and marketing departments. Applications began being used to feed directly to end users, businesses started to store company data in the cloud. Also, in 2002, "Amazon" introduced the "cloud storage" to allow people to get their own on-demand storage of data. [1][2][3][4].

2. CLOUD COMPUTING HAVE THREE BASIC MODELS

ORCATEGORY OF SERVICES:

1. Service-as-infrastructure 1. (IaaS)
2. Service-as-a-platform (PaaS)
3. Service-to-Software (SaaS)

2.1 Infrastructure-as-a-Service

A service model in which computing services, such as networks, hardware, servers, and applications are made available. Getting the

system portfolio allows cloud service providers the opportunity to use the things they've already acquired as well as the peripherals and other physical tools they possess. This reduces overhead and administrative expenses for the provider. The various Infrastructures as aps that can be provisioned online includes: physical computers, virtual machines (e.g. Oracle VM), software packages, firewalls, and more. The advantages of Platform-as-as-a-a-a-a-Service are:The infrastructure already in place supports the cloud services already.

As a customer or provider, it uses today's physical and software resources,therefore the expenditure in both resources is reduced.[5][6]

2.2 Platform-as-a-Service

One approach to using cloud computing is to provide a framework that provides end users (or customers) a range of programming languages, databases, tools for design and creation, and systems to work with. There are some benefits of doing it that way rather than that.

1.Stability:

If the provider has total control over the applications and

configuration for the environment, that reduces the complexity of installation significantly.

2.Fast testing and deployment:

It is almost impossible to carry out a wide range of stress and compatibility checks on the system in the local setting.[7][8]

2.3 Software as a service

This model implements a service delivery model where the services are delivered by a Vendor or a Service Provider on the internet. There are real examples that you can utilize: Google Drive, Docs, and Sheets. A real-world example: Bank, which offers real-time banking services, includes data storage, allows user account management, and security.

Advantages of SaaS

1. Auto updates and patches: cloud modified applications show the user's ability to immediately benefit from the common internet-based service.
2. Compatibility: Users must not worry about configuring their application machine because all users can normally access applications on remote machines through a simple browser.

3. Accessibility globally: very obvious, because no limitation has been applied, so that anyone can use the services.

3. CLOUD COMPUTING TERMINOLOGIES

Lock-in: Lock-in is a situation where a consumer does not actually switch to a competitor's product or service using a product or service.

For example, a person confronts the difficulty of transferring data from a cloud provider.

Data instability, data modification may be problems.

The lock-in can be three forms essentially:

1. Lock in platform: This means changing platform problems, e.g. from Xen to VMware.
2. Data lock-in: means consistency and problems related to where data can be placed or changed. Cloud computing, which means our security and other problems with data, is a legal notice for data security and alterations
3. Lock-in tools: means that multiple suppliers or distributors have different tools, mostly incompatible with the services and applications prehosted. [9]

Cloud

This refers to an IT environment designed to provide a remotely measurable IT resource.

IT: May be an artifact that is connected either to the real or virtual IT. For instance. Physical: Physical: Server: Server

Virtual: Program or software

Cloud Consumer: a group that uses IT services based on the cloud.

Cloud Provider: Cloud-based resource provision group.

Scaling: means addressing increased or lower demands for use.

Scaling has 2 subtypes

1. Horizontal Scale: Increase or decrease of similar type resources:

Resource increases are called out scale.

Scaling In is called the decrease of capital.

E.g. had 2 servers previously, up to 4.

2. Vertical Scaling: Increase / decline in capacity-based capital.

The Scaling Up is named to increase the capital.

Scaling Down is a reduction in money.

E.g.: the Scaling Up example is Core i3 to Core i7 server [10]

4. CLOUD BASED OPERATING SYSTEM (OS)

A lightweight operating system for computers is referred to as "Cloud OS" browsing the application and saving the data on the web-based server

Built by GOOD Inc. A web OS which boots in a browser to perform simple tasks that don't require installing the whole operating system.

- If you design a computer for browsing the internet, the first question you can ask is whether you want it to use Net books, phones, iPods, or iPods
- Reconnecting the idea called “Data ON-LINE and RUNNING in the CLOUD”
- The hardware requirement is extremely minimal because of the cloud OS app.
- First cloud OS makes its debut in the G12 Cloud Net book in 2009
If you can take away our happiness, you can take away our toaster, but you can't take away our pastries
- Cloud-based computing has plenty of extra functionalities and special features

The rest of the flavoring was mixtures of various ingredients:

cocoa, vanillin, chipotle, anise, cloves, fennel, horehound, liquorice, cinnamon, saffron, tea and **potato**.

4.1. Different Types of the Cloud OS

1. Zero PC:-The OS lets us bind cloud storage to a shared paperwork such as Drop box, Google Drive, Sky drive. Have some applications such as instant messaging, text editing, document management and online sharing.

2. JoliCloud: JoliCloud provides the Internet and other works with a 15000 application. The OS' main aim is to manage all the lives of online users, including Facebook, Twitter and more. "JoliCloud ME" is the name of the app.

3. Glide OS:-The OS has features such as e-mail, simple tools such as notes, text editors and presentation builder. OSis' main objective is to sync the files to HARD DRIVES between the operating system.

Silve OS:-OS is programmed to write articles, listen to music, make notes, and play games. The downside is that no data storage is supported by this OS.

5. iSpaces Cloud PC:- The OS offers such basic functionality such as File Manager, Notes, Office Suits, and Browser. The OS offers a

ZOHOOoffice office outfit.

6. ZimDesk:-The OS is full of functionality and applications. The wallpaper, contact management, ftp client, e-mail client, and file manager are also supported.

The OS supplies the basic apps such as radio, file manager, notes etc., in Places A:-. "Instant Messaging" among users is the main purpose of the OS. [12]

5. BENEFITS OF CLOUD COMPUTING

Lots of organizations and businesses now concentrate on fulfilling consumers' needs on time. Bargaining on price means a company has all of its money consolidated. Easiness and scaling of access to services the data may be held by a third party, and there is a possibility of alterations.

If there are any problems, it must be restored by hand or by big data, which is very expensive. Profitability is enhanced by better utilization of the capital several methods like surveys, resource monitoring are used, but it's measured on a pay-as-use model. It cannot meet all the needs. You must have access to the internet to use the cloud.

6. CONCLUSION

Every day our needs and expectations shift, static applications will no longer suffice. A software/hardware update is necessary to ensure uninterrupted service for users. Enterprises who seek to take the electronization of their facilities and processes have adopted cloud computing.

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Chapter –XXVI

26

SURFACING THE ART OF PEDAGOGY

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ABSTRACT:

The word pedagogy has been described as methods of teaching and learning. I have a creative understanding of teaching that has established it as a metaphor in the or ethological concepts, which in turn has established these mantic metaphors of pedagogy as an instructional method. To conclude, this paper will investigate the ways in which the pedagogical and aesthetic perspectives interweave in teaching this paper aspires to obtain a more comprehensive understanding of pedagogy. Finally, self-study of teaching for post-secondary learners is strongly advised to facilitate the appreciation of pedagogy in the secondary school setting.

Keywords: Training, training, teaching, education.

1. INTRODUCTION

Pedagogy has become a replacement for instructional approaches or teaching strategies in the education system (Loughran, 2006; van Manen, 1999). This instrumental interpretation of pedagogy is based, in part, on the view that education is a technological task, and reduces the teaching work to a widely applicable field of competence.

Thus, the science of pedagogy often excludes the intimate choices and experiences which shape instruction. Given that teaching in apprehensive practise (Grimmett&MacKinnon, 1992) is a situated and reflective area of operation, why curriculum and training decisions are made is as much a pedagogical part as the outwardly obvious process or approach is ultimately taken.

2. UNDERSTANDING OF PEDAGOGY:

Reverting to the etymological pedagogy, one discovers that the first definitions of words like instructor and pupil to be distinct yet complementary (van Manen, 1994). Pedagogy is fundamentally involving the behavior of pedagogues who are concerned with the personal ties between people.

Teachers stand in a pedagogical connection to their students. There is no sitting on the laurels in teaching and learning. It's about discernment and effort for both the academic and personal development, so that's why educators have to be continuously involved. With this point of view, the answer to the question of “Why?” and the inquiry of “What?” become entangled as it pertains to the link between a teacher and student.

Because of this conception of pedagogy, the essence of teaching is revealed as relational and reflexive. The Cartesian dualism of mind and body is typified by pedagogy. Every little thing we do or fail to do—is done to ourselves.” (Like others, bhfvn means that “our every move is directed against ourselves” [Bashkoff, 1981, p. 124; this page cites Freire, p. 129]) [Students] has significance. Why? Because as teachers we stand in relations of influence to our students...and We cannot assert ignorance of this, as this is undeniable truth (p. 19). Separating the act from the action is not possible in this situation.

A similar potential exists in education. David Loughran states that in his latest book, “Pedagogy”, “knowledge of teaching about teaching is pedagogue knowledge and knowledge of learning about learning and how that comes into play during that process is called pedagogue pedagogy (p. 1180). For when experience of teaching meets needs to be incorporated into something that the teacher does, pedagogy takes on an engaging role. Since teaching students are no less likely to be trained and guided than instructed and have as much to learn.

The practice of teaching an intricate relationship between “how,” “theory,” “skills,” and “why.” He said teachers were almost impossible to teach and almost impossible to comprehend, but created the easiest tasks the world has ever seen.

Unfortunately, the depiction of Wilson's various and confounding attempts to conceptualize the dynamics of teaching in terms of pedagogy in pedagogy has been disregarded in the teacher education literature (Loughran, 1996). Teacher preparation remains an unsolved problem (p. 748). While a number of scholars provide information about what goes on in teacher education classrooms, the many, various, and collaborative interpersonal, collaborative, and self-discovery facets of it have been left out of the study, according to what makes an effective teacher. Additionally, if the word “pedagogy” appears, it is used as a methodological approach or tool (Grossman, 2005). Unfortunately, while a vast majority of teacher education is done as "non-interactive" work, there is a glaring gap in the overall picture. While acknowledging this issue, I contend that in the quest for pedagogy in teacher education, we must explore all three categories of pedagogy.

Context plays an important role in the art of teaching, but that doesn't stop pedagogy and subtle decisions and adaptive responses to specific situations from taking place. Thus, teacher education must explore the consequences, rationales, as well as the intentions and intentions underlying the application of their effects I tried to answer Iatt and Burger and McDonald's (2008) call for a more nuanced understanding of pedagogy by delving into the large reservoir of educational literature following this, I draw on John Dewey to discuss the context of teaching as an art form of architecture. After that, I will turn to the practitioner inquiry school of thinking to highlight that teacher education (education in research methodology) has an epistemic course not previously taken to explore pedagogy to conduct education in pedagogy research.

3. PEDAGOGY AS ARTISTRY

That being stated on the assumption that teaching is both a matter of learning and defining the objective development, pedagogy can be described as a creative Endeavour.

Student skill has to do with what they know and their willingness to think critically, and instruction has nothing to do with

knowing subject matter and more to do with speed of effective and expedient reasoning. For the purposes of pedagogic reasoning, creativity, intuitiveness, and language, pedagogy is an art type of art. According to Dewey (1983: see Table 4.2, p.162),

The world looks to higher education as a work of art, which calls for the same qualities as those possessed by the composer, painter, or artist. Each of these artists requires a degree of technology, but is reduced to the extent that he relinquishes his own artistic vision. His image returns to that of him as an apprentice who follows instructions, draughts, specifications, and blueprints written and drawn designs handed down to him by others.

Education and art help us see the world more broadly because they expose us to new people and new ideas. Art is an act of self-expression in the name of the self, or self-improvement by expression. Clients of clay or text are shaped just like an artist with choices. Suggests Eisner (2002) that the artistry of teaching lies in having the ability to help students invent the script for themselves and design suitable scenarios while helping them find just the right instance of expression (p. 382). Pedagogy comes to the fore in these times

It's interesting to note that artists and pedagogues have an aesthetic concern for pedagogy like artists, pedagogues are constrained by their relationship to the students' well-being, and environments are thus tailored to their greatest potentials for students. We must exercise our ability with care if we want our work to be creative (p. 47-48). Likewise, the pedagogue should be committed to the academic and personal growth of student's while also ensuring that they have an outlet for personal speech. Students' point of view and an artist do the same creative language from learning jazz chord progressions as well as recognizing rhythmic cues: For van Manen (1991), teachers must feel their students' needs as they progress as they improvise the curriculum. It is more than just a way of teaching, it is a creative act. Pedagogy is an artistic presentation of learning that integrates concern for development.

4. THE SEARCH FOR PEDAGOGY

In order to account for the complexity of educational study, one of the most significant advancements has been the presence of practitioners (Bullough & Gitlin, 2001; Cochran- Smith & Lytle, 1993; Fecho& Allen, 2003; Lagemann, 2000).

Drawing out the hidden meanings of the teacher-centered job shows one's insecurities and discloses one's idiosyncrasies to the pupils. Traditionally education and study tries to seek information based on students' immediate and local needs, along with the repercussions to those in the educational and cultural milieu (Cochran-Smith & Lytle, 2009). An increasingly used and common method of facilitating people's learning in education is called "Practitioner-inquiry" and, an integral and versatile component of this approach is that it blurs the distinction between the roles of "inquirerler" and researcher." Contextualizing from practice (Munby & Russell, 1994) educating and researching the multifaceted and nuanced work of becoming a teacher.

The practice of research in higher education takes into account (Grossman and McDonald, 2008) on the instructive relationships that occur while learning about pedagogy. For beginning teachers, but giving researchers the ability to look critically at teaching methods and pedagogical systems. In a nutshell, the key goals of self-study are to understand ourselves better and, in a wider context, to get better acquainted with our subjects.

Personal and professional growth) are so interconnected that they cannot be examined independently. Samaras got less than three percent of the vote in the race (98 and 2002) self-based study looks to understand questions which are both unique to the instructor and shared with other people in the field (p. 9). (Methodological and epistemological advancement in the field of teacher study according to Zeichner (1999) (p. 8).

To use a range of qualitative analysis methods, compile, and evaluate issues like being an instructor, and introducing programme change (Cochran-Smith, et al., 1999; Zollers, et al., 2000). A good deal of self-study is grounded in the assumption that teacher awareness is dynamic and never solid or completed. More importantly, Bullough and Pinnegar (2001) make the case that “the aim of self-study is to challenge, provoke, and enlighten rather than merely reinforce (p. 20). A research done in one's own interests will clarify the “living contradiction” (Whitehead, 1989) Encouraging teachers to investigate their own thinking encourages place-based investigation (LaBoskey, 2004). Finding out how faculty members can look to someone else in the eyes (p. 18).

According to epistemology, both self-study and practice are interconnected (Cochran-Smith & Lytle, 2004; Cole & Knowles, 2000). The separation of teacher-directed study from self-focused analysis often serves pedagogical objectives since it allows for a greater development of direct and deliberative thinking in teacher education.

By formalizing self-study, pedagogy unadorned pedagogy's relational qualities can be revealed. Teaching is just as sensitive to teachers' emotional, instructional, and curricular needs as to their interests and concerns

5. BARRIERS TO SURFACING THE ARTISTRY OF PEDAGOGY

Despite the arguments about the possible self-study in pedagogy for building a richer understanding of teaching methods, educators sometimes underestimate the value of their work. Teacher education hardly receives any attention in the literature, according to a recent paper by Grossman (2005), and its emphasis is on teaching methods or techniques is the same.

Subsequently, interpersonal relationships, instructor and learner processes impact teacher practise, which goes entirely unaddressed in teacher education, are practices that should also be

investigated as aspects of teacher teaching (Cochran-Smith & Lytle, 2009; Johnston, 2006).

A large portion of the disinterest in holistic pedagogy in teacher education is founded on the knowledge that “inside knowledge” is better understood. For those who agree that is practical knowledge represents a different category of knowledge, a lot ask about the usefulness and/relevance of practical location approaches that have met the challenge (Fenstermacher, 1994; Huberman, 1996; Richardson, 1996).

Academic disputes over what is considered valid knowledge (historicism vs. modernism), but self-study modes of practice (principles, processes, and techniques) are a lower class of academic study. As a self-study scholar started her academic appointment, she said she was feeling like she was being smothered under papers. I am here to help and I have qualifications.

As I soon as it was clear to everyone that my experience was highly important (Arizona Group, 1995, p. 41). Gitlin (1996) argues that academics progress by doing research and writing things that are divorced from reality.

Practice-based methods are unwelcome in academia, and silenced in higher education. intentions, critics of pro-based research criticize this method, arguing that information generated by practitioners holds no epistemic value Many dispute the very notion that practitioners have the capacity or willingness to perform in the environments in which they work is usually performed, with Lytle and Cochran (2004) argue that it is even unrealistic to assume that one can “usefully carry out research and evaluate one's own work in the same context”.

In a view consistent with the post approach, critics maintain that the researcher (or context) is the focus of inquiry that is inherently biased and unpredictable, rendering all ideas of science invalid. Thus, relational concepts such as pedagogy are no longer possible because of their value-laden setting.

Some attempts are being made to transform education into a scientific research project by organizations such as the American Educational Research Association (AERA) and the National Research Council of the Trained Scholars (Shavelson and Towne, 2002). Though, of course, there is a Centripetal and centrifugal tension to

the issue of what science education is all about: these statements, according to Howe (2009), tend to be quite simultaneous to modern, positivist thinking on it.

Although a concept requiring replicable and applicable findings cripples the exploration of the social and human sciences, this modern model strips these elements of them (Tillman, 2009). Since it is critically important to gain a deeper understanding of pedagogy and teacher education, empirically-based pedagogical modes such as self-directed research are dismissed. ent seeking to elevate unformed schooling to a uniting structure (Freeman, deMaris, Preissle, & St. Pierre, 2007) When educators try to maintain strict separation between applied science and pedagogy, Pierre warns, this limited conception of education is likely to persist.

6. SELF-STUDY RESEARCH AS A FRAME FOR THE ARTISTRY OF PEDAGOGY

Bakhtin's work shows that pedagogy cannot be seen as a utilitarian paradigm for human behaviour. Structuralism runs across Bakhtin's writings. Unlike other authors of his time, Bakhtin rejected the attempt to find models for human life in the sciences.

In his view, human beings believe in transience because they are unable to sustain constant states, according to Bakhtin (1984), constant states are unlikely. He had faith in the capacity of individuals to twist everything to finalization in the world to their advantage” Men don't know what they are capable of saying, or what they will eventually plan to do, until the last moment.

Consequently, living in a state of flux, making attempts to formalise human beings unsuccessful man is not a final and immutable; he can never be compelled to adhere to any fixed norms (p. 59). For this purpose, Bakhtin proposed that generality is inherent in operation rather than attempting to isolate it.

Bakhtin noticed that any action was full of unanticipated possibilities. In a reflexive and interactive pedagogy, pedagogy attempts to extract universal truths are doomed to failure. Understanding and shaping pedagogy to students, all pedagogy is reflective of the student-teacher relationship. Teaching and Pedagogy encourages researchers to reduce the procedures of teaching and learning to identifiable instructional approaches.

The basis of self-study in teaching methods is an interrogation of the principle of pedagogy. Understanding that the requirements of pedagogy, and also understanding the symbiotic and interrelated mechanism of self-research is critical for the success of pedagogy, is consequently, learning pedagogy and practice are synonymous with being an effective instructor, and, and so self-research on teaching can help to support one's own self-concept as an educator.

It studies also helps us to comprehend what kind of subtle misjudgments teachers must deal with when performing self-evaluations on their job (Clandinin & Connelly, 2004, p. 597). In this manner, teacher education will further the dialogue about pedagogy dilemmas functionality. The precariousness of surfacing deficiencies, while not nearly as often as it was previously, remain an issue because teacher educators, for the majority of today's teachers is different.

In other words, training teachers for the objective work of teaching has a normative and an effect on the teacher's cognitive comprehension, which leads to the subjective discovery of methods for inspiring others to learn. Segall (2004) states that all pedagogy is

a mix of teaching and activity in organizing someone's experience as well as in connecting both worlds (p. 494). Neither are the pedagogical methods and pedagogical behavior of teachers left out of the game of questioning, theorizing, innovating, and building. Teacher education is formed by teaching method and pedagogies

7. CONCLUSION

This chapter makes an argument for the importance of pedagogy in teacher education programmes. Bearing in mind the essence of the teacher/student learning relationship, it can be said that a teacher is invested in a student's development. However, in the course of trying to adopt a positivist view of scientific science in education, their descriptions of pedagogy have ended up completely.

At the same time, by remaining solely focused on realistic goals such as standardization of teaching and applying and memorization of techniques, educational research retards access to certain perspectives that are relevant to pedagogy in a way. Self-study offers pedagogy is crucial for teacher education research since it elucidates the variability of teaching practices.

Self-based investigation of teacher research may be required for uncovering and understanding an adulter seen educational implications enhancing and comprehension of teaching by teacher educators gains in exposure to both deliberative and immediate thinking necessitates looking at pedagogy from different perspectives. I am fascinated by seeking pedagogy by my own self-examination. This allows me to fully understand the aesthetic education and make myself part of it.

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Chapter –XXVII

27

AN ANALYSIS OF DATA MINING: PAST, PRESENT AND FUTURE

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ABSTRACT

The amount of data and information generated and the amount of knowledge created by people has a major impact on human activities. Data mining is the knowledge discovery process that relies on the examination of different points of view to extract as much information as possible, then evaluating it for usefulness. Many different walks of life rely on data mining now that vast databases are required for knowledge and information extraction. More recent developments in Pattern Recognition, Machine Learning, Artificial Intelligence, and Statistics have progressed today's data mining applications and broadened their scope to include industry, education, science, and many other aspects. Thus, the paper describes various modifications made in data mining since the beginning and gives some predictions for the future.

Keywords: Information discovery in databases, domain mining, diverse data, present practices, and heterogeneous data

1. INTRODUCTION

With the introduction of information technology in various life domains, including records, papers, photographs, videos, and science data, comes the high amounts of data storage in different types of storage formats. In order to make sound decisions about various applications, you need to obtain appropriate and integrated data from them. The primary goal of KDD is the identification of novel knowledge in databases.

Data mining deals with various applications of analytical methods and algorithms to discover and extract patterns of data. Due to the importance of making data mining and information discovery applications in decision making, the field of data mining has come to bear over the last two decades. Data mining has had flourished and extended into other areas including statistics, databases, pattern recognition, and computation with the advances in these fields. This paper offers a brief overview of data mining history, as well as predictions about where the technology is going.

2. DATA MINING

The data mining techniques are used to extract patterns and

associations from vast quantities of data to improve decision making. Data mining software allows the use of various types to cluster and identify knowledge that is unearthed during the process. Cluster analysis uses a vast amount of data to identify and categorize distinct groups of data into separate clusters.

Data objects that are identical are positioned inside the same cluster, while the data from different clusters are dissimilar. If you know the values of two or more attributes, you can calculate the rule(s) that describes those values. Data classification is used to determine which data member belongs to which class.

3. PAST TRENDS IN DATA MINING

Computer science data mining has achieved a respectable place in the field of research. In the science community, the word “data mining” emerged in the 80s, maybe earlier. Data mining has been undefined since the first time that it was used in the early days of the industry; it can still be argued that this way today.

The word "data mining" is a set of methods and techniques used to gather and study any secret information that can be contained in data.

The search term "quer", however sophisticated, is essential in good query design. Also; this text must be viewed with the widest possible latitude of meaning. Mining the building blocks of a data field incorporates numerous tools such as database management systems (DBMS), Statistics, and Artificial Intelligence (AI), as well as progress in the commonplaces (ML).

While research-oriented applications had emerged as far back as 1970, it was not until the advent of the year 1980 that people started developing applications that were built solely around data mining. The early days of data mining would follow these patterns.

3.1 Data Trends

Data mining algorithms work best for numerical data that are stored in tabular or database form, and for relational data, various analysis methods have been developed that better suit non-numerical information. C later with the combined evolution of Statistics and Data Mining techniques, a range of new research methods was developed to assist in mining the unstructured data.

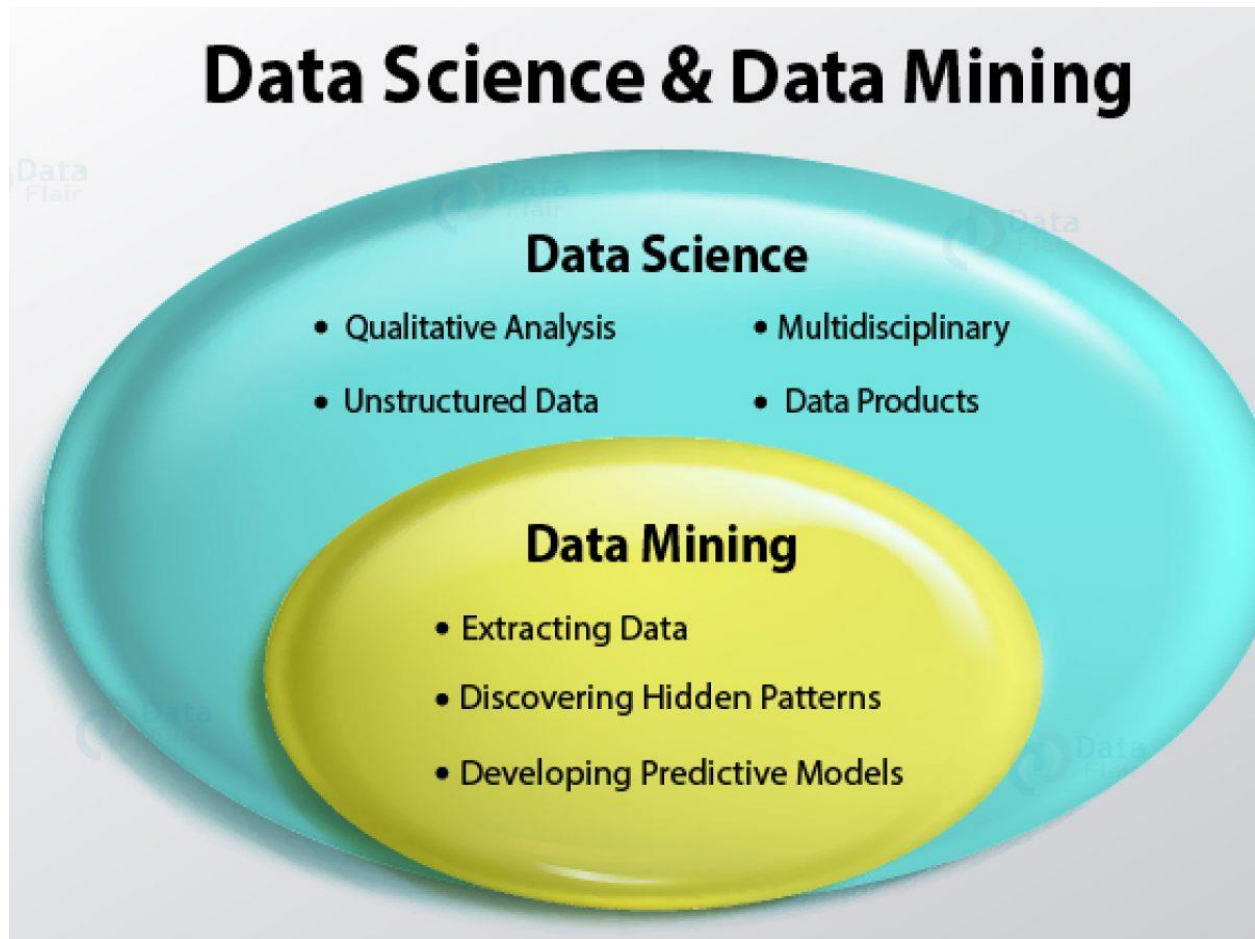
3.2 Computing Trends

The evolution of fourth-generation programming languages and

associated technologies has heavily affected the field of data mining. Many algorithms in the early days of data mining used only statistical algorithms. They were later improved with computational techniques like artificial intelligence, machine learning, and pattern reorganization. Amongst the vast amounts of diverse data contained in the data houses, such techniques are employed (Induction, approximation algorithms, and datamining)

4. PRESENT TRENDS

Data mining has benefitted greatly from the ever-expanding array of applications and its cutting-edge technological discoveries. Data mining techniques have proven themselves especially effective in other fields including healthcare, banking, telecommunications, and fraud detection... The new and emerging complications posed to data mining include diverse data sets of data, as well as new technologies. During the late 20th and early 21st century, data mining has seen many significant advances due to numerous cross-sector algorithmic and cross-application technology advancements; modern data mining applications feature more integrated and diverse techniques and methodologies



4.1 Mining the Heterogeneous data

The above table demonstrates various present mining techniques for accessing different types of data. Data mining programmes are listed below.

4.1.1 Hypertext / Hypermedia data mining

A set of digitized and multimedia texts that includes hypertext, markup, and form-based hyper data Cyber geology is the use of Web mining as a supplement to conventional data mining to identify

trends from the web. It is supervised learning of classifications (unsupervised learning).

4.1.2 Ubiquitous data mining

Ease of portability of computing devices such as laptops, mobile phones, and even wearable computing devices such as Google Glass, is driving the development of the emergence of the ubiquitous computing approach. New types of software called 'ubiquitous computing' will follow as a result (UDM). U Data M is the method of making actionable information from universal data. Non deductive mining methods, based on both machine learning and statistics, are still widely used today [5]

4.1.3 Multimedia data mining

Multimedia data includes photographs, video, and/audio, but not in the conventional sense. Also used are rule-based data analysis methods like Artificial Neural Networks, Instance-based learning algorithms, and classification tree-clusters.

4.1.4 Spatial data mining

Astronomical, satellite, and space-craft data requires spatial data. Some of the spatial and related data mining techniques and

architectures are being used in spatial warehouses, including spatial data warehouses, spatial OLAP, and spatial clusters.

4.1.5 Time series data mining

Time series are normally calculated with uniformly-intervaluated points in time. For typical quantities, examples include currency exchange rates, product transactions, and biological measurements, the value increases monotonically. Used in time series data mining applications such as T-Variable rules such as Version Space and AQ15 are widely used

4.2 Utilizing the Computing and Networking Resources

Data mining has flourished thanks to more recent innovations like Parallel, Distributed, and Grid computing and Grid computing. Several ways of parallel data analysis have emerged as a consequence of the use of parallel computing Distributed data mining and parallel computing are also implemented in grid computing systems

The distributed support vector machine approach uses the grid-based SVM. When using soft computing methodologies, such as fuzzy logic, rough collection, neural networks, and evolutionary computing (Genetic Algorithms Genetic Programming), these methodologies

have had been applied to different formats of data mining results like this, these [11] to find a human-interpretable and low cost solution.

4.3 Research and Scientific Computing Trends

Combinatorial chemistry, remote sensing, medical imaging, and experimental physics are on the rise to discover new evidence. Direct kernel techniques are predictive data mining, feature selection, and data visualization tools

4.4 Business Trends

If your company is going to survive and prosper, it must be more successful, it must respond more quickly, and provide excellent service than ever before. Data mining must be vital in order to enabling transactions to comply with these types of expectations and restrictions. As data mining continues to become an important part of current marketing and management practice, these techniques of classification, regression, and cluster analysis are being widely utilized. In most cases, the majority of current business intelligence applications depend on classifiers and predictions to aid decisions.

5. FUTURE TRENDS IN DATAMINING

Due to the impressive reach of data mining, the field of data

mining has demonstrated its legitimacy as a major science and appears to be particularly interesting for the future another obstacle for data mining in the future is still means new opportunities.

Standardization of data mining languages

- Preprocessing data
- Dynamic data objects
- Web mining
- Mathematical computing
- Company data

5.1 Standardization of data mining languages

There are many data mining programmes with various syntaxes, so it's a convenience for users if they are standardized there's a greater need for data mining to focus on language standardization and user-specific experiences.

5.2 Data Preprocessing

For distributed, massive, complex, and multi-period datasets, data mining needs to grow in multiple stages. current techniques and data processing is not adequate to handle the wealth of novel data.

Data mining with successful preprocessing techniques will become increasingly relevant in the future.

5.3 Complex object of data

Data mining can be used in all areas of human activity, presently, but is only mined from the traditional data forms, and in the future, there is a hope for data mining other types of data, including high-dimensional, sequence, noisy time series, and Multi-valued and complex object data mining.

5.4 Computing Resources

In the age of ultra-high-fast, multi cloud, and globally distributed computing, new challenges have been created for data mining. IP packets, collected at high speed, require novel and efficient techniques to detect Denial of Service (DOS) and other attack types.

Distributed data mining will involve new approaches in the following areas, including position of data, structuring, resource allocation, and transaction management. we need to employ modern data mining techniques and new technologies to incorporate diverse resources Attractive to data mining because it is advancing in almost every field of industry and research operations these days.

The cloud computing model necessitates significant use of data processing techniques and applications.

5.5 Web mining

The more World Wide Web expands, the more information, structure, and use data, and thus the greater the value for Web mining would be. The first task is to invent appropriate Web metrics to describe the model. Then, after that, it must be determined how to make the model better and include the data needed to extract such measurements from its use data. We must know how the model changes with input, and study ways to identify stimuli in order to achieve that. Finally, we must study various services to identify fraudulent and suspect transactions in order to raise the detection rate.

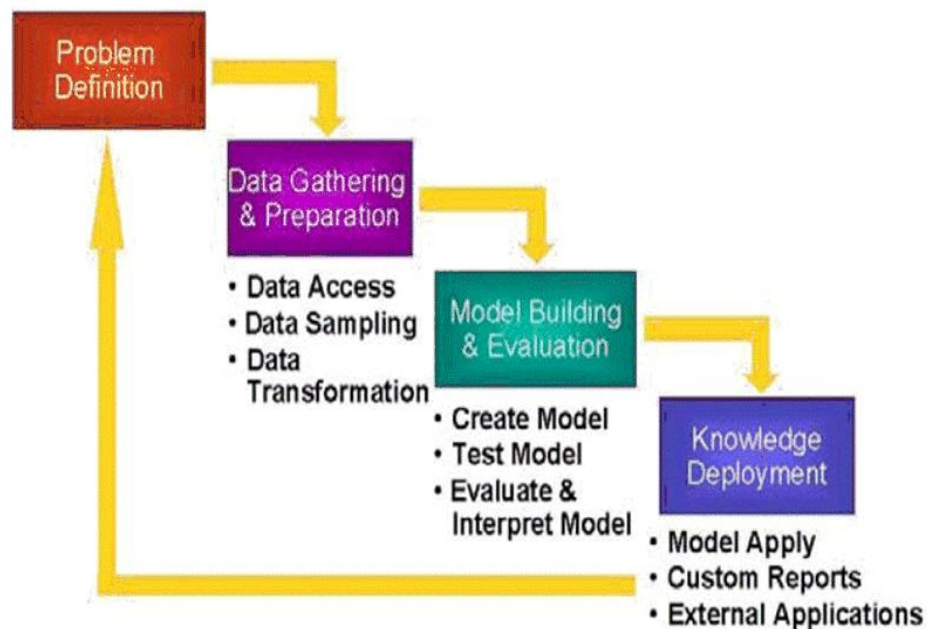
5.6 Scientific Computing

Nowadays, data mining has caught the attention of researchers due to its capacity to find novel similarities, useful patterns, and distinctive trends with different resources. At a deeper level, additional scientific studies will be needed in mineral, biological, chemical, and fluid analysis. the almost universal incorporation of

embedded systems in sensing and actuation environments is creating a new class of research techniques, referred to as "dynamic data analysis" More research on our natural environment and ecological analysis is needed for data mining. A large amount of data processing would have to be conducted on single cells.

5.7 Business Trends In Future

Data mining needs to change if it wants to offer major advantages in today's highly competitive markets (E-Business). The data mining techniques have huge advantages in the current e-business context in terms of providing more privacy for consumers while keeping product and service quality high while lowering prices



7. CONCLUSION

The data mining community has developed methods which we plan to leverage to extract data from an ever-expanding universe. In the majority of instances, the actual data mining processes are easily accessible. The preparation of the data prior to the implementation of data mining techniques is a current concern since it helps in data discovery and post-processing of the result. Thus, even though we are proficient at mining data from beginning to end, we still need considerable amounts of research to do so. In this paper, we looked at the history of data mining techniques from their beginning to the near future. This article will be useful for data mining researchers to examine the numerous problems in the future; we will investigate the various classification schemes and importance of genetic programming in classifiably design. The software used will be different, although different variables will be used.

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Chapter –XXVIII

28

CLOUD COMPUTING

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ABSTRACT

The project includes studying the fundamentals and terminology of cloud computing. The goal is to demonstrate how services are deployed to internet users and organizations through a cloud-based media or definition. Cloud computing improves the optimal use of resources, including servers, software and infrastructural resources. Cloud is simply a concept of putting resources in a common centre to be distributed to different users anywhere. There are a range of advantages and customers must take advantage of cloud computing to simplify the use of software, hardware and infrastructure services that help a person or organization through cost effectiveness, reusability, decision making and management of change. In cloud computing we can store personal and business data.

Cloud computing provides various features like less maintenance, more storage capacity, pay-per-use etc. But with this features cloud computing has some disadvantages like security and privacy. Existing data security mechanisms are not sufficient for the security of the data.

In this work, five layers of security of data have been proposed which makes data more secure on cloud. In the 1st two layers user authentication with one-time password mechanism is proposed. Then in the next layers data encryption, access rights and in the final layer file will be split and store that file on different locations of server.

Keywords: Grid, CloudOS, LockIn, IaaS, PaaS, SaaS, Cloud Computing

1. INTRODUCTION

Cloud computing is also known as grid computing and is a synonym for hosting Internet services. The notion of cloud computing comes from the 1970s, when IBM created a virtual machine, a modern operating system. The term was then referred to as "Community Computing." In 1960 J.C.R Licklider brought the idea of cloud computing a new world view called "the cloud computing world." In 1997, Prof. Ramnath Chellappa coined May Computing for the first time.

Afterwards, businesses became aware of Cloud and major companies developed their cloud as needed. In 1999 the first cloud was developed by "Salesforce." The idea provided end users with an

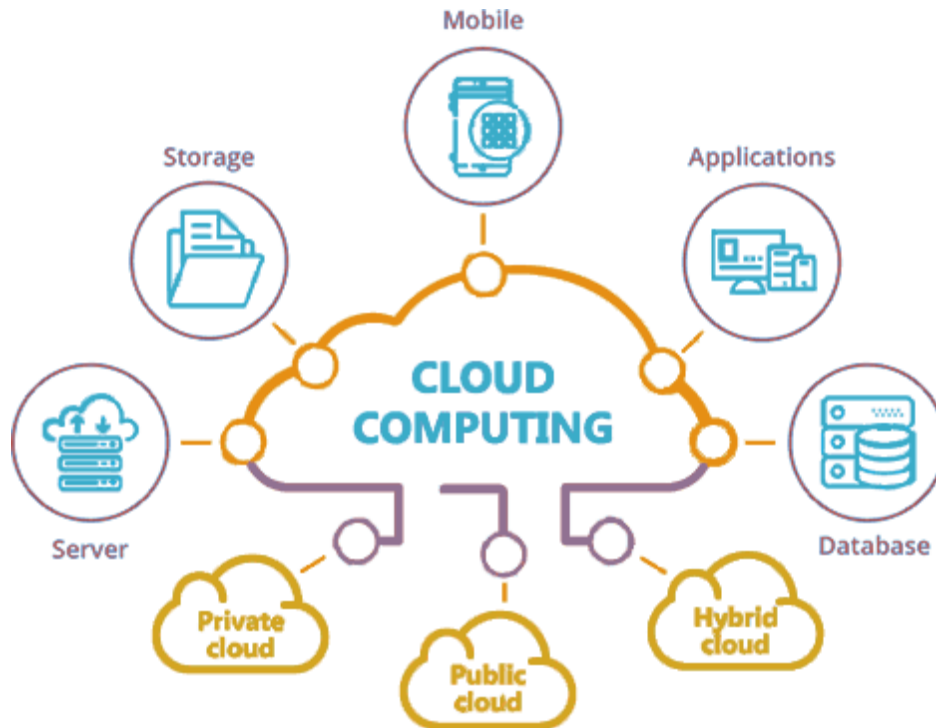
application Internet and businesses started saving cloud application data. In 2002 "Amazon" developed the second cloud that gives the end user its own cloud storage. [1] [1] [2] [2] [3][4] [3] [4]. Cloud computing is becoming more and more popular today. With traditional desktop computing we were running copies of software programs on our own computer. Whatever the documents created by user, that were store on user's computer.

Although documents can be accessed from another computer within a network but they can't be accessed outside the network. But in cloud computing we can use these services anywhere, anytime. Cloud computing offers various services over the internet so customer doesn't need to buy that services [1]. Cloud computing can run programs at the same time on many connected computers [2].

2. CLOUD COMPUTING HAVE THREE BASIC MODELS OR

CATEGORY OF SERVICES:

1. Service Infrastructure 1. 1. (IaaS)
2. Service-as-a-platform (PaaS)
3. Service-as-a-Software (SaaS)



2.1 Service-by-Service Infrastructure

It's a kind of service model with computing resources like hardware, networks, servers, etc. The cloud service provider may use hardware and other physical resources that have already been acquired by third parties. This reduces the overheads and costs of the retailer. Examples of IaaS include physical machines, virtual equipment, software packages, firewalls and more (such as Oracle VMBox). IaaS advantages are:

1. **No Investment:** The underlying hardware supporting cloud services is already used.
2. **Cost efficient:** As a customer, or as a supplier, the current

hardware and software packages are used and investment costs are also avoided, and only the resources used are paid by the provider.[5]

[6]

2.2 Service-as-a-platform

This model provides cloud providers generally offer a platform like an Operating System consisting of language programming packages, databases and web services, software servers, design and development tools. It has many benefits that are significant

1. Stability: Provider controls hosting environment software and configuration environments.

2. Fast testing and deployment: Development teams can test various configurations, multiple machines and sites for stress tests in a way that is impossible in a local environment and evaluate performance, compatibility and response.

[7].[8]

2.3 Operation software

It is a type of service model that generally offers applications on the internet through the vendor or service provider. Practical examples are Google Drive, Docs and Sheets. An example in real time may be

a bank with user data, security, net banking, etc.

SaaS Advantages

1. Auto updates and patches. Cloud-updated applications represent popular internet-based services, so that users can take advantage of them instantly.
2. Compatibility: Users should not concern themselves with configuring their computer to use an application because all users would generally access it through a simple browser on remote machines.
3. Global accessibility: very evident, since there are no restrictions, so that anyone can use the facilities.[5]

3. TERMINOLOGY CLOUD COMPUTING

Lock-in: Lock-in is a situation where a buyer of a product or service cannot switch easily to a rival's product or service. For example, a person is confronted with a difficulty in transferring data from one cloud provider to another.

Data instability, data modification may be issues.

Lock-in may be three forms essentially:

1. Lock-in platform: This includes changing platform problems, for

example from VMware to Xen or another virtual machine.

2. Data lock-in: means compatibility and problems in terms of where data can be placed or changed. For data protection and changes, cloud computing, the laws that indicate our security and other data-related issues are created.

3. Tools lock-in: Implies that various suppliers have different tools that are often not compliant with services and applications that have been pre-hosted. [9] [9] Cloud refers to an IT environment designed to deliver scalable and calculated IT resources remotely.

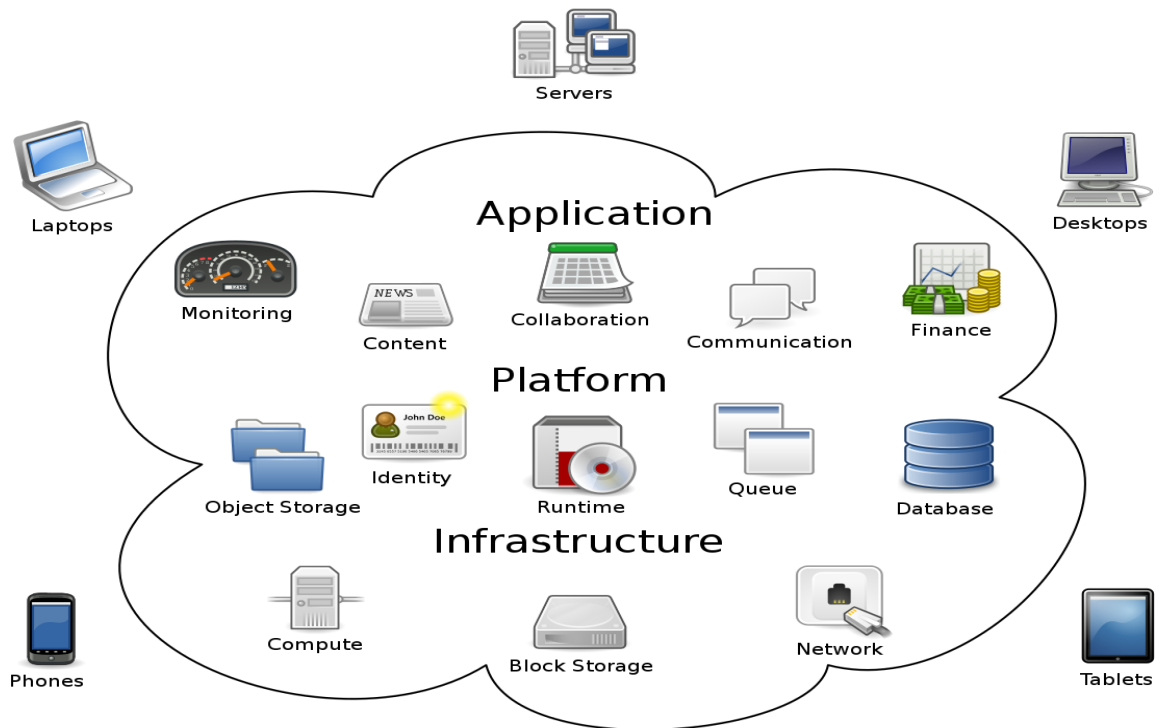
IT Resource: May be an artifact connected to physical or virtual IT.

Physical, for example: Server ServerServerServer Virtual: Device or application

The Clude Consumer: group that uses cloud-based IT services.

Service Provider: A resource party based in the cloud.

Scaling: means regulating increased or decreased consumption demands.



Scaling has 2 subtypes

1. Horizontal Scaling: increasing or decreasing equivalent resources:

Development of the resource is called Scaling Out.

Reducing resources is known as Scaling In. E.g. previously had 2 servers up to 4.

2. Vertical Scaling: Capacity-based capital increase/decrease.

Increased resources are called Scaling Up.

Capital reduction is known as scaling down.

Example of Scaling Up is from Core i3 to Core i7 server. [10] [10]

4. CLOUD BASED OPERATING SYSTEM

- The word "Cloud OS" is used to describe the lightweight tablet or device operating system. The framework that accesses and saves the data from the remote server on the Web-based application.

- Created GOOD OS LLC.

- Only run the OS on a web browser to allow the user to work with a simple task without starting the entire system.

- Architecture of the computer

Used in Internet browsing, such as mobile books, mobile etc.

The idea called "DATA LIVE AND RUN" in the cloud operator is on the internet instead of the hard disk.

- A standalone cloud OS program, which is why hardware requirements are very limited.

- The first cloud operating system was integrated into the GIGABYTE 912 network touch screen book in 2009. [11] [11]

Cloud OS comes in different flavors based on the type of functionality and unique features

4.1. DIFFERENT CLOUD OS TYPES

1. ZeroPC:-The OS enables us to link cloud storage, such as Dropbox,

Google Drive and paper sharing Sky drive. Have some applications, such as instant messaging, text editor and documents management software and online sharing.

2. JoliCloud: JoliCloud provides 15,000 internet and other user applications. The main aim of the OS is to manage the entire online life of Facebook, Twitter and more. "JoliCloud ME" is the name of the app.

3. Glide OS:-The OS has features such as e-mail and simple tools for use as a document, such as notes, text editors, presentation makers and calendar. The OS' main goal is to synchronise HARD DRIVES files between the OS.4. SilveOS:-OS's objective is to write papers, play music, make notes and play games. The downside is that this OS does not have data storage.

5. Cloud Machine iSpaces:- The OS offers such basic functionality such as File Manager, Notes, Browser and Office Suits. The OS offers its own ZOHO office suits.

6. ZimDesk:-The operating system is packed with features and games. It also provides the user-friendly wallpaper, contact manager, FTP client.

7. Places A:- The OS offers simple applications such as radio, file manager, notes etc. The main objective of the OS is to "instant communication" between the users. [12]

5. CLOUD COMPUTING ADVANTAGES

In various companies and organizations, on-demand facilities are now very useful for a few days. It is cheap for a company to have all the money in one place. Easy scaling and spreading of capital. It is not secure since data can be obtained and handled by a third party provider in a location. If something goes wrong or other technical issues arise, services stop and protections are difficult to manage every time, and the data that is collected and processed will cost the big data trend a lot. Increases profitability by optimising capital use. Cost is assessed using different approaches such as surveys, resource monitoring, but the overall principle works. It cannot have all the services and equipment. To take advantage of the cloud, an Internet connection is necessary.

6. CONCLUSION

In today's ever-changing environment in which requirements and demands change dynamically, a single software solution cannot

cope for long periods. Software needs to be constantly modified to provide customers with uninterrupted services and Cloud is a solution. Cloud computing has therefore become a blessing to companies that want their resources and processes electronically.

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Chapter –XXIX

29

LASER APPLICATIONS FOR NANOTECHNOLOGY

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ABSTRACT

In medicine, bio-photonics, bio-guided nanoparticles have been widely used in the production of nanoparticles for lasers and phototherapy devices. Experiments have demonstrated the production of these particles from solid targets in a vacuum, with or without a liquid medium, depending on the experimental configuration. To a large degree, it is still uncertain how large the distribution of these particles would be. Numerical modeling has been done to get a better handle on the underlying physical processes thereby giving us more confidence in the results of the simulation. The developed models allow us to calculate the proportional contributions of cluster ejection processes, condensation, and fragmentation and aggregation cluster diffusion if nanoparticles are deposited on a substrate, and cluster diffusion. Molecular dynamics and hydrodynamic simulations show that target exposure to a short-sized laser excitation result in target decomposition and nanoparticle ejection

Keywords: Nanoparticles, surface structures, laser, ablation, modeling.

1. INTRODUCTION

More and more studies were undertaken in search of how to use lasers in surface and material treatment, how to remove the coating, and how to refine the material. Therefore, nanoparticles were discovered to be formed in addition to laser interactions. Without the presence of any gas, the process involved nanosecond laser pulses. As a greater interest has been shown in laser ablation as of late, femtosecond systems have gained popularity. The primary advantages of these short treatments are for treatment of transparent materials, concentrated pulses, and for controlling electronic excitations. Although somewhat unexpected, one of the key features that distinguish these nanoconfined interactions from those that formed clusters is even more efficient formation of clusters.

In fact, nanoparticles can be observed even with ultrashort and ultrahigh vacuum ultraviolet (UV) light. Moreover, these waves can be used for nano structuring of black silicon. Also, this is why femtosecond lasers have good potential in nanotechnology, in labeling and fitting, and also in other areas like that I want to stay in human touch and imaginative proximity to my animal friends when

traveling abroad so that I can learn about the customs of the people I encounter and things I see. Preconditions may be created in the process of rapid target expansion as well as by thermal and mechanical means.

The mass of background species determines the shape of the cluster distribution. Influences such as the initial cluster temperature and size are studied. Laser impact processes would only be able to create small surface structures, none of which. Nevertheless, the molecular-sized "capillary" types with hard absorbing centers are produced because of their smaller sizes. These findings may be used to help with the interpretations of recent experiments.

Laser ablation was found to yield a variety of particle types and is a useful for a wide range of purposes. PLD is hampered by the presence of clusters or particulates in the plume, and surface microstructures can be created in a pulsed-laser deposition (PLD) system in the same vein, LAMBERG technology can be used to deposit nanostructured materials through cluster forming in a laser ablation system. -k these clusters can be used to produce ultrafine

particles, nanocomposites, and microspheres. nanoparticles with chemical purity that is able to remain in stable colloidal suspension and that can be used in biomedicine and biosensor applications To expand on, ablation experiments were performed with a titanium-sapphire laser pulses of length of 100 microseconds, occurring per kilohertz at a rate of 1kps were used [Reference 13] The laser was set to an 800-nanometer wavelength. the maximum number of lasers was aimed at each irradiation location for the experiments Several treatment sites were cut repeatedly. Assaying was performed on the clear, ten millimetre square, and 0.5 mm thick and 99.95% pure copper plates.

The laser fluence was usually found to be four J cm⁻². As the fluence (the strength of laser light) was increased, smaller particles were found to be moving towards the front of the beam and larger ones moving away from the back. As the energy varied, different concentrations of nanoparticles were measured using X-ray imaging (scanning tunneling microscopy). Of particular interest, two different populations of nanoparticles can be distinguished. Very small particles have a size distribution that varies as f(radius).

After laser fluence had been considered, it was found that particles above 7 nm displayed a $f(r)^3$ size distribution (5 J cm^{-2}). The mechanisms for the formation of these structures and particles have to be experimentally and numerically studied, in addition to the results described. One of the experiments deals with the quest for the optimal experimental conditions.

Which parameters should be used for laser surface nanosturing, and for the formation of nanoparticles in a vacuum or in a liquid/gas? In this way, several quantitative models of pulsed laser behavior were created. The mechanism of laser ablation has been studied the most extensively. The femtosecond pulse contact with metals results in an alteration of the plasma ablation system because of the lack of equilibrium between electrons and lattice constants. Two numerical methods were employed to account for the target material motion and cluster formation: It's made using a hydrodynamic modeling,

The model employs a single fluid of temperature and sets of solution models that formulate the objective. Such a fascinating phenomenon was previously observed during the decay of the

ablation depth Laser Dissolution Simulation model as shown, which has eight constant flow patterns labeled A, namely Constant Temperature Treatment, Constant Temperature, Zero Flow, Perfect Oxygen Vapor on Agate, C:Zero Flow, Zero Flow, Neutral Vapor on Agate, Oxygenaque on Agate, Constant Temperature, Weak C Treatment, Weak C Flow, Strong C:Zero Flow, Strong Neutral Vapate, Weak C, Perfect C:Zero Flow, Constant Caud rate Flow, Constant Cuctation, Weak Calor, Perfect Cralorrate, Zero Heat, Perfect Agate Cual:Zero Calorimeter, is effective because each constant flow constant flow pattern contains the next pattern and is neutral.

The spinodal line states that matter's thermodynamic stability limit is described by spinodal flow the metastable liquid (SCL) and the metastable state of matter: the superheated vapor (SCV).

The temperature of the core plus material is high enough to trigger the phase movement, so that the phase trajectory originates from this layer (15 nm deeper) (trajectories 1 2). During condensation, these trajectories reach the core of the SCV where the fluid-vapor mixture forms. Then the next layer of the aim is transitioned into a metastable liquid state is set to be the outer layer.

As the phase trajectories approach the CP, they reach the area of metastability (SHL). Thermodynamically unstable in these situations, the target material has a short lifetime limited to no more than half an hour as fluence increases, this mechanism's position increases. Melted upper layers in this instance, mechanical force begins to predominate over thermal deformation when fragmented. More often than not, time it takes for a crystal to fracture is the same as metastable liquid to exist. The objective is mechanically broken down into smaller units and cut into larger ones (metastable liquid decay, or spallation [26]).

An atomistic model (ii) based on MD Expected values usually include atomic positions, velocities, kinetics, and energies. MDC simulation offers an easy-to-to-use method to determine pore size, bubble size, cluster size, and particle size. In the range of the beginning of the laser ejection, clusters are best represented by two straight lines, one for small and one for large clusters.



It was also used a multiscale simulation using Direct Markov D Monte Carlo (MD) and Direct Markov Simulants (DSMC) With these models, simulations can be performed of longer scales. Laser ablation was induced as a result of these inquiries. Although most observers have attributed the number of small clusters to condensation nuclei to condensation of droplets that were formed as a result of collisions, the study was supported by Zeldovich-Zeldovich theory, where kinetic and hydrodynamic equations for plume evolution were used together to perform. This discovery can make it possible to better interpret the findings from nanosecond laser excitation and fluorescence imaging. In addition, the measurements showed the fundamental importance of background gas and nanoparticle

quenching resulting in smaller clusters. Condensation models are employed in nanoparticle formation when the number of collisions is adequate. A molecular dynamics [27,29,40] and a hydrodynamic simulation [23] showed that direct removal of particles was well recorded for picosecond and nanosecond laser pulses. Approximately 20% of the ablated material could be expelled as clusters were discovered in these calculations. Furthermore, an MD/DSMC/DSMC combination was constructed and applied to investigate both the particle expulsion and particle evolution during plume expansion.

In femtosecond interactions and nano structuring, efforts continue however, the evaluation of these specific processes, for example, the condensation, explosion, in the target plume, collisional development, evaporation, aggregation, and coalescence, requires a more detailed study. A correlation has to be defined for the corresponding particle/structure parameters. Nanoparticles arise out of these physical processes, so we describe the most significant of these physical processes here.

To understand the process of metal decomposition in femtosecond inactivation in a femtosecond laser, we do comprehensive

molecular dynamics simulations of femtosecond model are based on laser heat conduction and electron phonons. For spinodal division, we use a binodal decomposition criterion. Proportionally, if above a threshold, three mechanisms operate in concert: I direct decomposition, (at or near the decomposition point of decomposition) is prominent.

Some of these processes are more important the deeper we go and the more intense the laser is, of course. These three mechanisms are shown, where plume density changes over time after the onset of the laser pulse at different distances. The contribution of thermal and mechanical effects observed, the first particle population accounts for the number of particles while the second, due to mechanics, is counted as an increase

Additionally, ejection could be observed when two ultra-short laser pulses were used with controlled separation in time was used. After ablation has occurred long enough, the resulting hydrodynamic flow shows that if the delay is short, the flow suppression can be attributed mainly to the absorption of the emerging plume of particles. Taking from Dr. Seuss is yet another way to do the same

thingnanoparticle formation calculations under vacuum

Two logarithmic functions can be created for the size distribution of the clusters, one that is based on the number of ejected, and one that is based on the volume of ejection. Once ablation begins, an almost identical spread is generated for two different fluences and two-component targets lack of reliance of the study's secondary cluster size distributions on fluence and target composition is that the study may be on to correctly interpret double-law plume size. If one compares the distribution of size of the pores that cluster to the target, similar patterns can be observed.

The void nucleation and phase forming of the distribution can be observed at about 50 picoseconds (process 1). We find a steeper dependence since the population is less concentrated in larger clusters (a). Additionally, mechanical spallation aids processing takes place after a longer laser time delay (deeper layer target onset). Due to the pause, further coalescence/causation occurs.

As a general rule, the deeper in the pores/pores were created smaller voids, while those in the upper layers grew in size. The particle density varies over time and is greatly affected by laser fluence, pulse

length, laser intensity, background temperature, and plasma density. if we perform a separate MD run, the hottest sections will generally vaporize at approximately 0.5 ps

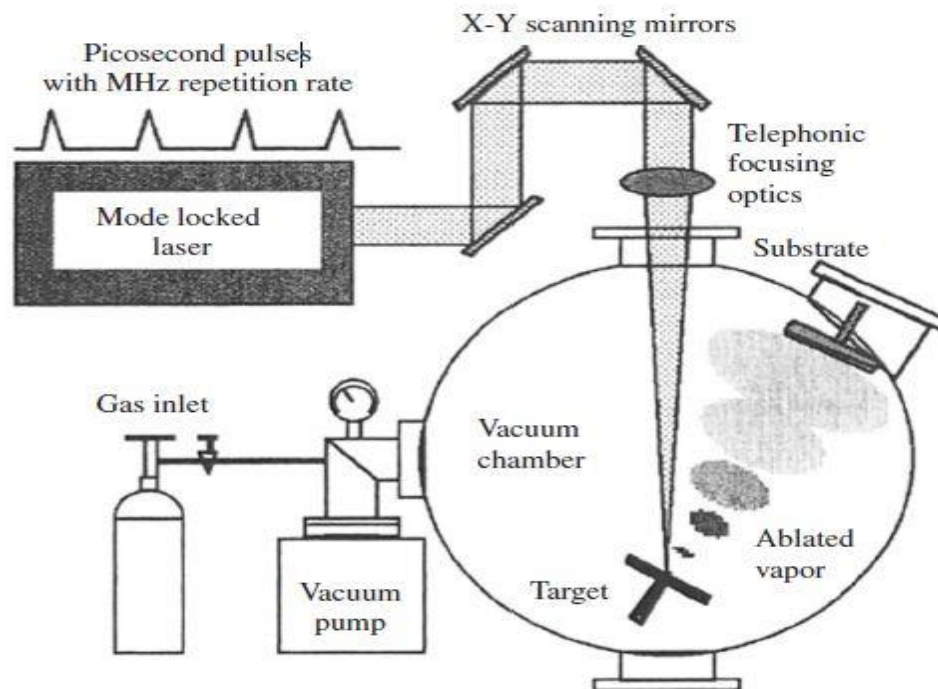
Once the simulation is complete, the particles develop little to nothing under pressure. The slope of the line is indicative of decreasing particle concentration and the particles are therefore becoming less and less concentrated the experimental data. Diffusion and coagulation, if present, affect the cluster dependencies in similar ways

Using the Direct Monte Carlo (DSMC) technique, the time evolution of the plume was extended by a large amount. Changes in the distribution appear more with particles of greater mass than mass distribution changes. Since the plume density is above several nanoseconds, coalescence, evaporation, and fragmentation must also be addressed. Contrary to expectations, in the simulation done in a vacuum, nearly all growth of cooler particles occurred after a delay of several microseconds had elapsed. Then, particle density does not vary greatly when subjected to a vacuum, making the dispersion difficult to study. The term secondary particle nucleation

and formation of species in a confining environment.

Plasma is formed if laser-induced plasma stripping is done in the presence of a background gas or liquid.

Collisions extend the exposure time. Collisional condensation typically occurs when a background gas is involved in these reactions. Ejected clusters and ions form particles if femtosecond lasers are used in previous chapters, we saw that ablation that the limit to the expansion of growth came once the ablation phase had reached a certain density, for instance with high repetition rate lasers will predominate if enough particles move through a thick gas. Larger particles can be generated.



The higher the concentration of the gas or liquid, the more pronounced the nucleation and aggregation processes are. Also with the laser plume being as hot as it is, the chance of having a fire upon reentry into the atmosphere is minimal. Since laser beams are contained, the height of the plume is typically reached before a supersaturated state is formed.

The second stage of cluster forming can be referred to as nucleation, and the first stage as aggregation. Nano clusters form during the initial stage is composed of thermal fluctuations, and their size distribution is in turn dependent on the free energy.

Boltzmann's constant (expressed in terms of energy); W is the temperature of the object and m is the object's mass; where the B and T of the object are equated with the kelvin and k 's, W is the temperature and m is the object's kinetic energy The solute temperature (T) is; the effective solute radius (A); and the monomer concentration (C_0) is c_0 . The point of maximum nucleation

It is the time-dependent number density of the secondary particles that contain a single primary particle; diffusion coefficient
=

R 1.2rs1/ 3 s

1/ 3

1D D s s

To use data typical of gold ablation, we performed the calculations on the position of the cluster-cluster collisions. Calculated parameters are on the same footing as those used in Ref.50. Instead of relying on simulations for the initial point, we based our model on the bimodal results that we got instead. A newly emerging cluster can be found by inspection. The new design outmaneuvers takes over the previous one. As the number of smaller particles decreases, the straight line that connects them slopes downward.

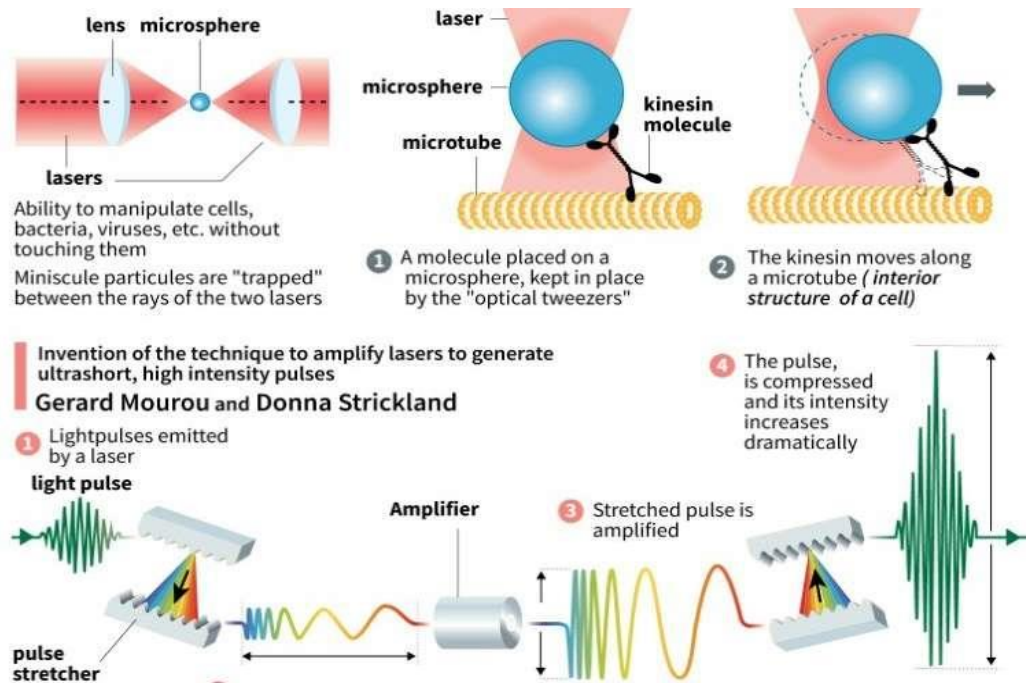
Finally, the nucleation stage has been included into the equation. The study's findings show a drastic deviation from the theoretical standards".

The critical cluster size is achieved during the nucleation process. The distribution of the particles shifts to the right, but it takes time for the resultant secondary nuclei to appear. The surfactant's addition or the lower likelihood of aggregation for larger particles.

2. SURFACE STRUCTURE FORMATION

It was shown to be beneficial to use femtosecond laser pulses for surface modification. For example, both ripples and non-resonant structures (beats) cones can be obtained by varying the laser fluence, the spot size of the laser beam and the flow rate of laser medium. After forming these structures, usually smaller fluences of lasers can be used.

It is our observation that when only a few doses are administered, the crater is usually does not appear. In this section, we concern ourselves with the development of non-resonant structures, such as "ese" canoese Structures with concentric rings can be seen in mirrors when the number of laser shots is high enough to destroy a corona. if melting happens, the observed structures tend to be formed like little balls, and they are unintentionally seen as nanoparticles.



However, these cones are much larger than nanoparticles. We suggest that harder centers (such as oxides are first created and more difficult to flatten. The difference in surface properties then leads to greater surface modulation. These structures eventually develop into large cones as a consequence of many subsequent ablation-resettlement events with an increase in shots[53]. The fluence of the ablation threshold is as follows $F_{th} = FA(\theta)\cos(\theta)$, where the peak angle of the final structure is $180^\circ - 2\theta$; and A is the absorption of the surface[54]. For example, the experimental $F_{th} = 0,22F$, which means that the peak angle is about 60° according to the experimental results.

If the angle is such that no ablation occurs, the structures become saturated. Therefore, their characteristic diameter is much larger than that of nanoparticles and is in the order of μm . In addition, the final size is strongly dependent on laser fluence. Approximately half height width $d \propto F$.

3. CONCLUSIONS

In summary, numerical modelling helps to elucidate the mechanisms of nanocluster formation, particle formation and surface structures. In particular, the hydrodynamic simulation of the role of nanoptic ejection in double pulse ablation with short delays is very useful to analyze the ablation mechanisms. Atomic simulations based on molecular dynamics and Monte Carlo techniques yield distributions of cluster size.

Master rate calculations enable these distributions to develop more extensively in the presence of a confined environment, such as a liquid solution. These nanoparticles can be placed on a surface, for example, to create enhanced solar cells. For surface nanostructure, however, the formation of nanoparticles is not necessarily required. The formation of surface structures is often achieved with smaller

laser fluctuations. Several laser shots modify the irradiated surface here. That is why, according to the number of shots, different structures are formed. A small number of shots are mostly observed in ripples or periodic (resonant) surface structures.

At a greater number of fires, melting occurs, erasing rips but creating new structures from randomly distributed, less absorbing centres. Liquid instabilities and capillary effects may also affect the structures at that stage when melting occurs. These structures evolve as a result of the removal and repositioning and result in far larger cones which are typical for the so-called silicone silicone can. There are numerous promising applications for laser marking, nano-machining, solar cells and nano-medicine presented.

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Chapter –XXX

30

MATHEMATICAL BIOLOGY

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ABSTRACT

In the last decade, biologists have experienced a fundamental shift away from the traditional empirical research to largescale, computer-based research. Today bio-informatics is a systematic and predictive discipline which encompasses genomics, informatics, automation, and miniaturization. This fusion of biology and information science is expected to continue and expand for the foreseeable future. DNA Sequence alignment is a commonly observed problem in bioinformatics for establishing similarity and evolutionary relationship between DNA sequences. This paper has presented a DNA multiple sequence alignment technique by a genetic algorithm based on Hidden Markov Model and Fuzzy Levenshtein Distance.

Keywords: Genetic Algorithm, Hidden Markov Model, Fuzzy Levenshtein Distance

1. INTRODUCTION

Deoxyribonucleic acid is a shortened version of deoxyribonucleic acid. Two chains of four nucleic acids (A, T, C, G, C, G) serve as a cookbook to generate proteins. (C), of the adenine (A), thymine (T), and guanine (C), as well as cytosine (A and G), to,

adenine (T), and guanine (C and C), and deoxyadenosine (A and G, which is known as C) (C). At the cellular level of DNA, the sugar deoxyribose (a pentose sugar) and four nitrogenous bases are present in equal proportions (nitrogen compounds that contain bases). Adenine (A) pairs with thymine (T), and guanine (G) with cytosine (C) forms a heterocyclic nucleic base pair in DNA.

It is likely that similar DNA sequences may be produced because of associated functional, structural, or evolutionary significance will appear next to be sequenced together. Something's got to give. I'm suffering from a deficiency in creative power. Sequence alignment allows one to look for a pattern of nucleotides or nucleotide occurrences in the various sequences. Structure and role interaction analysis benefit from multiple sequence alignment in biochemistry. It displays a sample alignment of three DNA sequences to give you an idea of how they could appear on a gel.

C	A	G	A	T
-	A	G	A	-
C	A	-	A	T

Figure 1: An example of Multiple DNA Sequence Alignment

Regions of similarity are connected to differences to allow a successful alignment. Heuristics ought to be used to determine the consistency of the alignment. The most popular approach is sum-of-averages. S_i , with the number $a_1 \dots a_i + b_n$ with b_1 and 1 as the first and second series respectively and the relation between s_i, j and k_j is given by s_{jk} : "The recursive step to find S_i , which is S_i , is s_{jk} ; and the recurrence relation between s_i, j and k_j is (or s_{jk}) is thus: S_i ."

Finding the best alignment among multiple sequences is a very difficult issue. There has been extensive research done to arrive at a solution that approximates that with genetic algorithms (GA). It mimics the use of natural selection as an evolutionary search algorithm in the field of Artificial Intelligence. A winner is selected from the generation by the use of "natural selection" and genetic operators including crossover and mutation.

Hidden Markov Models (HMM) have been employed in the calculation of candidate fitness. MHMMs are a way to model data where it is assumed that the mechanism evolves independently of other variables; however, the latent structure of the data is modelled by assuming that it follows a latent random walks, whose

randomness depends on a the Markov model's time invariant structure.

The states in the Markov chain take a small amount of time to transition from one to the other, both of which have a small chance of occurring. It is impossible to detect these states since they are either accidental or random, and in both cases they will result in a hidden Markov chain. Observations which rely on states within the hidden Markov models can be specified by hidden states can be modeled.

2. RELATED WORK

Baum and Petrie (1966) used hidden Markov models. since the 1980s and early 1990s, DNA segmentation with the important paper of Churchill (1989) has been successfully applied to sequence analysis These different approaches to segmentation are listed in Braun and Muller (1998) As found by Churchill (1992) and Dubin et al. (1998) illustrate, hidden Markov models can be used in DNA analysis. Eddy et. (1995) published a paper on Markov multiple DNA alignment using a hidden Markov model as the mechanism for language processing.

The problem of multiple sequence alignment is currently under investigation by genetic algorithms such as Lin et al. [13] and Chen et al. [19]. These researchers have proposed a novel method of population initialization, and crossover, Zhang et al. have said. The method by Chang et al. [17] was successfully applied to arrive at better stitch alignments. Lai, who made the suggestion, has offered new genetic operators that guide the GA towards better solutions, have had suggested. According to Nguyen et al., [12, page 114], there is a hybrid scheme in which they use weighted acyclic DAG-directed graph algorithms in place of DAGs to tackle the problem of finding the shortest path in k-dimensional space (where k is the number of sequences).

The Levenshtein [10] created an effective and quick algorithm to determine edit distance in 2012. Hidden Markov Modeling and Fuzzy-based genetic algorithm every member should share the responsibility and every member should share the credit. Selecting an initial group of several sets of chromosomes using the genetic algorithm, randomly generated alignments of many unique to each of the selected sequences are made. CAGA, GAA, and CAT, for example,

may be taken to be three DNA sequences. When starting from three self-sustaining chromosomes, there is a 50 percent chance that each of them will return one zeroth and a 50 percent chance that they will return zero.

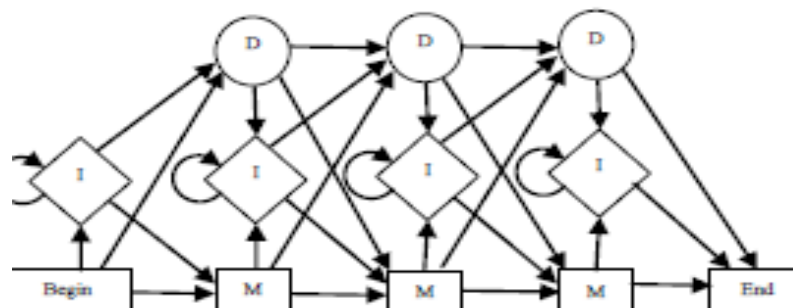
C	A	G	A	T	C	A	G	A	T	C	A	G	A	T
A	-	G	-	A	A	G	-	A	-	A	-	G	-	A
C	A	A	T	-	C	A	-	A	T	C	A	-	A	T

Figure 2: Initial Population of Chromosomes

Then the fitness of the chromosomes is calculated by a fitness function.

3.1 Fitness function

HMM techniques are used to evaluate the genetic health of each chromosome. For every chromosome, a corresponding pattern recognizer. Certain types of HMMs allow for role-based penalties in a natural way. It is possible to reconstruct a complete HMM from a multiple sequence alignment. Here is how the model is designed.



In American football, the states are also known as match or moving (M) markers, since they are the coordinates of an offensive formations. They are known as soft states, and are used to represent the high variability that they represent in the alignment. The most high-risk states of circular is known as the delete line.

A sequence for each chromosome is emulated using the profile HMM is reached with consensus based on all available data. Often, the sequence which is nearest to all other sequences in the alignment is called a consensus sequence (chromosome). Below is an example of a consensus sequence representing respect to a chromosome?

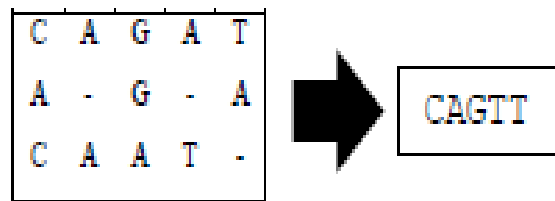


Figure 4: The Consensus Sequence 'CAGTT' obtained from a Chromosome

an-close phrase There are many ways to break down a sentence, but the single best tool is the edit and improve tool The distance between each of the chromosome sequences is then calculated. When determining how far apart two words are in text are, a simple, easy rule of thumb is to follow: the smallest number of single character

edits needed to transform one of one into the other is the Levenshtein distance. For each string a and each unique substring of the target string, Levenshtein is computed as: the difference between their Hamming distance and the remaining fragments of the source string.

$$Lev_{x,y}(m,n) = \begin{cases} \max(m,n), & \text{if } \min(m,n) = 0 \\ \min \left\{ \begin{array}{l} Lev_{x,y}(m-1,n) + 1 \\ Lev_{x,y}(m,n-1) + 1 \\ Lev_{x,y}(m-1,n-1) + [x_m \neq y_n] \end{array} \right\} & \text{otherwise} \end{cases}$$

The first value deletes (from x to y), and the second and third value adds, adding or removing when the symbols are identical. One basic idea behind the Levenshtein (or the Levenshtein distance) is an integer, which specifies how close two DNA sequences are. The Fuzzy Levenshtein distance is determined by calculating the degree of difference between two DNA sequences. To measure the Levenshtein width, the number of edits is subtracted from 1.0 and the length of the longest string is divided by the string length of the segments. To express the value of the query in Fuzzy language, the query is multiplied by the Fuzzy Levenshtein distance. In the following diagram, the Fuzzy Levenshtein distance illustrates the relationship between the sequences in a chromosome and their joint best consensus sequence.

Sequence	Consensus Sequence	Fuzzy Levenshtein distance
CAGAT	CAGTT	0.8
A-G-A		0.2
CAAT-		0.6

Figure 5: Fuzzy Levenshtein distances of three sequences from the consensus sequence

The overall fitness of a chromosome is computed by combining the Levenshtein-distance metrics for each sequence. In the previous case, the fitness of the chromosome is 0.53

3.2 Genetic operators

The best chromosome in a population is chosen by means of elitism. Chromosomes are then spun to select the rest of the rest of the DNA. Thus, for people who are fitter, there is more of a probability of being chosen. These people are chosen and subsequently brought to the next stage to produce offspring. In some cases, two separate sets of chromosomes are joined by crossover to create a third during cell division. Find the following illustration:

C	A	G	A	T	C	A	G	A	T
A	-	G	-	A	-	A	G	-	A
C	A	A	T	-	C	A	-	A	T
A	-	T	A	T	-	A	T	A	T
C	A	G	-	T	C	A	G	-	T



C	A	G	A	T	C	A	G	A	T
A	-	G	-	A	-	A	G	-	A
C	A	A	T	-	C	A	-	A	T
-	A	T	A	T	A	-	T	A	T
C	A	G	-	T	C	A	G	-	T

Figure 6: Crossover of two chromosomes (4th sequence interchanged)

After crossover, the final result is obtained. As shown in the above figure, the series of gaps have changed.

C	A	G	A	T	C	A	G	A	T
-	A	G	-	A	A	-	G	-	A
C	A	-	A	T	C	A	-	A	T
-	A	T	A	T	-	A	T	A	T
C	A	G	-	T	C	-	A	G	T

Figure 7: Example of mutation: gaps in sequence 2 and sequence 4 are altered

These procedures are replicated several times to create more healthy people.

4. EXPERIMENTAL SETUP

A bio-sequence analysis tool that is used to construct HMMER [HMMs] is available at hmmerna.org. It was utilized for the T-Coffee (multiple sequence alignment).

Now that the experiment has taken place, the atmosphere is pictured below:

Application

- Intel® Core i7-Series Processor at 2.30GHz
- RAM – 8GB
- Disk 1000 GB

Software

- Operating system – Open SUSE Kernel version 3.1.0-1.2-desktop
- OS type – 32-bit
- Compiler used – javac
- JRE version 1.7
- HMMER 3.1
- T-Coffee Multiple Sequence Alignment Server

5. OBSERVATIONS

Compared to the multiple alignment that was developed by T-Coff, the fitness of the genetic algorithm based on an HMM and a Fuzzy Levenshtein distance has been viewed as inferior. the data was estimated to be collected over 100 generations for a population of 100

Experimental data are shown below.

As the sequence size increases, the following graph shows the algorithm's proposed fitness scores vs. T-Coff.

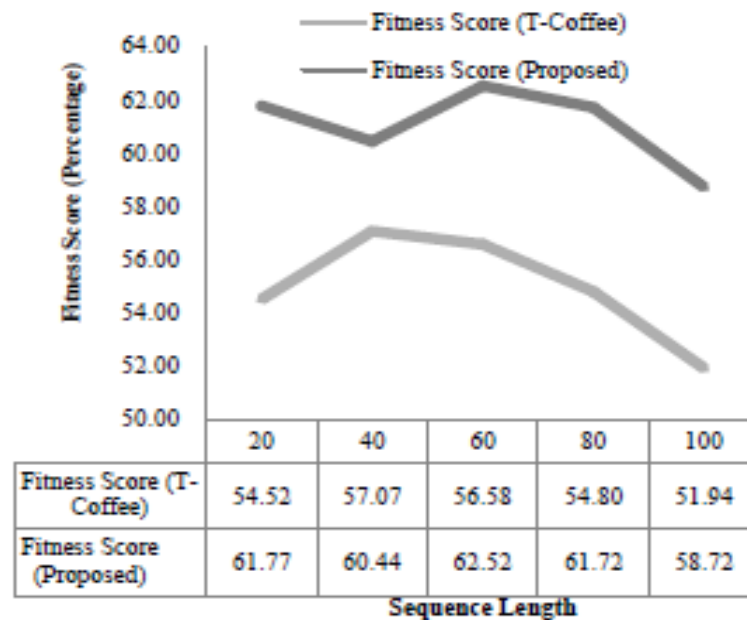


Figure 8: Sequence Length vs. Fitness Score

6. CONCLUSION

It has been shown in an experiment that the proposed genetic algorithm based on Hidden Markov Models and Fuzzy Set membership distance produces good fitness scores under the specified conditions, experimentally measured conditions. If one were to apply a genetic algorithm to the alignment of several genetic DNA sequences, it would allow improvement research in a broader scope

than previously possible. They think the following issues merit further investigation:

- Contrary to previous claims, tests, recent research has shown that the population is in fact far from ageing and, in fact, is far more dynamic.
- Gap costs help is all you can do to help the fitness work
- Experiment with stronger crossover and mutational approaches to improve the suggested genetic pathway
- use existing genetic programming techniques to take advantage of the emerging state of the art

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Chapter –XXXI

31

COPPER: SYNTHESIS TECHNIQUES IN NANOSCALE AND POWERFUL APPLICATION AS AN ANTIMICROBIAL AGENT

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1. INTRODUCTION

In recent years technology has been used as a key collaborator for the advancement of "nanoscience" that focuses more on the creation of new methods for synthesizing, studying, analyzing, modifying particles and nanosized structures, less than 100 nm. The physical properties of metal nanoparticles have been shown to be different from bulk metal, consisting of the same atoms that have been very interesting in their promising applications, such as incorporating antibacterial properties as well as pharmaceutical and textile incorporations and photocatalysis[1], electric conductors[2], biochemical sensors[3], oxidative cells, etc.

Nanotechnology opened up a wide range of possibilities in the field of material science, and other branches such as photochemistry and electrochemistry were needed to understand better their properties[8]. The easy adjustment of the size of nanomaterials (<100 nm) [9] allows incorporating into a wide range of materials to improve their properties, such as size; therefore, distribution and optical electric properties and potential biological applications are modified too [10].

Due to its antibacterial characteristics and antifungal activity, the copper nanoparticles (Cu NPs) have been a major focus in health-related applications, as well as their catalytic, optical and electrical properties [21]. Cu NPs are mostly synthesized with the use of polymers[12] and solvent evaporation[13]; some methods were suggested in order to generate smaller nanometer particles, such as the use of the ultrasonic or organic separation process and the application of solvents for extraction evaporation or diffusion[14].

In recent years, the introduction of inexpensive environmentally friendly systems for the synthesis of Cu NPs has been a challenge because of complex metal nanoparticles rather than metal oxides [15, 16]. The development of Cu NPs for future technologies is continuously growing and developing[17]. The highlight of this study concerns the synthesis and characterization in biomedical science of Cu NPs techniques and their biological characteristics and applications.



Figure 1: A schematic diagram of green synthesis of metal

nanoparticles from plant extracts

2.

TECHNIQUES FOR THE SYNTHESIS OF COPPER NANOPARTICLES

The production of nanometric materials has increased in various fields. The properties of these nanomaterials are vital to the world's technological turnaround, which rely primarily on synthesis methods for potential applications such as the bactericidal and antifungal effect[18]. Some of the nanomaterials contain metallic oxides, metal salts and hydroxides, such as copper oxide, zinc oxide,

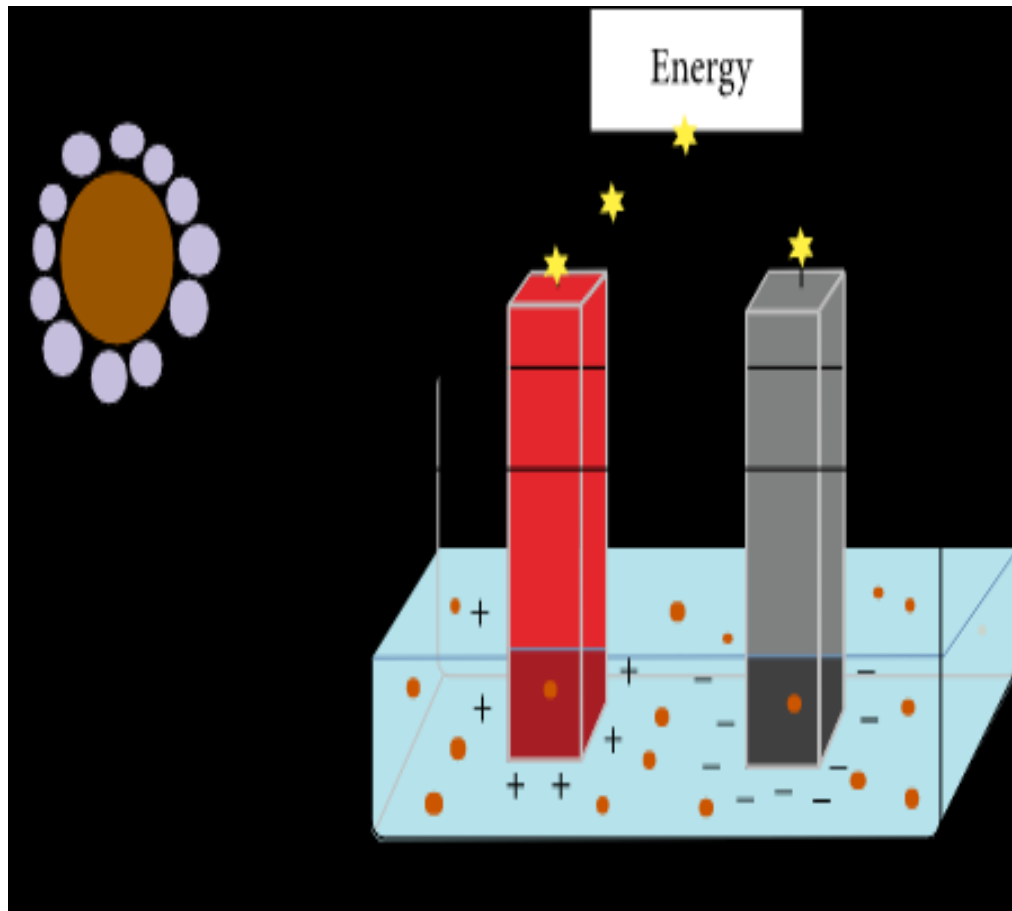
gold, silver, copper, magnetite, iron [7]. Metal-based nanoparticles constitute an option for biomedicine, primarily for the manufacture of antimicrobial coated biomedical products.

A high level of nanoparticle antibiotic activity depends on the amount of particle allowing for greater surface contact and direct interaction with the membranes of pathogenic microorganisms. NPs are also used for the delivery of drugs and ions and diagnostic imaging[19]. [19]. The increasingly unsuitable use of medicines like antibiotics has led medical professionals to develop new biocidal alternatives to fight infectious diseases[20, 21]. [20, 21].

The NPs are materials with different characteristics than the mass-form; these characteristics have made nanoparticles different in many areas, including electronics (nanofilms and nanosensors), MRIs (magnetic devices), drug-eluting systems, cosmetics and catalytics (nanodesigns)[19]. The most frequently identified Silver and Cu NPs with a strong antimicrobial activity enables them to be used in a number of materials including titanium, polymers and glass [22, 23].

In general, methods for nanoparticle synthesis are generally divided into two categories: physical and chemical techniques[24]. The physical method consists of reducing bulk solids in very fine grains to small pieces by grinding using either acidic substances or using energy sources. The grinding process is the most representative example of the physical methods by which highly effective mills are used to separate nanometrically larger particles. However, the metal nanoparticles obtained were not a reliable method because, in general, they are greater than 100 nm and can't be considered as a nanometric scale.

Another downside of this method is that the energy added to grinding must be constant, resulting in energy changes in solids, resulting in a large imbalance, resulting in a reduction in values in energy activation[25]. Indeed, it is possibly one of the oldest methods, but Cu NPs of a standard size and established morphology are not currently used. Unconventional methods are physical techniques (Table 1), for example those which involve vacuum or plasma.



Obtaining poor quality nanoparticles. During or after a chemical process, for example, many physical techniques are used, laser removal requires a colloidal solution that minimizes oxidation chances on the surface of nanoparticles, and must be placed in the vacuum chamber to remove or extract atoms from the bulk surface through the emission of laser beams. The number and time of exposure of the laser beam pulses are relevant parameters for determining the particle size. These parameters vary between 6000

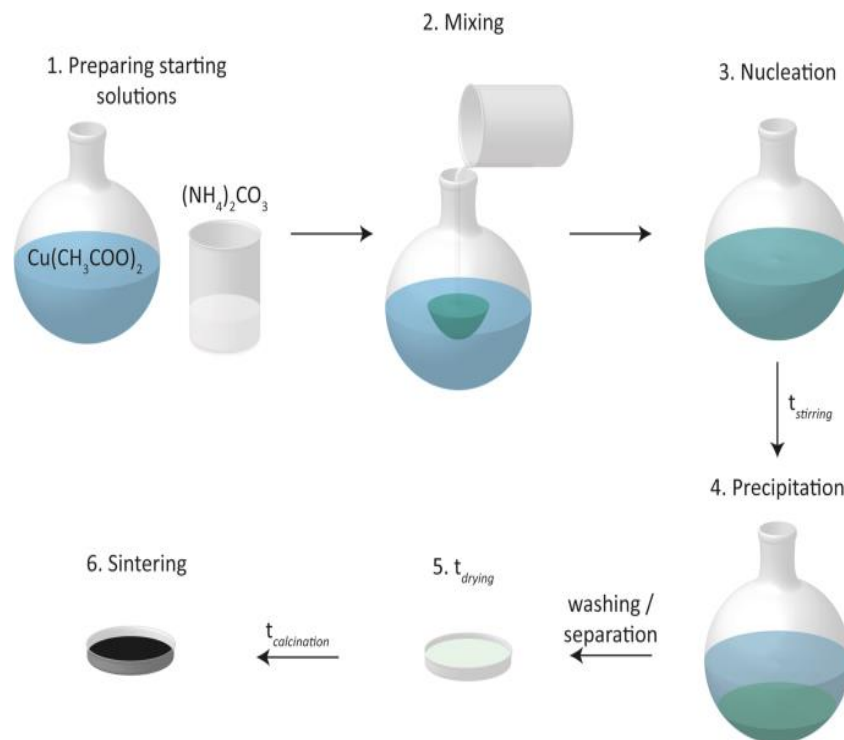
and 10000 pulses in 10 and 30 minutes[25]. For atomic or molecule-by-atom deposition the decomposition of volatile compounds inside a vacuum chamber or reactor is used to form layers on a solid surface at subatmospheric pressure[27].

In comparison to other physical methods, the ions are implanted in a pulsed wire discharge (PWD) by the pulse electric current on a solid substrate [28, 29]. The most popular and functional method is the synthesis of atoms or molecular entities condensing from the gaseous level, or a solution to obtain nanoparticles of special dimensions or morphologies; these properties are modified with the parameters of the synthesis, such as temperature, precursor concentration, stabilizer or solvent[30]. The Cu NPs synthesis method shows the relation between the precursor, reducer, stabilizer and solvent (Table 2). Among the chemical methods, it is easy and simple to obtain Cu NPs with regulated size and morphology that chemical reduction of copper salts [31–33].

The chemical reaction is responsive to aqueous media or air conditions where the surface of the nanoparticles is highly oxidized and thus inert environmental conditions (nitrogen or argon)

atmosphere) or surface active substances, such as ligand agent, surfactants, soluble polymers, weak acids, etc., must often be employed to protect the surface of nanoparticles.

For the first time, chemical reduction and micro-emulsion methods have been used as synthesizers of gold metal and other less noble metals such as copper have been reduced using primarily copper salt (sulfates, nitrates and chlorides) and reducing agents (sodium borohydrate, isopropyl alcohol, hydrazine and ascorbic acid) and, at times, through the use of stabilisers (polyvinyl pyrrolidone and polyethylene glycol)[35, 36].



Green chemical synthesis is a promising alternative for obtaining stable spherical Cu NPs of about 15 to 20 nm with the use of novel *Ginkgo biloba* linn. Leaves[37]. The micro-emulsion reduction or colloidal synthesis requires a surface-active microarray using immiscible water-oil, oil-water and water supercritical carbon dioxide [38]. Sonochemical decrease is dependent on ultrasonic waves (Figure 2(b)), with a frequency of approximately 20kHz to 10MHz; the reaction is active via an acoustic physical phenomenon [39]. The electrochemical synthesis is a process of reduction that takes place on the surface of the cathode electrode between two electrodes separated by an electrolytic solution (cathode and anode). The new alternatives for obtaining standard particle size and Cu NP morphology are microwaves and hydrothermal treatments [41, 42].

The technique consists of an electromagnetic energy with frequencies between 300 MHz and 300 GHz [43–45], where the appropriate energy levels directly affect the configuration of the Cu NPs. Finally, the chemical reaction involves a sealed autoclave for hydrothermal treatments when solvents are exposed above boiling points at temperatures[46].

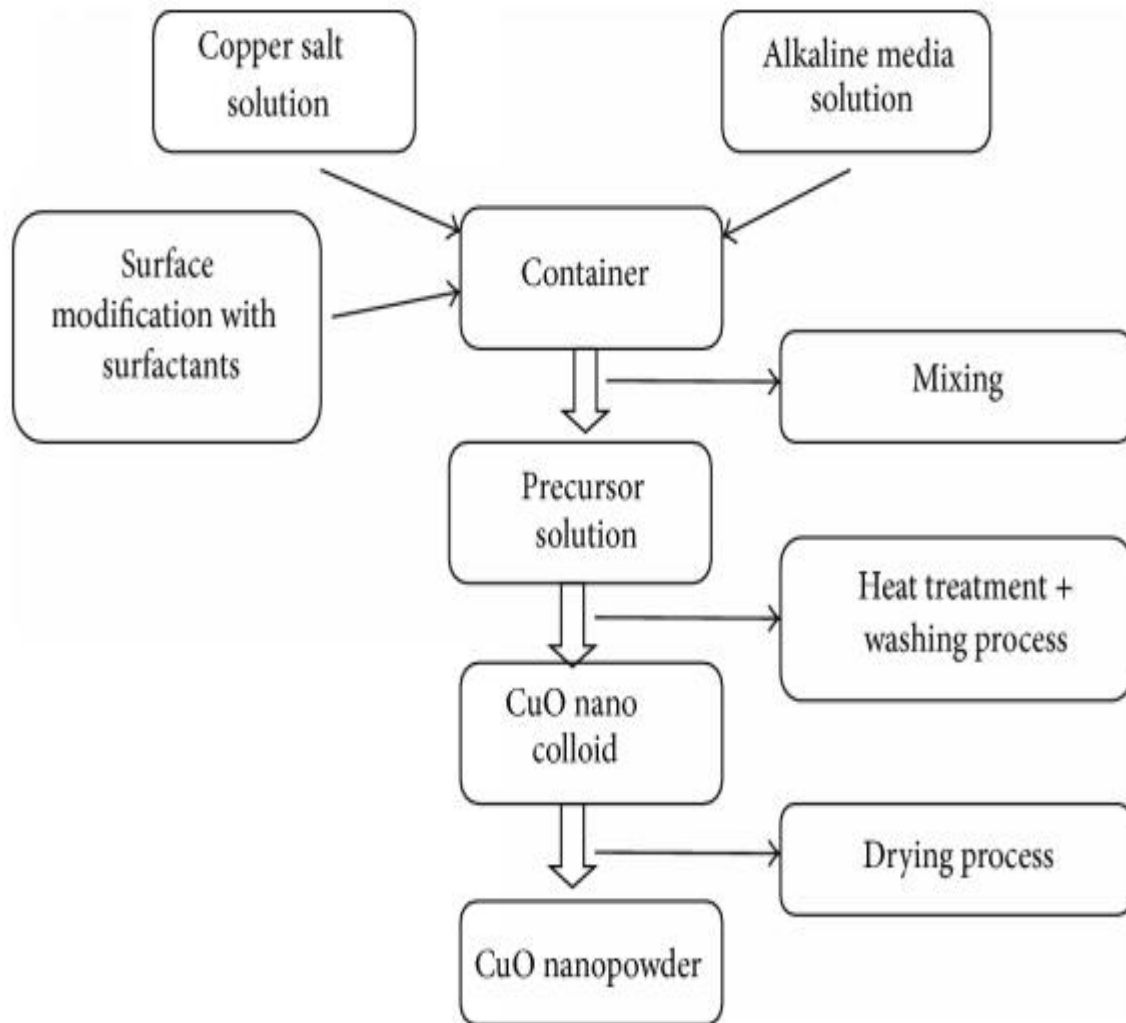
The methods of synthesis are also frequently categorized as "bottom-up" and "top-down" by the direction of creation of nanoparticles. The bottom-up reaction commences from the atomic level via the creation of molecules; however, the scale of the effects of nanoparticles is larger in the opposite technique defined as "top-down," so that mechanical processes or acids are required in order to reduce the particle size. The technique of "top-down" usually involves the use of complex and complicated devices[47].

Whatever the techniques used for synthesizing Cu PN, conditions for adjusting the size of the particles (less than 100 nm) and nanoparticle form (nanofibres, nanotriangles, and nanospheres) should be monitored, since the large particle size of the distribution has altered their characteristics[48–50]. Shankar and Rhim found that nanofibers, triangles and sphere nanoparticles, with different absorbing bands, can be obtained with the simple or acidic solution, the first of which ranges from 280-360 nm and the second of 240-280 nm.[51].

It has been discovered that both Cu forms have inhibited *E. coli* and *L. monocytogenes* as Gram negative, but that nanofibers

have more antibacterial activity than those triangles and spherical nanoparticles.

The synthesis of metal np currently needs the best features and the best properties for developing new materials, both physical and chemical systems. Certain characteristics can be achieved with significant variations between physical and chemical methods; chemicals are more useful if nanoparticles below 50 nm are sought; both methods effectively obtain Cu NPs; the characteristics conferred on nanoparticles of size should therefore be taken into account (52, 53). Three methods (atomic, physical and biological) were contrasted by Khodashenas and Ghorbani, which concluded that copper nanocarticles are more environmentally friendly, cheaper, and easier to obtain than physical and chemical nanoparticles[24].



3. TECHNIQUES FOR CHARACTERIZATION OF COPPER NANOPARTICLES

Different experiments consisting of photons, electrons, neutrons, atoms, ions or atomic sharp tips with different frequencies in gamma to infrared or beyond are used to evaluate structures of nanometric scales.

The results can be processed in order to produce images or spectrums which reveal topographical, geometric, structural, chemical and physical details. Several techniques for characterizing nanomaterials are available[32, 54].

Cu NPs have been physically and chemically defined to obtain the high data required to assess physical and biological characteristics (Table 3). The diminished sizes of Cu NPs are also their key drawback as they present the scientific community with the challenge of achieving a proper physical and chemical characterization[49, 52].

The stability or capacity to maintain its size and form in function of time is very necessary to maintain the properties and potential uses as "bioactive" material. Different methods, primarily from high energy to high resolutions, are used to analyze relevant data including phase purity, spatial distribution, surface chemical composition and crystallinity [55, 56]. The importance of the Cu NP analysis lies in the increasing field of application, which makes it necessary to understand the essence of this new material[57]. Ultraviolet visible (UV-Vis) metals such as copper colloids are usually

absorbed by the excitation of surface Plasmon resonance (SPR). The UV-Vis spectroscopy is therefore a simple way of characterizing Cu NP[58].

Some colloidal metal materials are different from the macroscopic level and have distinct absorption peaks in visible areas, with prominent absorption peaks being copper, silver and gold metals. The Transmission Electron Microscopy (TEM) is the most popular technique for determining Cu NP form and scale.

While further methods are also used to calculate particle size, such as Dynamic Light Scattering (DLS) and X-Ray scattering (SAXS),[59] only TEM analyzes provide real pictures of the morphology and the form. The Scanning Electron Microscope (SEM) is a method for examining the morphologically details provided by the inorganic materials. The key use of high-resolution EDS/SEM (CA100) is that three-dimensional images with wide depth ranges can be obtained by means of a simple sample preparation[60]. The achievements of recent years permit accurate control in the synthesis of CuNPs over the structure produced, depending on the application.

4. BIOLOGICAL BEHAVIOR: ANTIMICROBIALEFFECT AND TOXICITY

Since a decade nanoparticles such as silver, zinc, gold or titanium dioxide have been used as antimicrobial agents for the metal and metal oxide. Currently, the action of nanometals against pathogenic species at nanometric scale is still being studied[61]. The high antimicrobial activities of Cu NPs have been demonstrated in several studies with an ideal size range of approximately 1 to 10 nm [62, 63]. Because of their properties, especially their interaction with pathogens, their wide-ranging active area and their high chemical and biological reactivity, the Cu NPs have been effective in medicine and dentistry[64]. Copper is an important component for some metabolic processes but at low concentrations, as large doses could have serious effects on thematic efficiency.

Due to its redox properties, it can serve as an electron donor or as an electron acceptor in certain bacteriums which are induced by Cu^{+1} and Cu^{+2} ions[65–67]. Some bacteria like *Clostridium difficile* have evolved essential mechanisms to protect themselves from copper ion toxic effects when in contact with the surface of the Cu

NPs (Figure 3). The production of endospores, which makes its rapid diffusion, is a potential mechanism of bacterial copper resistance. However, copper's antibacterial response, mainly in human pathogens, is under investigation[68].

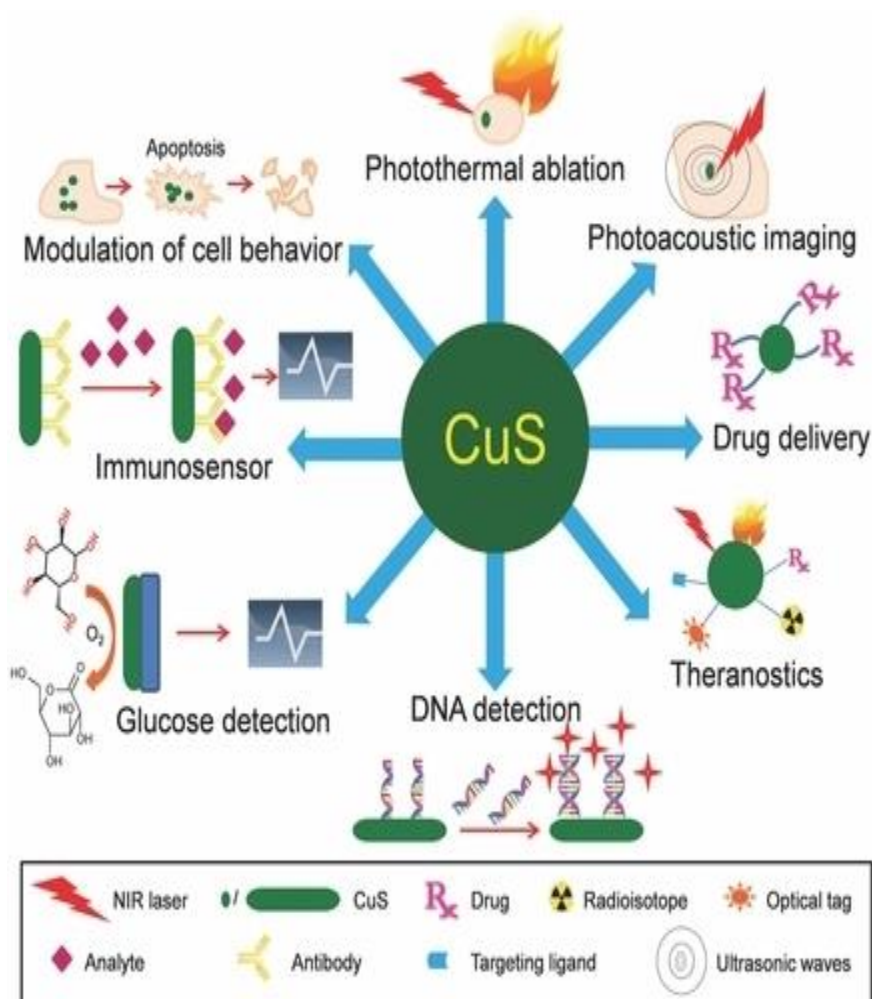
The most studied *C. difficile*, *E. coli* and *P. aeruginosa* bacteria in contact with Cu NPs were significantly inhibited by particle size between 22 and 90 nm and found a decline in the viability of these microorganisms [18, 69, 70]. Gram-positive bacteria (e.g., *S. aureus*) are more susceptible to Cu nitrates and Gram-negative bacteria (e.g. *E. coli*) are correlated by various sizes of Cu nitrates with reactive oxygen species expression. The free surface energy of the particles, directly correlated with size and morphology and the inner pH of the cells, could change these characteristics[71].

The antimicrobial effect has a direct connection to the size of the nanoparticles and the minimum inhibitor concentration (MIC) (Table 4) and surface oxidation [72]. The cell membranes of microorganisms interact with the medium. There are therefore interactions between metal nPs, particularly Cu NPs, in order to release metal ions which, interfere with DNA replication processes,

the formation of cell membranes, cell division, etc. in some microorganisms, including bacteria, which result in antimicrobial action [46, 73]. The copper NPs' action mechanism occurs by the interaction of enzymes and SHgroups which damage the DNA and therefore generate oxidative stress[74–76].

5. APPLICATIONS IN MEDICINE

Antimicrobial resistance has been increased and is now one of the world's most significant public health challenges[77]. Cu NPs have a new anti-drug strategy to reduce cell-adverse effects [37, 78]. It has also been extended into the oral cavity in medicines and potential antibiotic infections in normal circulatory, respiratory and digestive systems; the oral cavity provides shelter for a broad variety of microorganisms including bacteria, yeast and oral infection viruses. The predominant components of the resident microflora are bacteria and the wide variety of organisms found at the oral cavity [70]. It has currently been stated that, without altering the strength of the shear bond, the introduction of Cu NPs into the orthodontic adhesives has shown important bactericidal effects on *S. aureus*, *E. coli* and the *S. mutans* by adding them as nanofillers,[76].



Nanotechnology offers an affordable way to handle metals oxidizing nanoparticles as an antimicrobial material with a surface. Innovative nanoparticles can transform medical devices for antimicrobials. Nanostructured materials have special physicochemical features that are promising for dental use [80, 81]. Interesting features include small scale, high field, high reactivity, high biological interaction and functional structures.

6. FUTURE TRENDS

Cu NPs are of excellent physical and chemical properties, have a high electric conductivity and are well biocompatible and have high surface activity and thus promise to incorporate and incorporate magnetic nanodevices, electronic and medical applications [82]. Researchers are currently searching for new ways of synthesizing metal nanoparticles such as copper to discover new characteristics[83]. Microemulsion is the most frequent copper synthesis process for the use of surfactants and organic solvents, with plenty of energy and high cost[16, 17]. [16, 17].

Through the incorporation of low toxicity substances like alginate used as a stabilizing agent[38] or copper-organometallic chitosanitis into 33 bimetallic particles, it aims to establish new methods that are environmentally friendly[84]. The surveys are new trends to establish a method to acquire NPs that do the least environmental damage possible and are cheap, but the road is still long and unsure, while efforts are growing. The development of nanoparticles concentrated in nanomaterials is expected to be 20 times higher by 2020 than in the past decade[38].

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32

A LITERATURE REVIEW ON THE USE OF GENETIC ALGORITHMS IN DATA MINING

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ABSTRACT

At the same time, an increase in global interconnectedness and competition has increased the demand for useful information. Because of recent advances in technology, the storage capacity of data has grown. That being said, getting valuable knowledge from the growing databases is a necessity. Data mining is a method of collecting knowledge that helps researchers find relevant findings. The technique of data mining can extract information which is useful and confidential from large quantities of data. In terms of data mining, we must now deal with high volume and fast processing as well as accurate performance. The general strategy of genetic algorithms is to reward longevity. a genetic algorithm determines the 'tribes' in the 'species' of best solutions to an optimization problem (called individuals, organisms, or phenotypes). It was explained in this study how important the data mining is to relationships, how it's described, and what the models, methods, and techniques are that go along with it From the explanation and information on genetic algorithms, one can learn how genetic algorithms operate, and what their goals are. which describe and summarize genetic algorithms,

and describe their working principles and important contributions. The use of genetic algorithm techniques in the field of data mining has been investigated. The use of genetic algorithms in data mining has been studied, and has thus far shown how the methodology may be used to analyze different contribution models.

Key words:Data Mining, Genetic Algorithms

1. INTRODUCTION

When the data is accessed using computer programs, it is of little interest to the naked eye since it is meaningless. It has to be processed according to a certain procedure before it can be of use. In contrast, information is the data that is processed for a specific reason. It is important to process large-size data to discover new knowledge as well as to acquire new information to make appropriate future predictions. To analyze and make sense of raw data, one must convert it into usable information, so data mining does this procedure (Savas, Topaloglu and Yilmaz, 2012, p.2).

The need for information as well as being able to tap more customers is driving the need for data mining these days. The processes of data mining, analysis, information extraction, and data

interpretation far exceed the capacities of humans. Data analysis methods are innovative in this case because novel techniques were applied to fill the resulting holes in the analysis. Data mining, because of these new needs, has taken on a whole new meaning and importance (Savas, Topalog, and Yimaz, 2012, p.2)

Most excellent application studies have been conducted on artificial intelligence and data mining use genetic algorithms, which could be used in a number of fields.

1.1 Data Mining

In essence, it's a method for extracting previously discovered, useless, but potentially valuable information from existing data. The findings have been deduced by studying the similarities and differences between datasets and by using software tools such as Mathematica (Baykasoglu, 2005, p.1). Larger scale data mining can be studied in terms of classifications, forecasts, group formations, and content descriptions (Oguzlar, 2005, p.1). For software, its purpose is to define the law, connect the data, or create a link between them. The point of these observations is to unveil patterns which have previously been hidden.

Although data mining may look like a set of statistical procedures, it is different in some ways from statistical data analysis (Baykasoglu, 2005, p. 1).

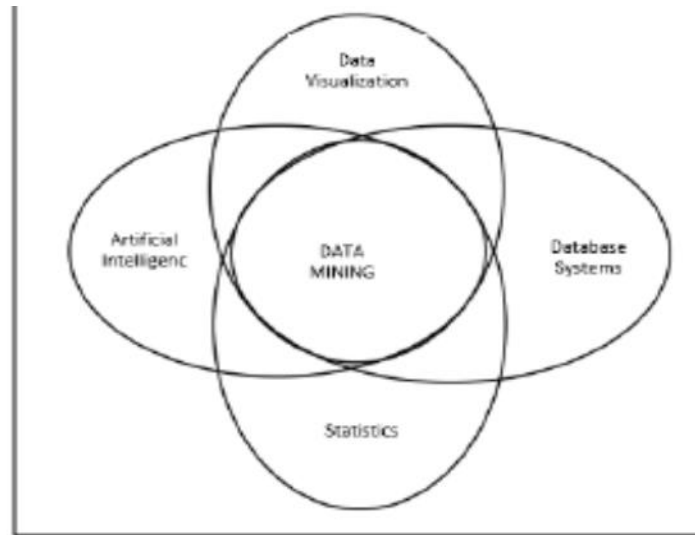


Figure 1 The Interaction between Data Mining and Other Disciplines

Since nowadays, in light of the additional data in digital media and databases with newer methods, and computer systems that collect data automatically, as well as consumer extension, and technological discoveries (the internet, simulation software, etc.), the source of knowledge differs (Facebook, Twitter, etc.).

Many developments still remain in the field of data mining that are yet to be used to realize these data mining applications. Some of the applications that will be used are; SPSS, SPSS Clementine, Excel, SQL Server, and Matlab (Dener, Dorterler and Orman, 2009, p.1).

1.1.1 Data Mining Models

The two general classes of predictive models can be classed as either predictive or descriptive models (Zhong and Zhou, 1999).

Data-driven prediction models strive to use data from the past and to project unknown values from it to the future. It is the explanatory models, on the other hand, that aim to provide insight into the relationships in the data, and inform the process of decision making.

There are three key categories of models used in data mining: Classification, Associations, and Regression, and Clustering, as well as special ones that fall under those three categories.

In Classification and Regression models, the main techniques are as follows:

- Decision Trees
- Genetic Algorithms
- Artificial Neural Networks
- K-Nearest Neighbor
- Memory-based Causation
- Naive-Bayes

2 The important methods used in Clustering models are as follows:

- Divisive Methods
- Hierarchical Methods
- Density-based Methods
- Grid-based Methods
- Model-based Methods (Akpınar, 2000).

For an efficient use of data mining applications, it is required to use different types of data, that the method used in data mining is efficient and scalable, that the obtained result is useful, precise and meaningful, to be able to show the generated rules in new formats, to be able to work on data in different media, and to guarantee confidentiality and security. Data mining, in a different sense, can be defined as a part of knowledge discovery. The steps of knowledge discovery are as below

- Data Cleaning
- Data Integration
- Data Selection
- Data Transformation

- Data Mining
- Pattern Evaluation
- Knowledge Presentation (Dener, Dorterler and Orman 2009, p.2).

1.2. Genetic Algorithm

First popularized by John Holland and others using "survival of the fittest" as a basis (Kucuksille, 2009, p.2). It was intended, by detailing the natural processes of the software already existing systems (Emel and Taskin, 2005, p.6). are designed to imitate in the manner of nature (Bolat, Erol and Irmak, 2004, p.264). scientists are considering whether an approach that has enabled important scientific discoveries to be made in both natural and man-made systems (Holland, 1975). We can break up a problem into a large number of small, simple, specific, non-conflicting pieces and compute each piece, one at a time.

Coming up with a completely random answer In other words, we have one possible answer for every problem we face. Creating an objective function to solve the problem and subjecting the elements to it On the other hand, the fitness function judges if the value is right.

After an application of individuals in the solution space is subjected to the goal, the health or the objective is judged. There are alternate approaches to process selection, e.g. "elitism", a wheel of fortune approach.

Crossover allows new individuals to be made by taking the best features of the ones being created. A process such as one-point or multiple-point crossover is possible.

Individualization is used on the individuals during the method of random breeding. The search approach can be modified. If it is to be effective, it must be at a certain level.

As time passes, new types of individuals replace the old ones in the solution. selecting the fitter(s) is/are picked out, so curing the problem involves removing the weakest individual(s) (Das et al., 2006, pp.68-69).

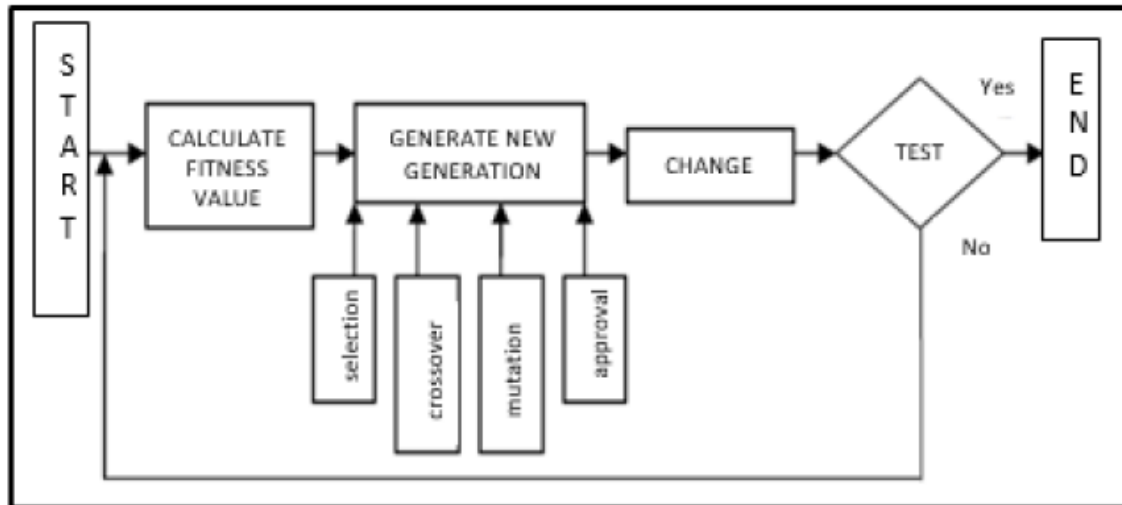


Figure 2 Flow Chart of the Genetic Algorithm

3 DATA MINING EXAMPLES WITH GENETIC ALGORITHM METHOD

A plurality of continuous pattern classification problem is presented using a small number of fuzzy if-then rules was examined by Ishibashi, Yamamoto (2004) to start, you must determine the population of candidate rules by means of evaluation and then apply multi-objective genetic algorithms to find the good rules. When using the multi-objective genetic algorithm, only a small numbers of fuzzy if-then rules were needed to provide support and trust for their existence. When the aim of the evolutionary algorithm is to find non-dominant patterns, the task is to look for a count of the minority set

of patterns. Simulation studies have shown that computer algorithms can help to better formulate fuzzy rules

In a study by Misri-Bidoli (2003), a methodology for sorting students by grades was presented that obtained data from web-outlooked-based databases. Improving efficiency by use of multiple classifiers results in a substantial gains. A genetic algorithm was used to optimize the feature set and predictive accuracy and a marked improvement was observed. When the number of features is kept low, it is shown that feature weighting is more successful than feature selection.

Searching for accurate information from large amounts of data is a must, and the results are derived from mining algorithms in Verma (2012). An extensive search is difficult because there are a large number of elements to search in this instance, effective searching has validity. The topics of genetic algorithms and their uses in different disciplines were examined, as well as their relation to each other.

They tested various genetic algorithms in the data mining and data discovery arenas. Another impetus for application of genetic algorithms in data mining is to solve some of traditional data mining problems when coping with noisy data, inconsistent data; as well as novel features such as data interpretation. Interactive algorithms are an environment where data mining holds great promise. Genetic algorithms were illustrated and described in a study by Wei, Yan (2009), according to the study by Jun-an, Yan (2009). The primary goal of this research was to find the most suitable employee from the employee database by using the genetic algorithm.

In their experiment, Shah and Kusiak used genetic algorithm for feature selection on phenotype database. Huge amounts of single nucleotide polymorphisms (in the order of thousands) although whole-exome research doesn't deal with genetic knowledge, whole-genome or exome sequencing does. A new method has been created that draws on the use of genetic algorithms and data mining techniques to predict the potency. A global search process, a function heuristic, aucto decision tree, and the evaluation of gene sets intersecting with one another are used to narrow down the results.

A hybrid approach to classifications using a decision tree/genetic algorithm was developed by Carvalho (2003). Small differentials are essential to this technique of data mining. Although a traditional rules algorithm is used to produce examples from large decision tables, genetic algorithms (GAs) are used to produce rules for small tables. Here the findings are provided showing the efficacy of the algorithm designs in 22 real-world data sets. Kamath researched the different phases of data mining with the aid of a genetic algorithm in this research, they explored feature extraction, feature selection, and classification of the features was the areas of interest. Other algorithms, such as artificial neural networks, and evolutionary algorithms were also tried out in isolation and in combination.

The primary objective of the authors' (Vizhi, Bhuvaneshwar 2012) research is to compile a detailed quality rule-of-thwarting guide for database manipulation. The primary objective of this research was to apply a multi-objective genetic algorithm to categorical data. According to this research, Bridges (2000) created an intrusion detection prototype using fuzzy logic and genetic

algorithms for showing the efficacy of data mining techniques (data mining methods) in finding security holes, the Antifuzzy framework is designed using both rule-based and data-driven expert systems to detect anomaly. There are two types of genetic algorithms: fuzzy membership functions and feature generation.

Modern heuristics and data mining methods were previously applied in data exploration, according to a Zhang (2006) report Biodiscovery GeneSight was mainly used for methods of data mining when the company used neuralWare's Predict™ for genetic algorithms. Using genetic algorithms, Parshutin and his team (2009) optimized the database for data mining purposes. By combining the k-nearest neighbor approach with genetic optimization, they then proceeded to optimize the weighting function. The k-nearest neighboring algorithm was paired with a genetic algorithm. Through several experiments it was found that the evolved hybrid algorithm reduced errors.

It found genetic algorithm yields better results when the problem is too big, according to Agwal (2015). The global-scale BP neural network learning and optimization research developed by Han

et al. (2008) uses the genetic algorithm and the learning algorithm in tandem. This strategy delivers global optimization, accelerated convergence, and excellent results. This report analyzes and explains how a real data mining application was created.

Nedunzi and Vivekam have done research that applied genetic algorithms to maximize information acquisition in the form of knowledge over the course of generations. When he acquired this expertise, he used it to predict the search space and generate possible solutions. As a result, it reduced the learning costs. Using the genetic algorithm, the experiments showed that search time was significantly reduced. In their research, Kanmani and Indira (2012) studied the output of genetic algorithm using variables which were accurate and flexible. To look into this further, the authors performed a genetic algorithm study of mining and association rule extraction from previous studies over the past seven years. The effectiveness of the genetic algorithm was verified when other techniques were also employed. It was discovered that genetic algorithm variations and mutations affect the system's efficiency. When the selection and fitness of the system was adjusted, the performance improved.

He researched the data loss on the work sites. As compared to other information, the quality of the latter data is very low since most comparisons are made on it. Furthermore, it has been shown that traditional techniques can fail in this situation. For the purposes of this analysis, they used a series of genetic algorithms. As a result, a novel scheme was suggested, and its application debated. They employed a genetic algorithm-trained neural network in their research by Sexton and Sikander (2001) specifically, the researchers found out what all of the variables went into the models that predicted how well each system worked.

One of the goals of the studies is to find a general solution, so it is hoped that reducing the network structure would help. a genetic algorithm work by Takac (2004) looks specifically at the discovery of classifications gained from databases, including A parallel genetic algorithm is being studied in this research. The vastness of the research issue, as well as increasing the efficiency and scalability of data mining are both highlighted in this comment. SQL queries are utilized to perform cellular model genetic programming application and classification. To study the results, the AI is then compared to

other algorithms. a new genetic algorithm has been proposed by Dr. Kamble (2010). This new algorithm works for any database, including transaction databases of any scale. Therefore, it's established, according to the formal definition of the term, incremental algorithms return the same results. A genetic algorithm (GA) was used to evaluate the proposed algorithm on a geographic database and showed the greater efficiency. In this analysis, ICGA (Incremental Clustering using Genetic Algorithm) yielded substantial speedups.

Such an illustrative applications of genetic algorithms is seen in (a review by) Romero et al. (2002). A primary aim of the effort here is to achieve an association rule here. To evaluate the algorithm, data was obtained from a web-for-medical-students web-developed course was used. data mining was done on sequences in the amount of DNA in the dataset and repetitive patterns and motifs emerged This approach puts genetic algorithms and data mining together into play to achieve a better solution than either could on their own. As a preliminary step, the genetic algorithm was used to produce a large number of motifs and populations, and only some of them were examined using data mining to see if they were applicable.

They analyzed business delivery in their inquiry, with the goal of reducing costs. In the first step, the problem was addressed using the k-nearest neighbor algorithm, and then genetic algorithms were used to generate solutions for vehicle routes. When genetic algorithms were applied, a rapid improvement in routes was seen.

SQL query language and MEPAR-SQL algorithms were used in a research by Telcioglu (2007) different aspects of each entity were placed in separate MEPAR-SQL datasets MEPAR-SQL was found to be an efficient for qualitative data as well as massive datasets with significant amounts of missing values and continuous within qualitative clusters. Additionally, MEPAR-SQL is shown to be suitable for solving a significant production problems by attaining a high level of accuracy in simulated results.

In the other words, although different risk factors were searched for, Jdan were primarily interested in the characteristics of polygenic diseases such as obesity and diabetes. Therefore, they drew on the Institute of Biology of Lille's experimental data With genetic algorithms, they wanted to get as much as possible out of the information already on hand, and in addition, they suggested using

data mining techniques and They felt this was safer because there were a lot of features that had to remember. A genetic algorithm was used for feature selection and multiple genetic mechanisms were applied such as sharing, random selection, and operator mutation for addressing a particular problem. in the second stage, they employed the K-means stratified random forest algorithm, then performed a cluster analysis based on the previously-granted features By specifying diseases in this way, the issue of concern is one that may involve more than one function relationship. The algorithm provided evidence that supported the biologist's claims for eliminating unhealthy topics.

4. CONCLUSION

It also increases the storage capacity of the more advanced technology. As time goes on, the need for knowledge in such significant quantities grows. The availability of dependable and up-to-date information has become important in several fields, particularly business, education, medicine, science, and technology. As critical as the supply of new and reliable knowledge is the opportunity to discover it and the pace of distribution.

Data mining in Turkey and around the world is becoming increasingly important each day. Data mining and data analysis share the goal of being useful in various ways.

It is a worldwide investigation to show how genetic algorithms, one of the data mining techniques, can yield exemplary results.

It was noticed in examining the scope of genetic algorithms and data mining that these results can be found in diverse studies. It was found that studies dealing with education, business management, data protection, and health were employed, but examples of this methodology used in industry were rare.

Data mining methods which rely on massive datasets showed a marked improvement in application speed while at the same time producing optimal results. With this method, results were found to be obtained faster, errors were minimized, and higher quality was preserved. Additionally, it was found that real-world data yielded the best results.

It was discovered that the genetic algorithm, which is widely used, would produce rapid and accurate results. Based on this study, we think that we're of the opinion that genetic algorithms would be

useful in data mining in our country and the world.

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Chapter –XXXIII

33

QUALITY ANALYSIS OF NETWORK SECURITY USING CRYPTOGRAPHIC TECHNIQUES

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ABSTRACT

There is a heightened need for data or information security today, which is tough to fulfill. In light of the fact that all data is necessarily stored on structured machines, system security is the most basic aspect of the security strategy. Due to the large number of people who have applied different algorithms, there has been significant examination in cryptographic research. For malicious reasons, personal data may be accessible by unauthorized users. For the process to work, the encryption/decryption to succeed, it is important to realize successful calculations. We've provided an extensive mixture of calculations and algorithms, such as Triple DES, RSA, elliptic curve, dual RNG, Elliptic Stegistic, steganography, and crypto streams in this paper. It's a question of mathematics, which will be tested, and under what techniques and with regard to what purposes, and in light of what kind; and whether or with regard to what conditions a signature or private key encryption (the other kind) will be enforced.

Keywords: Elliptic Curve; Quantum Cryptography.

1. INTRODUCTION

It is useful in the context of Network Security to have knowledge of cryptography. Conceaseption: The Greek prefix "crypto" means "encrypted, hidden" and is used to encrypt information by means of a key. Every technique is thoroughly investigated in its fine detail to test its capability of protection

This is not mentioned in the document, but there are drawbacks and pluses for each approach in the text. although the overall rate of innovation is growing, the importance of protection is increasing Constant security is one of the most prominent realities of the modern world. Off-harmful information because of which information that can be used for evil the problem of unauthorized access can be adequately assuaged with distinctive cryptographic methods and delays the unscrambling of the message for long enough time for appropriate compensation

2. TYPES OF CRYPTOGRAPHIC ALGORITHMS

A critical review of protection strategies based on factors is offered in this study. An accurate analysis of the cryptographic technique's consistency would have the following values:

2.1 Network Security Using Cryptographic Techniques

Cryptography, the study paper. Since the data travels through prearranged computers, system security is the most basic, with regards to data protection. System and data security and cryptography Your system protection is defined by what you permit the system manager to approve. System protection is the most critical given that it handles all data which is passed through structured systems. The system director will rely on different computer foundation approaches to help ensure the system and the system open assets are available and secure, as well as support constant and safe measurement of its functionality.

2.2 Literature Review of Cryptography & Network Security

The study postulates that cryptography serves as the base for all other engineering arrangements, including verification for computer working frameworks Perhaps the greatest myth to maintain about cryptosystems is that they provide solid protection, but of limited utility. When everyone's key is public, and one is private, it creates less security, so we will use a Cryptography and Network Security 23 key administration.

Most basic security is enforced through public key cryptography: the system must be able to allow formulas and operations to be freely audited in order for it to function

2.3 Cryptosteganography

Conserving Information with Effective Data Hiding It used cryptography techniques and steganography to improve the confidentiality of the results. This takes the receiver and the message far farther away from prying eyes. The two layers of cryptography that are applied to hide the message, Cryptosteganography, make it almost impossible to find the encrypted message's origin.

But in this situation, if the hacker has infected the victim, all of the message's content has been lost due to having been enciphered here. Cryptography uses a hidden communication system that slows down the process of cracking. Although all these approaches are easy to realize, they do have useful attributes.

2.4 Encoding and Decoding of a Message in the Implementation of Elliptic Curve Cryptography using Koblitz's Method

It suggests that elliptic curve cryptography is ideal for environments where pageable disk space is limited, such as PDAs,

mobile phones, and ATM cards. Additionally, the vital steps are Encoding and Decoding. ECDSA is an open and more safe than symmetric key cryptography. It is necessary for a single user to possess the private key while the key has to be given out to several people in order for them to have the correspondence Koblitz's methods found that different ECC domain parameters yield distinct execution times for encoding. In terms of distinct space parameters, translation takes an identical amount of time. The decoding time is miniscule as compared to the Encoding time.

2.5 Hybrid Cryptography Algorithm

To the best of the authors' understanding, Ellic Curve cryptography should be applied for encryption, and the Dual-RSA states that MD-5 should be used for authentication. By implementing both symmetric and asymmetric cryptographic techniques, this new security technique has been designed for better security. Most prominently, RSA encrypts and decode two blocks rather than just one.

The message is encrypted with RSA (Rivest Shamir Shamus / Shamir / Rivest, "R", and decrypted with Shamir / Shamir, "v"), dual

ECC keys are used. Therefore, the ability to unscramble two messages and the time required to perform the encryption and decryption were found to be about equal in light of the two blocks.

2.6 Encryption Using Different Techniques:

An appraisal (Diffie and Sherman), AES (Adi Shamir and Hellman), and public key cryptography (Digital Signature Algorithm). The results show that Diffie-Hellman key exchange is used to ensure two clients interact, while an advanced mark provides evidence that the mark hasn't been tampered with.

It's also understood that the various methods can be used over and over again in the course of the encryption's life. Each device has its own unique characteristics, which may be appropriate for different applications. The movement from conventional security to regularity, fast-to-secure encryption continues at the same pace with innovative advances.

2.7 Timing Evaluation of Known Cryptographic Algorithms

This analysis suggests another assessment which focuses on an arbitrary unit of time as it calls for Data Encryption Standard (3DES), as well as RSA (Rivest-Sham-Ad-Adelman) and ECC (Elliptic-Curve

Cryptography) (Rivest-Shamir- Adleman). Assessment (SdSK) (SPDK). There is no relationship between the numbers that are used to construct the plaintext and the key. Under the same key length and with the same key scale, the results show that triple-DES is significantly slower than RSA by a factor of about three. The downside is the computational complexity. Therefore, a new and more efficient assessment method could profit from an assessment system based on the calculation process.

2.8 Stream and Block Cipher Algorithms

For their research paper, which analyzes both Block and Stream cipher algorithms, the authors suggest the association between distinctive information sizes and key sizes. RC4 appears to be popular, not only in throughput, but also in preparation time. However, the IDEA created the most noticeable issue out of any one equation after they implemented it. It's more difficult to distinguish between a line and a stream of events in the course of the former than it is in their entirety. only the effect of increasing the key size was discussed, and the numbers show that greater key size decreases computation time

2.9 Quantum Cryptography

This chapter discusses quantum communication, which supports the overall security of the system. The system utilizes a number of encryption technologies to create a secure QKD (quantum Key Distribution) system. incompreferably non-orthogonal states The Q.C. relies on two main principles of quantum theory- the Heisenberg's Uncertainty principle and the polarization of photons. Quantum security depends on quantum mechanics being set in place. The progress in force-handling and restrictions throughout today's latest development of quantum cryptography will remain a high priority.

2.10 Multiphase Encryption:

A groundbreaking theory of modern cryptography The content in this article is based on the latest in encryption technology. crypting is a technique used to add an extra layer of encryption on top of an already encrypted string of text. In terms of cryptography, it is understood that encryption is achieved by text. Wies and Hellman and Hellman have argued that the 56-bit key in First State (Data Encryption in Touch) is too weak, and thus a new methods, each

using three keys, have to be utilized. The best thing about this approach is that it makes the algorithm more efficient. Our data may be more secure in this complexity, but transmission is more likely to be compromised as a result. Even in the event of any element zero of the data being destroyed, clever data encryption provides better protection. It has a slight impact on the scheme's success and pace.

3. CONCLUSION

The authors states that the theory of symmetricity was discovered here. At the time of the Civil War, Francis Scott Key wrote in his unpublished manuscript that there was no need for secrecy as all type used to be available as plain text, as he thought a field edition, but he was secretly improving his typewriter with a private key when an English soldier used a widely used key to convert encrypted text back to normal text. The encryption key can be thought of as the key to decrypt the data, and as a transform to make the data available for use in its raw form. For each new loop, "Programmer's plaintext is using an expanded MSA algorithmic rule: The DJSA symmetric key algorithm". The test results show that proposed technique outperforms the DJSA key algorithm, "Enhanced

Security Encryption Using AES Symmetric Method." Because any computation requires its own specific parameters, this paper describes various algorithms in an attempt to provide a generalized advice. Every process and equation is different. Quantum cryptography is best because it is so fast and scalable, which means that it can't be hacked easily. The distinctive techniques applied in this paper show how the amount of protection increases.

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34

ARTIFICIAL NEURAL NETWORKS- A HIGH PERFORMANCE COMPUTING IN THE MODELING OF HIV EPIDEMIC

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ABSTRACT

A wide variety of fields including economics, data mining, medicine, engineering, geology, physics and biology have been successfully applied with neural networks. In finance, neural networks were used for stock market forecasting, credit ranking, bankruptcy projections and predictions for economic indicators. In medicine, neural networks were widely used to diagnose and detect medical disorders and evaluate treatment costs. In addition, neural networks have found application for prediction, classification, information discovery, response modeling and time-series analysis for data mining projects. This research will present the application of neural networks to the HIV study. HIV research encompasses four wide-ranging areas: behavioral research, diagnostic research, vaccine research and biomedical research. Most of the publications of research included in this review paper come from the four broad research fields of HIV and will be presented in three categories: prediction, classification and approximation of functions.

Keywords : Multi-layer Perceptrons, neural networks, HIV/AIDS

1. INTRODUCTION

The artificial neural network (ANN) consists of a range of processing units known as neurons. The ANN can be used to estimate the relation between the device input and output signals (Rebizant et. al. 2011). ANNs use an information processing mathematical or computational model. This paper discusses the use of neural networks in the HIV/AIDS research. This review is targeted at readers who have little or no understanding of neural networks, and is intended to direct the literature to improve their knowledge of this method.

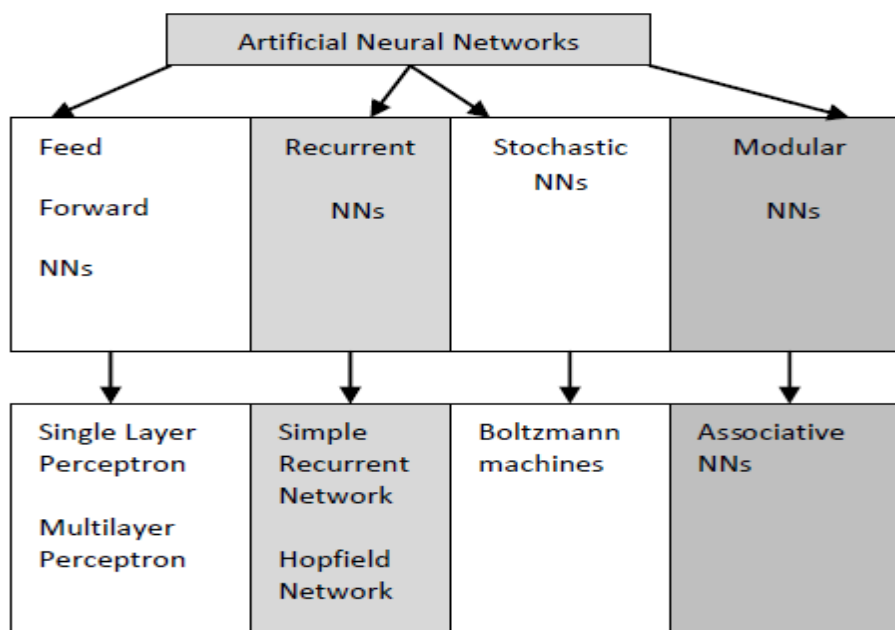


Fig. 1: A taxonomy of neural network architectures

This analysis consists of a brief introduction to the various forms of neural networks (NNs), followed by a description of the most common training NNs algorithm known as back-propagation. Following this would be a summary of some of the NNs' latest applications for HIV.

2. TYPES OF NEURAL NETWORKS

2.1. Feed-forward Neural Networks

These are the first and simplest ANN form. In these networks, the information travels from the input nodes through hidden nodes into the output nodes in just one direction. There are no network cycles or loops. Single layer perceptron (SLP) and multilayer perceptron are examples of feed-forward NNs (MLP).

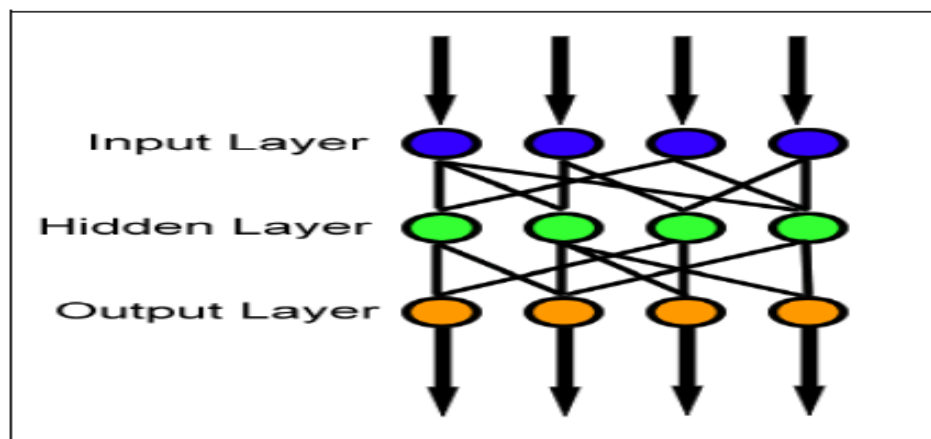


Fig. 2: A schematic representation of a Feed-forward NN.

2.1.1. Single Layer Perceptron (SLP)

A single layer of output nodes is an SLP network. Inputs are supplied directly via a series of weights to the outputs. Each node is used to compute the sum of the products of the weights and inputs, and if the value exceeds a threshold, the neuron fires and uses the active value, otherwise it takes the deactivated value. Neurons with this form of activation mechanism are also called neurons or threshold neurons of McCulloch-Pitts. Warren McCulloch and Walter Pitts identified these networks in the 1940s (Graben and Wright, 2011).

2.1.2. Multi-Layer Perceptron (MLP)

MLPs consist of several layers of computer units linked in a feed-forward way (Calcagno et. al. 2010). The most common of the MLPs is back-propagation, where the output values are compared with the correct response to measure the value of any predetermined errors. The error is then returned via the network. This knowledge allows the algorithm to change the weights of each relation to reduce the error function value by a certain small amount. A general non-linear optimization process called gradient descent is used for weight

adjustment.

2.2. Recurrent Networks

Current neural (RN) networks are models of bidirectional data flows, unlike feed-forward networks. Although a feedback network spreads data linearly from input to output, RN also spreads data from later processing stages to previous stages (Bitzer and Kiebel, 2012).

2.2.1. Simple Recurrent Network (SRN)

An SRN is an MLP variation. Because of its invention by Jeff Elman, it is often called a "Elman network." A network of three layers is used to add a collection of context units fixed with one weight. The input is spread at each stage in a normal way, and then a back-propagation rule is applied. For sequence-predictions beyond the capacity of a regular MLP, SRN can be used.

Every neuron receives inputs from every other neuron in the network in a completely repeating network. These networks are not layered. In addition to the inputs of all other neurons, only one subset of neurons normally receive external inputs, while another disjunct subset of neurons record their output externally and send it to all neurons. These specific input and outputs act as feed-forward or

simple recurring network input and output layers and also bind all other neurons in recurring processes.

2.2.2. Hopfield Network

The Hopfield is a recurring neural network with symmetrical connections. John Hopfield invented this network in 1982. (Dong et. al. 2011). The Hopfield ensures that its dynamics converge (Pajares et. al. 2010).

2.3. Stochastic Neural Networks

The fact that a stochastic neural network incorporates random changes in the network is different from a normal neural network (Su et. al. 2011). An example of a stochastic neural network are Boltzmann machines.

2.4. Modular Neural Networks

A modular neural network is a neural network characterized by a set of distinct, intermediate neural networks (Pandey, 2012). Each independent neural network acts as a module and works on separate inputs to fulfill certain tasks of the Network (Azam, 2000)). The intermediary takes and processes the output of each module to generate the entire network output. The intermediary accepts the

outputs of the modules but does not respond to the modules or signal them. The modules are not communicating. A modular neural network has one of the advantages of reducing a large neural network to smaller, more manageable components (Azam, 2000). Examples of modular neural networks include machinery committee (CoM) and neural networks association (ASNN).

2.4.1. Committee of machines (CoM)

CoM is a set of different neural networks that determine and vote on a specific example together in the hope that errors cancel, because there are many experts (Bettebghor et. al. 2011). This results much better than other neural network models. CoM resembles the general method for learning a machine, except that training on the different random starting weights instead of training on various randomly selected subsets is the required diversity of machines in the committee (Bettebghor et. al. 2011).

2.4.2. Associative Neural Network (ASNN)

This extends the CoM beyond the simple/weighted average of various models. ASNN is a mixture of feed-forward neural networks and neighboring technique (kNN) (Sivaram et. al. 2011). The

correlation between the ensemble response is used as a distance measure between the analyzed cases for kNN. This corrects the choice of the neural network ensemble.

3. TRAINING A NEURAL NETWORK

An input layer is called a neuron that receives information from outside the network. The output layer is called a neuron containing the predictions or classifications of the network. The secret layer is made up of neurons located between the input and output layers. The transfer function normally is a log, sigmoid or hyperbolic tangent function and scales all information into the neuron. The sigmoid curve is also used as a transfer function as it incorporates non-linearity into the equations of the network. The sigmoid function benefits further by the extremely simple derivative function required for back-propagation errors through a feed-forward neural network.

Since values are sent from one layer to the next, each interconnecting line is assigned weight and multiplied by values. Each neuron on the hidden layer contains all inputs, and the function changes the combined input. The transfer function output value is usually transferred directly to all neurons of the next layer

with a weight assigned to each value. Interconnecting weight values predetermine the computing reaction of the neural network to any arbitrary input pattern. As information is transferred from the inputs to the outputs, weights are adapted to the most expected output by a back-propagation algorithm during the learning stage.

The most popular algorithm used to train NNs, as mentioned above, is back propagation because it is able to generalize well on a broad range of issues. It is a feed-in, fully connected, controlled network. It creates models that identify or forecast patterns according to inputs and outputs that it has studied.

NN training is the process whereby the values for the individual weights are calculated in such a way as to accurately address the relationship that the network models. An error surface is formed, as illustrated in Fig. 3, by changing weights over all possible values and by tracing errors in a three dimensional space.

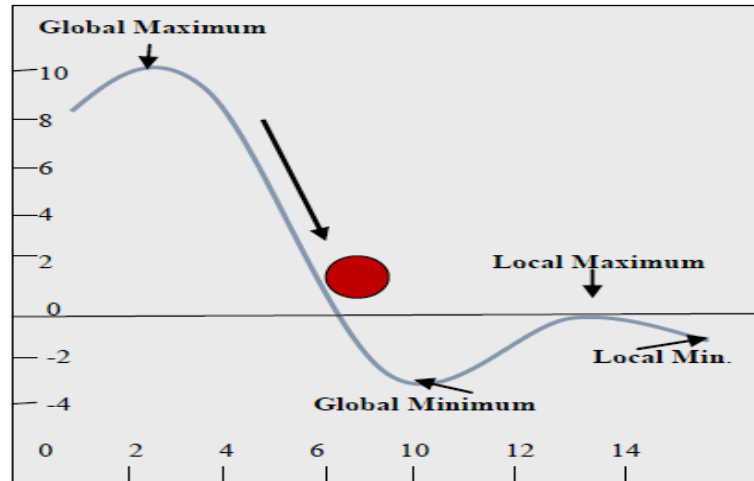


Fig. 3: A schematic representation of an error surface

The aim of neural network training is to find a combination of weights that will lead to the least error. In reality, due to the multitude of weights, it is not possible to designate such a surface and it is therefore more important to find the minimum fault point. A method known as a gradient descent is a possible technique. The back-propagation training algorithm uses this approach to try to find the minimum global error surface. The back-propagation algorithm is the easiest computer-free algorithm for the multilayer perceptron preparation. Back-propagation has been shown in many applications to be satisfactory. In this paper a great many applications used context propagation to train NNs.

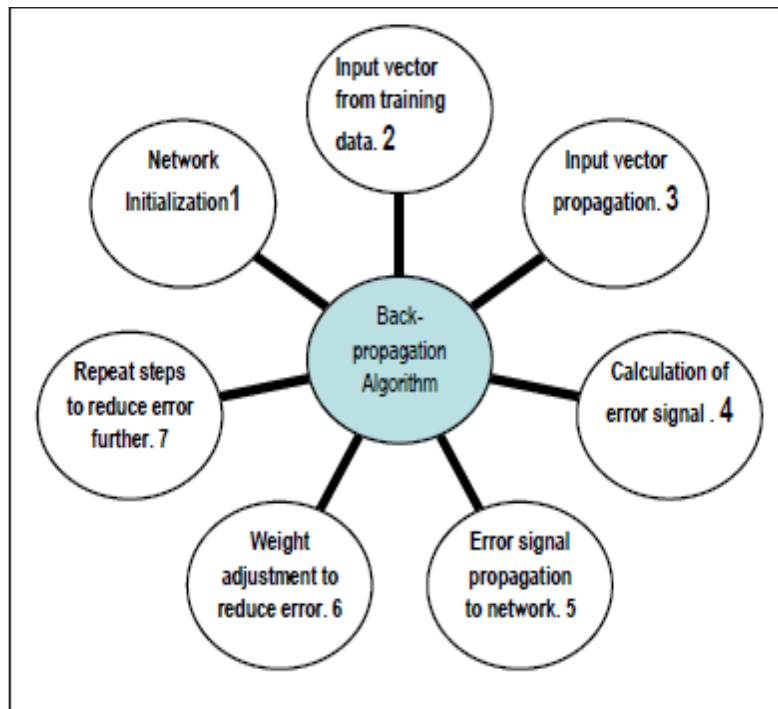


Fig. 4: A representation of the back-propagation algorithm

Fig. 4 demonstrates an algorithm for back propagation also known as on-line training in which the network weights are changed according to each pattern (Reuter et. al. 2010). The alternative is known as lot preparation, where the summarized error is used for weight updating for all patterns.

In practice, several thousands of training iterations are required before the network error can reach a sufficient level as the problem is decided. Training should be stopped when the NN reaches maximum output on the independent test results.

Fig. 3 includes more than one minimum of the error surface. It is critical that the training algorithm is not at least locally stuck. The background propagation algorithm includes two adjustable parameters, a rate of learning and an impulsive term that can help to prevent this. The rate defines the phase size of the learning process during the iterative gradient descent. If this is too high, the network error can change erratically because of massive changes in weight, with the ability to leap over global minima. Conversely, if the learning rate is too slow, it takes a long time to learn. The word momentum is used to support the descent of gradient if it is stuck to a local minimum. By applying a proportion of the previous weight changes to the new weight shift, the local minimum can be avoided.

4. GENERAL APPLICATIONS OF NEURAL NETWORKS

Neural networks have been used for a number of activities, which can all be either predicted, approximated functions or classified as patterns. Prediction includes prediction of future patterns under current and previous conditions in a time series of data. Function approximation is the modeling of the relationship between variables.

Classification of patterns requires classification of data into distinct groups.

Modeling of HIV requires a number of approaches. The choice of the most effective solution depends on the complexity of the problem and how well the problem is understood. If the problem is strongly technically known, a complete numerical model is possibly the most desirable solution. In general, however, as the problem's complexity increases, the theoretical understanding falls because of poorly described device interactions.

And statistical methods are therefore essential. Neural networks have recently been shown to be an important alternative to more conventional mathematical techniques. Neural networks have proven to be trained to approximate almost any smooth and measurable function. Unlike other statistical methods, NNs do not make any previous data distribution assumptions. NNs can design highly non-linear functions and can be trained to generalize correctly when new unseen data is presented. These characteristics of NNs make them an appealing alternative to the development of numerical models and the option of statistical approaches.

4.1. Function approximation and Prediction

Approximation of functions and forecasts are somewhat similar. The input data are also modeled on only one variable. To use a NN for prediction, a network is trained to generate a future variable value given an input vector with earlier observations.

The NN approximates highly non-linear functions and does not require prior understanding of the essence of this relation. This is one of the advantages of NNs over traditional regression analyses. If the relationship between variables is non-linear, linear regression is obviously an unsuitable method however, where non-linearity may be rejected, it may also be possible to apply linear regression locally. Nonlinear regression is useful if the nature of the nonlinearity can be identified and if the nonlinearity is consistent over the entire measurement range.

Extremely non-linear relations exist in the real world and the attempt to explain the issues using standard regression is inappropriate and attributes dispersal to the existence of "noise." NNs provide a valuable method under these circumstances.

4.2. Pattern classification

The classifier divides the entire measuring space into disjoint subsets, or the set of all possible input vectors, each representing one of the several target classes. Classifiers strive to reduce the likelihood of misclassification by classifying a new example in the class with the highest retrograde probability. The subsequent probability indicates the probability of a specific measuring vector belonging to a certain class.

For classification, NNs can be used by assigning output nodes to represent each class. Contrary to the approximation and estimation of the function, the NNs used in classification have more than one output node.

For many factors, NNs have been shown to be superior to conventional classification approaches. First of all, this method requires no preliminary assumptions on the distribution of training data. Bayes theorem classifications depend on a gaussian distribution of data, which in practical applications is often not the case. Another advantage of the NNs method is that there should be no judgment on the relative value of different input measurements.

The weights are calibrated to choose the most discriminating input measures during preparation.

5. USE OF NEURAL NETWORKS IN HIV MODELING

This paper presents a brief overview of HIV modelling NNs applications based on the estimation, approximation of function and pattern classification. These papers hopefully highlight the principal concepts of applying the NNs to HIV modelling problems in the real world. For reference purposes, other papers will be listed.

5.1. Function approximation and Prediction

The multi-layer perceptron was used in the field of HIV prediction Larder et al. (2008) discusses the use of ANNs for the support of medical decision-making. The model involves episodes of therapy shift (TCE) and mutations in the HIV drug resistance as basic variables for the training of ANN models. In conclusion, the authors of this paper describe the reliability of ANN predictions for HIV-treated patients, the use of ANN models to classify successful therapies for non-treated patients and to improve predictions of ANN and performance of ANN models compared to current rules-based methods.

Dechao Wang et. al. (2009) compared three prediction computation methods for the virological response of HIV-therapy combination. HIV treatment failure is usually associated with drug resistance, and genotypical resistance tests also direct the selection of a new regimen. The interpretation of complex genotypical data presents an important challenge, and in this regard the authors have developed artificial neural network (ANN) models which predict virological response to HIV and other clinical information therapy. ANN's accuracy was compared with alternative simulation methodologies like random forests (RFs) and vector supporting machines (SVM). In conclusion, the researchers noted that RF and SVM models can produce an HIV prediction that is comparable with a committee of ANN models in exactness, but combining the predictions of the various models would increase their accuracy further.

Lamer et al. (2008) demonstrated the use of evolutionary computation-trained ANN to predict the co-receptor use of R5, X4 and R5X4. The findings showed R5X4 viruses with a predictive accuracy of 75.5%.

Application of ANN methods to predict HIV protease cleavage sites in proteins was studied by Yu-Dong Cai et al. (1998). The authors developed the self-organizing model of Kohonen. The Neural Network of Kohonen's self-organization is a two-layer network. Output nodes on a planar mapping grid are organized periodically. Each input node is connected through a variable weight connection to each output node. The self-organization model is well-known for its low-dimensional, topological and continuously changing mapping of high-dimensional patterns. Yu-Dong Cai et al. concluded that the superior capacity of the neural network to solve nonlinear issues, such as predictions of HIV protease cleavage sites (92.06 percent) in proteins, is very reliable and accurate and should be thus useful in identifying successful HIV protease inhibitors.

The application of neural networks to the modeling of mortality and morbidity during HIV failure of T-Cell homeostasis was researched by Hatzakis et al. (2002). The mortality of HIV patients including initial therapy response, viral factors, and host immune parameters can be predicted across multiple factors. Because of the complexity of this problem, the authors built feedback background

neural networks to optimally assess therapy outcomes and predict morbidity and death. There were 1 input, 1 hidden layer and 1 output layer on the neural networks for a sigmoid transfer function. Adaptive learning was used but not eventually implemented because a constant factor of learning and dynamism created more precise predictions. The cumulative epoch number was set at 100 000.

The model stopped its training at the time when the gap between two R^2 measurements met the 0.0001 convergence criterion. Weights The Pasomsu et al. (2010) have studied the application for the phenotypical drug resistance prediction of artificial neural networks. While phenotype resistance tests provide more direct antiretroviral medication resistance measurement than genotypical tests, they are costly and time consuming. Genetic resistance testing, however, has the benefit of being easier and more affordable.

The research used the method of artificial neural networks (ANN) to predict the HIV-1 genotype resistance phenotype. Results suggested that drug resistance was correctly predicted and generalized for individual forms of HIV-1 using the ANN at related

amino acid positions known to affect drug resistance of individual antiretroviral drugs.

Singh and Mars (2010) examined the use of vector support machines for estimating changes in HIV-1 CD4 counts. HIV infections with antiretroviral (ARV) medicines can be effectively treated, but close monitoring of the disease progression is essential. The use of CD4 cell counts is one of the strongest markers for the development of the disease. The CD4 count prediction allows physicians to plan care and allocate resources.

The objective of this study was to study the application of machine learning to predict potential changes in CD4 counts. The model used the genome, current viral load and number of weeks in baseline CD4 counts as input and estimated the range of CD4 counts. The model achieved 83 percent accuracy.

Deeb and Jawabreh (2012) present an inhibitor consists of 127 symmetrical and unsymmetrical cyclic urea and cyclic cyanoguanidine derivatives, which comprise various substituent groups, using artificial neural network (ANN) methodology. The results of artificial neural networks gave advanced models of

regression with strong predictive capabilities. Thus, artificial neural networks generated better models without separating them into families for heterogeneous data sets.

Purwanto et. al. (2011) researched the implementation of the HIV/AIDS adaptive neuro-fuzzy time-series inference method. Improving the accuracy of prediction in time series has always been a difficult job for researchers. In healthcare management, predicting time series data such as HIV/AIDS data is of interest.

Statistical techniques such as average movement (MA), weighted moving haderage (WMA) and integrated moving average autoregressive models (ARIMA) have constraints in handling the non-linear relationship between data.

In general, high levels of prediction accuracy can not be achieved by statistical or AI models in complex healthcare data and the authors suggested a hybrid model like adaptive fuzzy inference systems (ANFIS) to predict HIV/AIDS data to address this issue. The results of this research showed that the model proposed was superior to other models.

Goodarzi and Freitas (2010) researched GFA and the Artificial Neural Networks (ANN) to model the behaviors of a series of TIBO derivatives for the inhibitor of HIV reverse transcriptase. The results of the prediction were higher than those previously established. The researchers applied multi-varying image analysis to the quantitative structure-activity relationship (MIA-QSAR) combined with the primary component analysis-adapted neuro-fuzzy inference systems (PCA-ANFIS) for the same group of previously recorded compounds. ANFIS could compare the inputs (PCA scores) with bioactivities accurately. The result suggested that the current approach could be helpful in solving other QSAR problems, in particular non-linearities.

In order to research missing data by industrial plants, industrial winding processes and HIV seroprevalence data, nelwamondo et al. (2007) have established a comparison of neural networks and anticipation maximization technologies. The authors compare two approaches to the missing data estimation problem. The first technique is based on the latest approach to this issue, i.e. maximization of likelihood (ML) and maximization of expectations (EM).

The second method is the use of a self-associated neural network and genetic algorithm scheme (GA).

The authors found that the EM algorithm is best suited and performed in the case of low to no interdependencies between variables inputs, while the autoassociative neural network and the GA combination were more appropriate when certain of the variables existed inherently nonlinear relationships.

5.2. Pattern classification

In order to differentiate between HIV positive and negative subjects, multilayer perceptrons were added to the classification of HIV/AIDS data. It has been shown that multilayer perceptrons yield better classifications than discriminatory analyses.

Pradhan and Sahu (2011) proposed a new multilayered perceptron (MLP) network approach to identify infected and uninfected people with HIV/AIDS. Seven patient characteristics were used as input for neural network training, such as age, sex, weight, HB, CD4, CD8 and TB.

Three various training algorithms such as back-propagation, Levenberg-Marquardt and Bayesian rule algorithms were employed

to train the MLP networks to detect the applicability and best performance of the MLP network.

The authors concluded that 89.80% accuracy was achieved with the best results in the MLP network trained on backpropagation algorithms in comparison to Levenberg-Marquardt and the Bayesian law algorithms. The findings also showed significantly that the MLP network is adequate to measure and determine the positive/negative status of the patient with HIV/AIDS.

Lee and Park (2000) have investigated the use of neural networks to identify and foresee HIV/AIDS patients' symptom status. The aim of the study was to apply an ANN to correctly classify AIDS versus HIV patients. The AIDS Cost and Service Use Survey developed an ANN model using publicly accessible HIV/AIDS data (ACSUS). The authors concluded that an ANN model will promote planning, decision-making and management control by providing knowledge for hospital management.

The application of neural networks to the classification and estimation of HIV/AIDS patients' health status was investigated by Kwak and Lee (1997).

Neural HIV/AIDS network modelling requires the interaction of several different variables, sometimes ambiguous and undefined. The research used the AIDS Cost and Services Usage Survey, a longitudinal study of people with HIV-related illnesses using a mix of personal and abstract interviews. The model created was the neural network of the three-layer background algorithm.

The pattern was divided into 9 variables: race-white, race-black, race-hispanic, exproute-IDU, exproute-IDU for particular purposes, totipngt (total number of nights stayed), totamv (total number of outpatient visits) to toterv (total number of visits) and totobs (total number of days of observation).

Tim and Marwala (2001) used HIV risk management statistical intelligence approaches. The study consisted of two sections, namely the use of neural networks trained in antenata survey supervision for binary grading and the use of trained neural networks in the production of inferred probability of risk using Bayesian classification methods. On complete data sets, an autoassociative neural network was trained.

Pradhan and Sahu, (2011) researched the use of the MLP network to identify individuals infected with and without HIV/AIDS. Age, sex, weight, HB, CD4, CD8 and TB were included in the study. Three separate training algorithms, such as Backpropagation, Levenberg-Marquardt, and Bayesian Rule algorithms, have been used to train the MLP networks in order to assess the applicability and best results of the MLP network. This research found that, compared to Levenberg-Marquardt and the Bayesian rules algorithms, the MLP network trained with the back-propagation algorithm provided the best outputs with almost ninety percent precision. Thus, the study showed that the MLP network is appropriate to measure and determine the positive/negative status of HIV/AIDS in patients.

Goldbaum et. al (2011) applied machine learning classification devices to search for visually differentiated fields (VFs) between normal eyes and eyes of HIV-positive patients in order to identify the effects of immunodeficiency on VFs and to compare the efficacy of MLCs with the standard Statpac automated perimetry indexes (SAP).

The authors concluded that both low-CD4 and high-CD4 eyes have VF defects suggesting retinal injury. Efficient to detect HIV eyes that had field defects even if the defects were slight, generalized learning classification, SVM, and Statpac classifier, MD. Seyagh et al (2011) researched the use of vector support machinery, artificial neural networks and decision-making trees for predicting organic compounds for HIV activity.

The prediction of molecular biological behavior by its chemical structures is a problem in the discovery of drugs. In this respect, the classification of patterns has been shown to be one of the tools used for drug discovery. Three classification models for anti-HIV behavior were used by the authors in this research, based on pattern recognition methods such as support vector machines, artificial neural networks and decision trees.

All methods produced strong learning and prediction results. The latter results showed that the three models can be used as an alternative for classification problems in the structural relationship between HIV activity.

Larder et. al. (2011) has explored the possible use of computer modelling by doctors as a method for the selection of HIV. In collaboration with partnering clinical institutions around the world, the UK based HIV Resistance Database Initiative (RDI) has used patient antiretroviral care and response data from around the world to develop computational models that are extremely predictive of virologic response. The results of this study show that most doctors would use the system if it were available, especially in highly therapeutic cases with difficult resistance profiles.

Kim et. al. (2010) have explored an MLP-based sub-set feature selection for site analysis of HIV-1 protease cleavage. In recent years, multiple machine-learning methods have been used to model the specificity of the type 1 protease cleavage domain of human immunodeficiency virus (HIV-1). A limited number of samples are included in the high-dimensional domain data set that could mislead classification modeling and its interpretation. A proper feature selection can mitigate the problem by removing unnecessary and redundant characteristics and thus increase forecast efficiency.

In this regard, the authors proposed a new method for selecting a subset of features called FS-MLP, which uses multi layered perceptrons (MLPs) to select suitable features.

The protocol involved MLP learning with a training dataset, followed by selecting subsets using a decompositional approach to analyze the qualified MLP. The experimental results showed that the FS-MLP is efficient for analyzing multi-varying, non-linear and high-dimensional datasets like the cleavage protease data collection. The authors found that the FS-MLP was a valuable tool for the study of the computational sequence.

6. CONCLUSION

Artificial neural networks have proved to be a valuable method for prediction, approximation and classification of functions. The real advantages of a modeling technique that accurately reproduces any observable relationship are huge.

The advantages of neural networks can be seen in applications where a complete theoretical model cannot be constructed, especially in non-linear systems. The great number of problems in the implementation, training and interpretation of neural networks must

be combined and the performance advantages of more conventional and sometimes inappropriate techniques weighed.

The minimum requirement for inclusion in our literature review met 27 studies conducted between 1997 and 2012. All studies have concluded that neural artificial networks can play a key role in explaining the dynamics of HIV in populations.

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35

ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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ABSTRACT

For several years, Assisted Instruction (AI) has used its ability to influence the instructional method of the computer system. One day, artificial intelligence approaches were used instead of aided instructions to build intelligent ICAI (Intelligent Computer Assisted Instruction) systems. It's an effort to build tech tutors. This teacher shapes the teaching methods to match individual student learning habits. This paper is focused on the literature reviews on this new subject. The paper presents information on artificial intelligence and machine learning. In order to make better use of it in academics and their studies. The advantages and drawbacks of artificial intelligence and engineering are presented in this research paper.

Key words: Artificial intelligence (AI), Machine learning, CAI systems, ICAI systems, Expert System (ES), Natural Language Processing (NLP), Library System, Exploratory Factor Analysis (EFA).

1. INTRODUCTION

A literature review is a study of academic sources including books, journal papers and theses related to a particular subject or recent subjects.

The aim of this book chapter is to increase the use of artificial intelligence in library and information centres. AI's benefits and drawbacks must be identified for the best use of this emerging technology. Artificial intelligence, powered by committed researchers, has come a long way from its early beginnings. Introducing the term "artificial intelligence" as a "digital" substitute for analog "cybernetics." Artificial intelligences started as an experimental field with the founders of the artificial intelligence laboratory George Boole (1815-1864), Allen Newell and Herbert Simon (Kumar, 2004). The concept of artificial intelligence (AI) is that an artificial agent exhibits intelligence to solve complex issues and this device is usually believed to be a computer or machine.

2. DEFINITIONS AND CONCEPTS

2.1. Artificial Intelligence

The convergence of computer science and physiology is artificial intelligence (AI). Simple language intelligence is the computational component of the world's capacity to accomplish objectives. Intelligence is the capacity and thinks to create memory and understanding, to recognize patterns, to make decisions that respond

to change and learn from experiences. Artificial intelligence to make machines more human like mode, and in much less time than human beings, as artificial intelligence (Poole and Goebel, 1998).

2.2. Learning

Learning in a specific domain is described as the acquisition of knowledge or skills. This meaning is linked to humans. In psychology, many generalized concepts of learning are suggested and several interpret learning as changing a being's behaviour, subject to a specific circumstance or as a series of his or her repeated experiences.

2.3. Machine Learning

In simple words, learning means gaining new knowledge or improving or upgrading the skills of the person. The combination of different methods, for example gaining significant concepts and knowing their meanings and relationships with each other and the area concerned, means learning new knowledge. The improvement of capacity can be interpreted biologically as improving a pattern of neural connections in order to perform the desired function (Bavakutty, 2006).

Machine learning is a mathematical analysis of algorithms and predictive models where the computer system for a particular task is named. It is considered as an artificial intelligence subset. Machine learning algorithms create a mathematical model based on sample data known as training data to make predictions or decisions without being configured specifically to carry out the task (Bishop, 2006).

3. COMPUTER ASSISTED INSTRUCTION SYSTEMS

Computer-assisted education has been used for many years and contributes to the education process through the power of the computer. Early CAI services basically imitated existing educational materials. A popular CAI technique, for example, reflects a process called a programmed instruction. In a programmed text, the students read brief teaching material and then receive short questions to test their understanding. Depending on their responses to the questions, students turn to various pages in the book and each student effectively schedules a new course through the material based on their particular skills. The programmed CAI technique is known as frame-based CAI. The efficiency of the CAI framework software is entirely determined by the way it is structured.

While several successful programs have been created, CAI frame-based programs simply use computers as electronic pages. An obvious potential application of ES inside libraries is that a system could be developed to select a salesman's automatic ethic based on past achievement in the provision of publications of a given type that such a feature would be particularly useful in acquiring less robust material (Mishra and Srivastva, 2008).

4. INTELLIGENT COMPUTER-ASSISTED INSTRUCTION SYSTEMS

The addition of AI techniques to CAI results in a modern and successful training approach known as Intelligent Computer Assisted Instruction. ICAI seeks to create teaching materials that efficiently assess the success of a student to develop individualized tutoring strategies. The key elements of an ICAI system include experience in problem solving, a student model and a tutoring module.

The skill problem solving portion of an ICAI program includes the information that the system attempts to communicate to students. This experience is expressed by methods similar to those used in the expert system knowledge base.

This part can indeed be seen as a specialized expert system that contains ICAI expertise. The tutoring module is the component of the program which sets out the strategies for presenting tutorial information to students. A tutoring module usually utilizes natural language processing strategies to interact at each student's level.

5. AREAS OF ARTIFICIAL INTELLIGENCE

The emphasis is on symbolic, non-algorithmic methods of problem resolution. Intelligence depends on symbol handling. Intelligence artificial has changed culture beyond imagination. Its main objective is to simulate human intelligence with machines, i.e. expert framework, natural language processing, pattern recognition, robotics. Table-1 mentions some of the most recent analytical methods and areas used in the development of artificial intelligence.

6. APPLICATION OF ARTIFICIAL INTELLIGENCE IN LIBRARIES

Computers have the ideal platform for experimenting and using library artificial intelligence technologies. AI had more effectiveness than perceptual tasks in academic tasks such as computer based games and theorems. These computer programs are often programmed to enhance human activity and are often designed for

technical applications including computer aids (CAI). In certain instances, the main objective is to find a strategy that makes the process easier. Table 2 provides information on the use of AI in different areas and activities of libraries.

7. ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE (AI)

One of the main benefits of artificial intelligence is that its decisions are based not on feelings but on facts. Also after our best efforts, it is well known that our feelings still have a detrimental impact on human decisions.

7.1. Advantages of Artificial Intelligence (AI)

The advantages of artificial intelligence are amazing, so this field will definitely develop and step into the history of artificial robots. The key benefits of artificial intelligence are below (AI).

- Mission completed faster than a person,
- Complex and stressful work quickly done,
- Difficult short-term jobs,
- Various tasks can be performed simultaneously,
- High success percentage,

- Less mission mistakes and defects too,
- In short time, more quality,
- Less space, smaller size,
- Long term and dynamic circumstances estimation and
- Find unexplored things. Outside room, i.e.

7.2. Disadvantages of Artificial Intelligence (AI)

Some of the main disadvantages of Artificial Intelligence (AI) in our daily lives are as follows.

- Some time it can be misused leading to mass scale destruction,
- Programme mismatch sometime done opposite to the command,
- Human jobs affected,
- Unemployment problem increased,
- Creativity is depend upon programmer,
- Lacks the human touch,
- Younger generation becomes lazy,
- Require a lot of time and money, and
- Technological dependency increased.

8. ADVANTAGES AND DISADVANTAGES OF MACHINE LEARNING LANGUAGE

Machine learning not only provides a remunerated profession, but also promises to solve issues and support businesses and NGOs by making predictions and helping them take better decisions. To know clearly where it is used and where it is not, the advantages and drawbacks of machine learning must be established. The following figure illustrates the advantages and drawbacks of machine languages.



9. CONCLUSIONS

In future AI would allow new capabilities to meet the information needs of library users. Libraries can use AI resources to provide insight as a service, not just knowledge, but also profound intelligence (IAAS). The benefits and drawbacks of artificial intelligence and machine learning for efficient use and use in libraries and information centers should be understood. AI affects the way information is stored and searched and information professionals will use these innovative emerging technology to improve services and allow consumers to easily and efficiently locate and access relevant information. The implementation of an effective expert framework for technical services as well as information processing and management would support Library and Information Centers.

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Chapter –XXXVI

36

LASER ABLATION SYNTHESIS FOR THE PRODUCTION OF SILVER NANOPARTICLES

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ABSTRACT:

Silver nanoparticles (AgNPs) are famous for their antimicrobial effects and are proposed as active agents to combat against antimicrobial resistance in many classes. Nanoparticles synthesis provides a wide variety of methods providing a wide range of chemical and physical properties. In this study, we discuss the main characteristics of AgNPs provided by laser ablation synthesis in solution (LASiS). Laser ablation synthesis is one of the best candidates for Ag nano-antimicrobial preparation relative to wet-chemical syntheses. This method enables stable Ag colloids to be made in pure solvents without using capping, stabilizing or reducing agents. LASiS manufactures AgNPs that can be better suited for medical and food-related applications, where non-toxic chemicals and human materials are essential to use. Furthermore, laser ablation enables nanoparticles of different properties to be accomplished using experimental laser parameters and thus affects antibacterial mechanisms. However, the concentration obtained by AgNP colloids produced by laser is often low and difficult to manufacture on an industrial scale. To obtain interesting

concentrations for final applications, high-energy lasers that are very costly need to be used. In this analysis we address the advantages and disadvantages of the use of laser ablation synthesis in producing Ag antimicrobial colloids in the field of food packaging.

Keywords: silver nanoparticles; laser ablation synthesis in solution; nano-antimicrobials; food packaging

1. INTRODUCTION

Their specific characteristics [2] have led to their use for metal nanoparticles (NPs) in various fields, including medicine and biomedical sciences [2,3], cosmetics[4,5], food and agriculture[6-9], electronics[10], energy science[11] and catalysis[12] and to substantial improvements in each sector. This study focuses on laser ablation synthesis (LASiS) nanotechnology, with particular emphasis on food packaging and its unique potential in the food industry.

The increased demand for ready-to-eat foods and the need for quick and healthy transport have resulted in extended service life, preventing food-borne diseases, minimizing industrial production, keeping track of them and improved storage preservation. The use of antimicrobial metal nanoparticles increases continuously for this

purpose. They are used in agriculture (e.g. pesticide and fertilize supplies [13-16]), in food processing (e.g. enhancement of flavor or odor encapsulation, improvement of food texture, or quality), in food packaging (e.g. pathogen limitation of proliferation, gas sensors; UV protection for impermeable polymer films).

Inorganic or organic nanoparticles may be put either on or dispersed into the bulk of polymer matrices used for food packaging [20]. The introduction in polymer matrix of nanoparticles aims to increase the properties of traditional packaging, for example, containment and protection (facilities to transport and prevent leakage or breaking-up), food storage (protection from microbial contaminants, longer shelf life), convenience (consumer-friendly products), marketing and communication (real time information on the use of nanoparticles), Food packaging uses creative materials in response to the specifications which can be classified as follows:

- (1) Improved nanomaterials, but not in direct contact with food (the inclusion of nanoparticles in the polymer matrix enhances mechanical and/or chemical properties of packaging); (1)
- (2) Active nanomaterials that allow the packaging to interact actively

with the environment and regulate food preservation (dispersed nanoparticles into polymeric bulk);

(3) Intelligent nanomaterials (packaging, due to the incorporation of nanosensors and modules, is able to track and recognise the condition of the product)[8,21].

Because of their antimicrobial properties, nanoparticles and particularly silver nanoparticles (AgNPs) can be widely used in active packaging [22]. Organic antimicrobial materials are usually less stable at high temperatures compared with inorganic materials and nanoparticles of metal and metal oxide are more difficult to process [23].

The most commonly used nanocomposites for food packaging use are AgNPs that are known for their effectiveness with a wide variety of micro-organisms with high temperature stability and low volatility [20].

Several reviews picture the characteristics of typical food packaging nanostructures and use them [8,20,21,24–31]. AgNPs are respected but few papers are based exclusively on AgNPs in food packaging [23]. Rhim and coworkers proposed one of the earliest

works on this particular subject. They produced chitosan-agNP nano-composite films, and examined their bioactivity and mechanical properties[32].

AgNP-based nanocomposites generally are stable and slowly release silver ions in the surrounding medium, resulting in prolonged antimicrobial activity [8]. In addition to the properties of the nanoparticles themselves — for example, their size, shape, structure, structure, and composition — the amount of silver ions released is based on external factors including the surrounding medium's properties: ionic pressure, pH, composition, humidity, dissolved oxygen, and temperature [26].

This analysis focuses on AgNPs for food packaging and, in particular, on a particular approach to NP synthesis. AgNPs synthesized by laser ablation will be given special attention, a process suggested by several groups as a green route to nanomaterials of high purity. The advantages and the disadvantages of this technique for Ag antimicrobial nanocolloids will be addressed critically.

2. SILVER NANOPARTICLES

AgNPs are chemically stable[33,34] antimicrobial agents[35]

which are highly active in a wide variety of pathogenic microorganisms, including bacteria, yeasts, viruses, fungi and parasites even at small doses (full inhibition of bacteria growth can occur in some mg/mL)[36]. In addition, AgNPs are not harmful to humans at low levels [37]. The OSHA and Mine Safety and Health Administrations (MSHA) suggested that a limit of 0.01 mg/m³ should be allowed for metallic and most soluble ag compounds.

Argentina, Bulgaria, Columbia, Korea, New Zealand, Singapore and Vietnam are recognized as the threshold limit values (TLV) of 0,1 mg/m³ for metallic Ag at the American Conference of Governmental Industrial Hygienists (ACGIH) while 0.01 mg/m³ is recognized as the occupational exposure limit for all types by Austria, Denmark, Germany, the Netherlands, norway, Switzerland and Japan [38]. Under registration, assessment and authorization of chemicals (REACH), 0.01 ppb of ag (for medical products) is not an environmental issue, even though this threshold can not be construed as a healthy concentration [39].

The Food Additives and Nutrient Sources Added to Food Panel of the European Food Safety Authority (EFSA) identified upper levels

of Ag migration from packaging. The recommended values in water should not exceed 0.05 mg/L, and in food should not exceed 0.05 mg/kg. This implies that the evaluation of silver migration profiles is essential in order to assure antimicrobial efficacy while complying with current legislation and that food packaging products and agnp food supplements are not permitted in the EU unless authorized [23]. AgNPs' toxicity often depends on their age, as it usually increases when their size decreases [40,41].

Lower scale results in: (1) higher inclinability into organisms; (2) higher surface atoms usable for a wide range of reactions; (3) more released nanoparticles Ag ions; and (4) higher surface output of more reactive oxygen species (ROS), ultimately leading to increased toxicity[40]. Many reports, however, address in depth the properties and aspects of toxicity associated with AgNP such as [38,42-49], to mention a few.

2.1. Synthesis Methods

The synthesis of assisted (beyond the scope of this review) and colloidal AgNPs has been thoroughly investigated and over the years a variety of techniques for the synthesis of the AgNPs have been

suggested. We suggest reviewing works and book chapters published in the last two years for a comprehensive view of such a literature, such as [50–66], which address colloidal syntheses. The key methods of synthesizing ANS, including chemical reduction [67,68], photoreduction [69–71], microemulsion (RM)[72,73], electrochemical processes [74-76], evaporation/condensation processes[77], laser ablation[18], and biosynthesis [78,79].

The most common way of preparing AgNPs as stable colloidal dispersions is chemical reduction. This involves a reducing agent capable of converting silver salt into AgNPs, also used for stabilizing or capping purposes to ensure the stability of colloids. Ascorbic acid, sodium borohydride, sodium citrate, ferulic acid, poly(ethylene glycol)-block copolymers, and hydrazine compounds are commonly used reducing agents[64,80–82].

AgNPs are made, using polyethylene Glycol (PEG) as a reducing agent, stabilizer and solvent with Silver (AgNO_3) as metal precursor to nanocomposites for low density polyethylene (LDPE) by Jokar et al. Researchers typically use reductants and stabilizers, which have additional antibacterial properties, to increase antibacterial activity

of AgNPs. For eg, Cao and coworkers suggested synthesizing AgNPs using AgNO₃ for precursor, ascorbic acid for reduction and chitosan for stabilisation. ascorbic acid for stabilisation. Chitosan has been used in several studies to prepare silver nanoparticles and shows excellent biocompatibility, biodegradability and antibacterial and antifungal activity [84–86]. Often a microwave will support chemical reductions to achieve a more uniform heating process and to accelerate reaction rate [87].

Biological nanoparticles synthesis using biological agents including bacteria, fungi, yeast, plants and algal extracts is becoming increasingly popular due to the need for simpler, economical and environmentally safe procedures. The basic process is an ordinary chemistry reduction, which differs from natural substances. Plant and its components include carbohydrates, fats, proteins, nucleic acids, pigments and many kinds of secondary metabolites, which may serve as reducing agents of metal salt nanoparticles with no toxic by-product [88]. Similarly, biomolecules such as microorganism enzymes, proteins and bio-surfactants can act as agents reduction [64].

Terpenoids, glycosides, alkaloids, and phenolics (flavonoids, coumarins, ubiquinones, tannins, lignin, etc.) are the key phytochemicals to reduce silver ions to AgNP[79]. In the synthesis of NPs, there are many species.

In the presence of silver nitrate, bhoir and coworkers [89] used mint extract as precursors and polyvinyl alcohol (PVA) as a coating material. In addition, these nanoparticles have been demonstrated in food packaging: by integrating them into chitosan and gelatin blends they have achieved improved mechanical and barrier properties in chitosan gelatin as well as antimicrobial activity for applications in food packaging.

Terenteva et al.[80] examined AgNP syntheses as reducers under flavonoid control and found that quercetine, dihydroquercetin, rutin, and morin were better producer of AgNPs than chrysin, naringenin, and naringin.

Most of the above synthetic techniques will suffer from certain disadvantages. With chemical synthesis, precursors, reducing agents and stabilising/capping agents are present in the synthesis solution, often needed to ensure stable chemically synthesized colloids.

They (or their by-products) can, however, be human health toxic and dangerous. Adverse compounds must also be isolated and extracted from the final nanocolloids before they are used in bacterial, biomedical or catalytic applications.

LASiS is typically a low environmental impact process, with no metal precursors and reduction agents and a relatively high degree of purity colloids compared to chemical methods. The possibility to fragment a metal target without the use of capping and reducing agents reduces inherently the risk of contamination by unknown chemical agents of the resulting colloid and offers NPs a specific surface characteristic[90]. LASiS-produced nPs should show higher reactivity and antimicrobial effects than their chemical synthesized homologous NPs due to the absence of ligands and/or stabilizers on the NP surface[91,92], in the field of nano-antimicrobials.

Furthermore, LASiS makes nanoparticle conjugation with biomolecules in situ, which often proves more effective than the ex situ conjugation needed for chemical synthesized nanoparticles[93].

High-purity laser ablation nanoparticles can therefore be considered to be very promising agents for antimicrobial

applications, especially in food packaging.

However, laser ablation also poses some limitations with respect to other preparation methods. In reality, because of the high price of the Laser Device, it entails high investment costs; to be economically convenient, a large number of colloids should be prepared and reasonably frequently. In addition, lasers need a substantial amount of energy (although many other routes of synthesis need a high level of energy consumption)[94] and industrial nanomaterials are not generated from the most difused laser sources.

To achieve a good ablation efficiency, a lot of energy is required. Ablation efficiency decreases due to the large number of NPs positioned along the laser beam with long time. This disadvantage can be overcome by carefully selecting the fluidics, such as by extracting the as-prepared NPs from the optical path through a flow-through system [95].

The synthesis of nanocolloids at continuous multi-grams ablation rates (e.g. up to 4 g/h) for different metals and under tight composition control was recently demonstrated by Barcikowski and Gökce et al.

They operated a laser source of 500 W picoseconds which was completely synchronized with a polygon scanner at a 10 MHz repetition rate to achieve a scanning rate of up to 500 m/s[96.97]. This technological solution allows the laser induced cavitation bubbles to be spatially circumvented to avoid higher ablation rates due to the shielding effect at a repetition of MHz. We therefore strongly believe that LASiS is a very interesting and flexible way of producing nano-antimicrobials of technologically important Ag and we will systemically explore the aspects that make this technique invaluable.

2.2. Bioactivity of AgNPs

Many studies of the mechanism of action of AgNPs have been conducted and the full importance of AgNP bioactivity remains under investigation. Some related works published in the last three years include a bird's-eye view of [36,52,66,98–113]. Various mechanisms against a wide range of organisms can involve the antimicrobial activity of silver (Figure 2).

Some of the widely accepted mechanisms include interactions between silver–amino acid and the silver–thiolate, interactions

between silver and DNA, reactive oxidative species production and cell membrane damage [47,114].

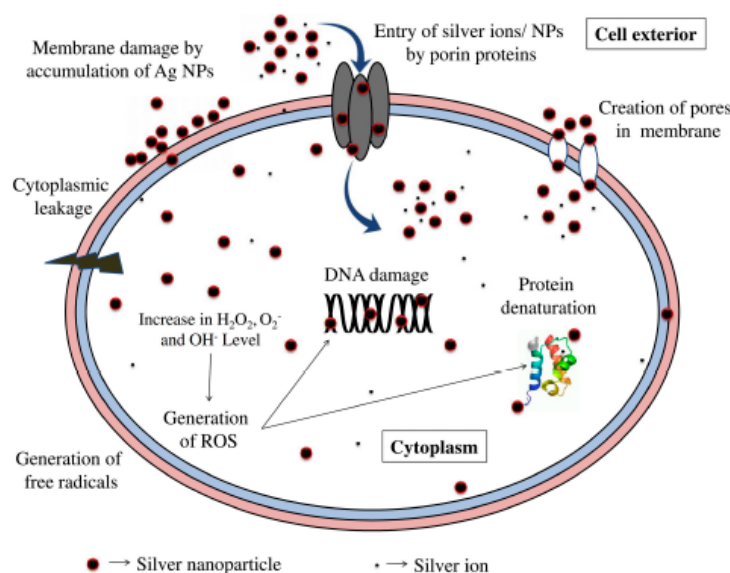


Figure 2. Schematic representation of the known mechanisms of antibacterial action of silver nanoparticles and silver ions. Reprinted from [108], with permission from Elsevier.

Zhang and his collaborators stress that Ag⁺ can demonstrate a high level of affinity to soft base-like thiolate ligands abundant in the bacterial membrane and subcellular structure (i.e. the proteins and enzymes containing the sulphur), leading to the inhibition of critical biological cellular functions [114]. It has been found to interact with thiol groups of antioxidants such as glutathione (GSH), superoxide dismutase (SOD) and thioredoxine intracellularly released, leading to increased lipid peroxidation, oxidative stress, DNA damage and subsequent apoptotic cell death [100].

Nomiya and colleagues found Ag^+ bonded to amino acids, which formed slight bonds Ag-N that substitute biological bonds and caused cell machinery to be altered [115]. AgNPs in mitochondria may potentiate the possible breakdown of mitochondrial membranes, respiratory chain disorder, and oxidative stress, inhibition of ATP synthesis and subsequent activation of apoptosis intrinsic mitochondrial-independent pathway.

NPs can be electrostatically attached to the bacterial membrane [100,114,116]. Lara et al. indicated that the positive charge of the ag^+ ion, through the electrostatic attraction between the microorganism's negatively charged cell membrane and the inorganic active ingredient, is vital to its antimicrobial activity.

According to these writers, the formation of pits in the cell wall due to AgNP build-up in the bacterial membrane, which affects membrane permeability, causing membrane degradation and cell death, is one of the mechanisms of antibacterial action of agNPs [37].

In addition, AgNPs and Ag^+ ions can be used as catalysts and increase reactive oxygen species generation (ROS).

ROS normally occurs in small quantities in cells, but an excess can contribute to oxidative stress [47,117]. Nanosilver also interacts with DNA and damages DNA [118]. DNA is responsible for the mechanism of reproduction. Any damage may cause the organism to mutate or to die. AgNPs were found to directly interact in the adenine, guanine and cytosine bases with exocyclic nitrogen that causes DNA changes [101]. Of course, both Ag⁺ and AgNPs have antimicrobial activity, but the effects of ions and nano-silver are very difficult to discern accurately[44].

Li et al.[119] stated similar Ag⁺ ion mode of action to that of AgNPs, but with stronger antibacterial activity. Navarro et al.[120] indicated that the release of Ag⁺ from the particles damaging cells could be explained by AgNP's toxicity. The effects of both silver ions and AgNPs on several microorganisms [103,121] have been shown to be active against both gram-positive and gram-negative bacteria as briefly described in Table 1. AgNPs and Ag⁺ are well known to lead to different cellular uptake pathways (Figure 3) depending on whether or not gram positive or gram negative bacteria are considered, as has been demonstrated in recent papers [103,122].

Electrostatic contact with antibiotics 2018, 7, 67 6 of 28 membranes [100,114,116]. Lara et al. indicated that the positive charge of the Ag^+ ion, through the electrostatic attraction between the microorganism's negatively charged cell membrane and the inorganic active ingredient, is vital to its antimicrobial activity. According to these writers, the formation of pits in the cell wall due to AgNP build-up in the bacterial membrane, which affects membrane permeability, causing membrane degradation and cell death, is one of the mechanisms of antibacterial action of AgNPs [37]. AgNPs and ions Ag^+ can also function as catalysts and increase reactive oxygen generation (ROS). ROS normally occurs in small quantities in cells, but an excess can contribute to oxidative stress [47,117].

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nano-silver are very difficult to discern accurately[44]. Li et al.[119] stated similar Ag^+ ion mode of action to that of AgNPs, but with stronger antibacterial activity. Navarro et al.[120] indicated that the release of Ag^+ from the particles damaging cells could be explained by AgNP's toxicity.

AgNPs were proven active both against Gram-positive and Gram-negative bacteria, as briefly outlined in Table 1, where they were listed on multiple microorganisms for both silver ions and AgNPs[103,121]. AgNPs and Ag^+ have been recognized as leading to various pathways for cellular uptake (Figure 3), depending on whether Gram-positive or Gram-negative bacteria are taken into consideration as is also shown in recent papers [103,122].

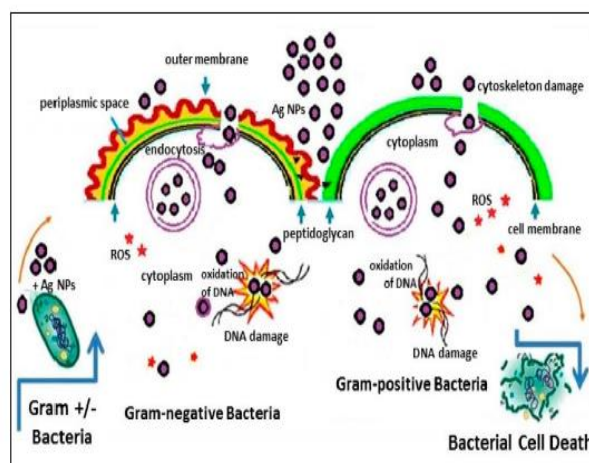


Figure 3. Schematic diagram of bactericidal activity of AgNPs on Gram-positive and Gram-negative bacteria. Reprinted from [105], an open access article distributed under the Creative Commons Attribution License. ROS: reactive oxygen species.

AgNPs were also shown to be involved in the fight against multi-resistant bacteria such as *Staphylococcus aureus* (MRSA), multi-drug Resistant *Pseudomonas aeruginosa*, *Escherichia coli* O157:H7 ampicillin Resistant and *Streptococcus Pyogenes* Erythromycin Resistant [37] or other pathogenic species such as *Bacillus subtilis*, *Vibrio cholera* or *Syphilis typhus* [643]. Pazos-Ortiz and his colleagues demonstrated the antibacterial efficacy of polycaprolactone dispersed AgNPs (PCL). They found that *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* were more vulnerable and that there was low performance for *Bacillus subtilis* and *Streptococcus mutans*[123].

Gram-negative bacteria have, in general, been shown to be more susceptible than those of gram-positive agNPs (i.e. *Staphylococcus aureus*, *Streptococcus mutans* and *Bacillus subtilis*) due to their negative external membrane and the thinner peptidoglyca layer that enables adhesion and subsequent penetic diseases.

AgNP's biological activity relies on factors such as surface chemistry, morphology, scale, shape, coating / capping agents, NP

agglomeration and dissolution rates, solution partition reactivity and ion release efficiency [136-140]. Riaz Ahmed and colleagues [100] report that smaller-sized AgNPs (<20nm) with an improved cell permeation ability and higher ion release ratio between surface and volume have a higher risk for cytotoxicity and cell injury. They suggested an empirical scale of AgNP bioactivity, according to the size (Figure 4) and demonstrated that cellular effects worsen with a decrease in size. They also defined how the DNA damage entity is not dependent on AgNP diameter.

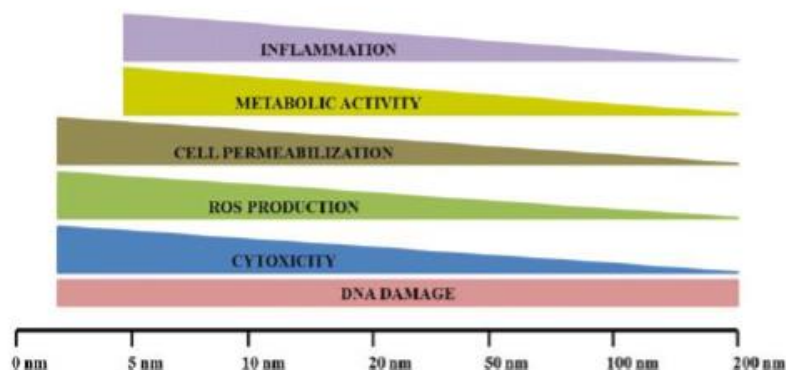


Figure 4. Size-dependent effects of AgNPs in vitro. In general, adverse cellular effects are associated with exposure to smaller AgNPs. One exception is DNA damage; the magnitude of response appears to not depend on AgNP size. Reprinted from [100], with permission from Elsevier.

The form of AgNPs has also been found to have a vital effect on antimicrobial activity. Plate and rod-shaped agNPs demonstrated greater antibacterial efficacy than spherical agNPs and thus could be

employed at lower concentrations. It was in fact observed that the bactericidal activity of plate and rod shaped AgNPs was favored by the existence of high density facets of atom $\{111\}$ while the latter had relatively lower bactericidal activity due to $\{100\}$ facets on the spherical agNPs [108,127]. Another critical factor influencing toxicity is the concentration of AgNPs. The minimum concentration level of NPs that causes toxicity and its variance in various subjects is important. It summarizes a number of works discussing the bioactivity of an AgNP based on the concentration.

The laser ablation agnp ensures the cleanliness of the surface and a lack of capping agents that can cause a possible protective effect on the antimicrobial activity. We would therefore expect the laser-generated nanoparticles to be of greater anti-microbial activity compared to the bioactivity of colloids produced by other methods, resulting in NPs that have a core shell structure. Additionally, AgNPs synthesis reaction by-products may have potential toxicity.

This poses serious problems in allowing these nanomaterials to be used. However, only a few studies are available to evaluate the bactericidal characteristics of laser ablation agNPs and no

comprehensive review of these aspects is yet available.

Perito and colleagues have [146] tested the antimicrobial activity of the AgNPs, prepared either with a laser ablation of nanoseconds (ns) or picoseconds (ps) using a 1064-nm ablation wavelength in the purest water and in LiCl solution against two bacteria. They found that silver colloids in chloride solution show higher antimicrobial activity than colloids in pure water.

They proposed that AgNPs are covered by a thin oxide layer that "activates" the AgNP surface by adding a small amount of LiCl, which increases the reactivity of the metal surface due to positively loaded active sites. They also reported that the inhibition of bacterial growth in AgNPs with the average diameter of less than 10 nm (i.e. made from ns pulses) is more effective, and this is consistent with findings from several other works [129,147-150]. As a general statement backed by various organizations, it can be concluded that AgNPs decrease their antibacterial activity as the particle size increases [88].

In the case of the use of silver nano-antimicrobials, the effect of the AgNP concentration on final biocidal properties is not evident though intuitive and rational, because of the strict solubility limits of

Ag⁺ in vivo ions, particularly due to precipitation of insoluble salts such as AgCl which can lower biological activity. Nevertheless, Korshed and coworkers investigated laser-generated AgNPs[151], showing the major dose dependence on AgNP concentration from 10 µg/mL to 50 µg/mL when investigating the NP antibacterial effects against both Gram-negative and Gram-positive bacteria. Pandey and his colleagues have found similar patterns, analyzing concentration ranges from 40 µg/mL to 600 µg/mL[122].

Zafar et al. [152] published a comparison of the bioactivity of laser-ablation AgNPs with chemical-reducing AgNPs. The dimensions of chemically synthesized nanoparticles ranged from 30 to 40 nm, while those of laser extracted nanoparticles ranged from 20 to 30 nm. Experiments were conducted at the same AgNP dose and laser removed nanoparticles given maximum pathogen inhibition (*S. aureus*, *E. coli*, *Salmonella*).

In comparison with laser-ablated ones, the reduced bioactivity of chemically synthesized NPs was interpreted as adsorbing chemical species on its surface, causing adverse effects on their antibacterial action. NP size however plays a central role in antibacterial action so

that different NP sizes could also be attributed to the different bioactivity of laser-ablated agNPs and chemically synthesized agNPs shown in this chapter.

It is evident from the aforementioned literature that the impact of NP size and concentration are strictly dependent on the single microorganism concerned. In general, while NPs of <10 nm can perform a stronger antimicrobial action, a conservative approach to potential nanotoxicological questions arising from the use of such small materials is best retained.

It is in fact known that risk associated with NP penetration through main entrance roads in the human body reaches a limit of ~50 nm of diameter for dimensions below the critical value[153]. Thus, the existence of a (polymeric) matrix that immobilizes NPs seems extremely significant in an increasing number of applications of NP-based materials in real-life products. In reality, human exposure to bare (and potentially dangerous) NPs can be prevented and/or limited [154].

3. Laser Ablation Synthesis in Solution

In the laser ablation process, an incredibly high intensity is

focussed on a solid objective at a particular point to extract the substance from the surface. If a laser pult irradiates the surface of a bulk material, electromagnetic radiation is absorbed into the material's vibrational grid by the target electrons and energy is transferred. As a consequence, material is expelled from the surface as a plasma pen (which is formed into nanoparticles)[155].

Owing to the high pressure from the ambient liquid and the significant temperature gradient between the feather and the liquid, the plasma pen is confined. The energy is transferred to the surrounding liquid when plasma is decayed, a layer of steam with a volume about the same as that of plasma is produced and a cavitation bubble is formed. Soon after the cavitation bubble, nanoparticles are released into the environmental liquid and then expanded and shrunk before collapse [156].

Laser parameters, such as: wavelength, fluence, pulse duration and repetition rate, light absorbing effectiveness of the target material, transmission, and chemical composition of the liquid usually determine the ablation rate. The characteristics of NP therefore depend on the laser parameters and the liquid medium.

Typical specifications in laser ablation are UV-Vis wavelength to near-infrared (NIR-IR) laser fluence of about 0.1 to 100 J/cm²; nanosecond (ns) to picosecond (ps) and femtosecond (fs) pulses of around 92,95. [92,95].

These laser parameters are designed for tuning multiple NP characteristics, such as scale, shape, surface characteristics, aggregation state, solubility, structure and chemical composition [156,157]. As we discussed previously, these characteristics may affect NP antimicrobial activity: it is therefore important to know how NP properties rely on certain laser parameters.

3.1. Ablation Medium

Distilled or deionized water is the liquid medium most used for LASiS metal nanoparticle synthesis as demonstrated by Mafuné et al.[19,158–161]. Using water as a synthesis medium, several species of oxide or hydroxide can produce reactions from a plasma-induced decomposition of a water between the target material and dissolved oxygen. Species (for example hydroxy groups) can be adsorbed on the surface of the NP that can lead to highly charged surfaces, which help to stabilize synthetic nanoparticles electrically [156].

In most ablation processes, water is an acceptable medium because it is inexpensive, safe, heat-efficient and does not absorb laser light [162].

Organic solvents were also examined for laser ablation and methanol, ethanol, isopropanol, acetonitrile and ethylene glycol are the most frequently used. The higher dipole moment of the solvent was recorded to result in higher ablation efficiency and in smaller particles when using organic solvents. This effect was due to the increased electrostatic interactions caused by the higher molecular dipolar moment of solvent molecules that generate a stronger, dual-level electric layer on the NP surface and enhance the repulsive force among NPs [156].

When comparing organic solvents with various viscosities and dipole momentum it was discovered that the smallest and most stable agNPs were obtained in acetone and 2-propanol, with the smallest distribution of scale. In fact, the former has a high, but low viscosity, dipolar moment, while the latter has high viscosity and low viscosity. Factors such as solvent dipolar moment and viscosity therefore play an essential role in preventing NP agglomeration [163].

In addition, it has been shown that short chain alcohols (e.g., methanol and ethanol) generate unstable particles while using homologous solvents, like alcohols with different chain sizes, while those with chains from C-3 to C-5 produce fewer and more stable particles than those formed in alcohols with chain lengths exceeding C-5 [164].

Moura et al. [165] have shown that ethanol and acetone can be good stabilizing environments in order to keep NPs free of precipitation and oxidation, but organic environments have led to low process efficiency and a greater mean NP size than water. Figure 5 shows TEM images of Au, Ag, and Fe laser ablation of bulk targets with 9-ns pulses at 1064 nm and 10 J cm⁻² in different solvents. Moura and collaborators [165] hypothesized that a protective surface dipole layer formed in the most outer plane when acetone molecules are adsorbed around the metal NP, causing a repulsive interaction between nanoparticles. In ethanol, NP aggregation can be more extreme as ethanol is a solvent with low polarity compared to acetone. However, the ablation processes performed in the ethanol setting have been stated to have a low ablation efficiency [165].

This was due to the decomposition of ethanol during the ablation process, which promotes the creation of permanent gas bubbles. This can act as a hindrance within the laser path in combination with the ablated plasma feather and the as-formed NP, thus reducing energy to the target. Kalus et al. [167] have recently studied the impact of permanent microbubbles on the productivity of nanoparticles in colloid Laser Synthesis and concluded that the highest productivity and monodisperse efficiency in liquids with lowest viscosity is achieved.

Tajdidzadeh et al. [168] have shown that the ablation efficiency of NPs in chitosan solution is higher in EG than in EG, and higher in EG than in deionized water because of the plasma containment of the Ag target (Figure 6). It is noteworthy that the width of the tail with high wavelength values recorded in the AgNP UV-Vis spectra is considered to be NP agglomeration [169]. For fundamental knowledge on those phenomena, those who are not familiar with the UV-vis spectrum of nanoparticles can see [22]. For fundamental knowledge on these phenomena, refer to antibiotics 2018, 7, 67 11 of 28 who are unfamiliar with the UV spectrum of nanoparticles[22].

The same paper shows that TEM causes a mean decrease in chitosan solution which has a higher density and viscosity than other liquids. The same authors also presumed that the plasma generated on the target surface is confined, generating high local pressure and grazing the target surface. The method, called secondary ablation, may boost the efficiency of ablation. The chitosan functionalized NPs obtained were additionally shown to be fairly stable since the biopolymer acts as a capping agent.

Al-Azawi and his colleagues have published similar results [170], synthesizing the AgNPs in three solvents: water, ethanol, and polyvinylpyrrolidone (PVP). In fact, the efficiency of ablation for Ag colloids has been found to be the lowest in ethanol, whereas in water, it was higher than in PVP solutions and confirms that the ablation rate of AgNPs is generally low in the organic solution. The efficiency of laser ablation has been found to increase and the NP size for the solvent of a higher density and viscosity has been reduced in accordance with the Moura and Tajdidzadeh findings.

Consequently, the absorption of colloidal silver surface plasmon resonance (SPR) in water and ethanol in Ganiev [171] has decreased

noticeably over time in comparison with AgNPs in ethylene glycol and has resulted more stable due to high viscosity of the solvent. A higher viscosity of the solvent can be attributed to this, preventing NP flocculation.

Overall, we can claim that removal efficiency in a watery environment is higher, but AgNPs are more stable in organic environments in general. This is related to physical properties of solvents, such as dipole moment and viscosity, which affect NP growth and stability. Higher solvent viscosity prevents the flocculation of NP and enhances the ablation performance, and a stronger double electric layer at NP is created by a higher molecular dipolar moment in solvent molecules.

3.2. Pulse Duration

The effects of the pulse length depend on the electron cooling time (electron-phonon connection constant). For fs lasers, pulse times are shorter than electron cooling times; thus, the electron-gate coupling (phonon) is negligible and the ablation phase can be called a transformation of solid-vapours. A thermal ablation process associated with ns pulse involves laser heating and melting

[166,172]. For these factors, craters are smoother and more defined during fs laser ablation than during ns.

Tzuji et al. [173] reported a comparison of AgNPs with pulse lasers of ns and fs. They showed that fs ablation was less than one nanosecond. The sizes of ns-prepared particles are widely scattered and they have been irregularly shaped (Figure 7).

Barcikowski and colleagues [95] have shown that the fs rate is higher than picoseconds, but the process yield for ps laser ablation was about three times higher compared with fs ablation. At the same time, it has been shown that the ultrashort lasers of ps and fs produce nanoparticles of comparable scale. Hamad[172] noticed a similar trend in reporting a comparison of AgNPs provided by the pulses ns, ps and fs, and in reporting increased ablation efficiency for fs pulses.

3.3. Laser Wavelength

The photon energy equation $E = hc/\lambda$ shows that a shorter wavelength means a larger energy. For example, with a wavelength of 532 nm, green laser pulses have higher photon energy (2,33 eV) compared to those with a wavelength of 1064 nm (1.16 eV). In

general, the 532-nm wavelength makes smaller ANPs more efficient than the 1064-nm wavelength. This is because the lower energy of photons of 1064-nm causes less fragmentation and hence produces larger nanoparticles in the near-infrared field with a higher end coefficient. On the contrary, a fragmentation at 532 nm is larger, not only due to the higher photon energy but also because the wavelength of this wavelength is beyond AgNP's SPR peak, thus reducing the colloidal solution's NP size[174].

The laser wavelength also defines the laser penetration into the metal objective and thus the extent of ablation. This parameter decreases with the laser wavelength, suggesting that for longer wavelength the ablated mass per pulse will increase if reflectivity is identical [156].

It is important to emphasize, however, that the impact on NP characteristics of the laser wavelength still depends on all other laser parameters, e.g. pulse energy and duration, liquid medium and radiation focus. Solati and his colleagues [175] examined the impact of laser wavelength on the output of acetone agNPs (Figure 8), used nano-second pulses of 532 nm and 1064 nm and worked on different

laser fluences for each wavelength. The results indicated that the NP was smaller for a 532 nm wavelength than 1064 nm. They showed also that an SPR shift between colloids formed at different fluids is more obvious at 1064 nm than at 532 nm.

Studies of Tsuji and staff [176,177] showed that ablation efficiency (evaluated by measuring interband absorption at 250 nm) increases for shortened wavelengths if radiation is not targeted, while the wavelength increases for tighter beam focussing (Figure 9). Authors assumed that ablation efficiency depends on the laser fluence that changed with the focusing of beams.

3.4. Laser Fluence and Energy Pulse

Laser fluence is an important laser parameter that defines the efficiency of ablation. The performance of NP is influenced by the bubble of cavitation. In general, with laser fluence, cavitation bubble life increases [178]. Consequently, when the time interval (determined by pulsed laser rates) between two subsequent pulses spatially overlapping at the same spot on the target is faster than the lifetime of the bubble, it significantly shields and reflects the incoming pulse, thus decreasing ablation rate[156].

Increased laser fluence steadily raises the synthesis output above the ablation threshold. Indeed, Moura et al.[165] found that the absorption rate appeared to be higher when laser fluence increased, indicating that the concentration of AgNPs increased. For example, Dorranean and colleagues [179] showed an increase in ablated mass as its fluence increased (Figure 10).

They found also that smaller average NP sizes were achieved with higher laser fluence values, as seen in the STEM micrographs of Figure 11. This activity has been clarified by melting of the target surface with less evaporation and NP auto-absorption of laser light at high pulse energies. This absorption causes smaller particles to form as a consequence of the fragmentation of larger particles.

This pattern was also discovered in other documents [175,179–181]. Nevertheless, Nikolov et al. [182] showed that the average size of particles remained unchanged by laser fluency in its fundamental wavelength ($\alpha = 1064$ nm), but that the laser fluence in the second harmonic wavelength grew considerably ($\alpha = 532$ nm). By comparison, Al-Azawi [170] found that ablation efficiency improved (as the particle size decreased) when laser fluence reached its

maximum; the ablation efficiency then dropped rapidly as the laser fluence increased. This activity was due to the auto-absorption processes that contribute to the fragmentation of larger particles.

Ablation performance is typically increased as pulse energy is increased, as shown by the use of higher Laser Pulse power by Valverde-Alva et al.[183]. This finding was due to higher pulse energy concentrated AgNP colloids.

Our Group has also performed the synthesis of AgNPs using 1064-nm wavelength Nd:YAG laser with pulse frequency of 20 Hz and 4 ns pulse duration. We found that the ablation rate increased with pulse energy at a fixed ablation period of 200. In addition, the average size of AgNPs decreased with energy. In addition, we found that the ablation rate grew over longer ablation periods with pulse energy. This effect was due to the increasing concentration of AgNPs on the laser beam direction, which caused the incident radiation to be attenuated by scattering phenomena.

3.5. Repetition Rate

The RR is defined as the number of laser pulses per unit time. For a given power of the laser, the lowering of the repeat rate results

therefore in an increase in pulse energy, thus giving the increase in laser fluence a higher rate per pulse (and larger cavitation bubbles).

The ablation efficiency and concentration of AgNPs generally increases with the repetition rate. To explain this phenomenon, Valverde-Alva measured laser pulse transmission through colloidal solutions and demonstrated that it increased with the RR. A similar pattern came from Zamiri and coworkers [184].

In comparison to the patterns of Menéndez-Manjón and Barcikowski [185], they examined the difference in average AgNP size and demonstrated that the RR was increasing. In this latter case, however, substantially higher repetition rates of between 100 and 5000 Hz were used in contrast to Zamiri's very small RR range of between 10 and 40 Hz. For RRs reaching tens of kHz or even approaching the MHz regime, pulse energy needs to be reduced to decrease the bubble's size and life, which would otherwise protect the laser radiation and thus minimize the ablation rate[97].

4. AgNPs in Food Packaging

AgNPs are a legitimate antimicrobial additive for control in commercialized foods of the microbial community. The development

of spoilage microorganisms has been shown to limit, postpone or inhibit, thereby improving food safety.

Latest reviews and chapters on the use of AgNPs to deal with this particular application [8,20,21,23–31,186,187]. These reports illustrate the antimicrobial activities of AgNPs, the mechanism for microorganism action, and the current associations of bioactivity and AgNP characteristics, such as scale, form and concentration. AgNPs are embedded in packaging films and checked against foodborne microorganisms or used directly for the packaging of fruit and vegetables, meat and dairy products for most literature in this area.

For example, in packing freshly-sliced fruit salads, Costa and coworkers [188] prepared and used silver-montmorillonite (Ag-MMT) and found inhibition of microbial growth and improved life. Sivakumar and colleagues [189] have also shown in a further interesting work a new method of producing non-poisonous silver nanorods from the milk industry waste. They were used to monitor bacterial development of milk through processing and storage, showing that milk shelf lives are extended.

The most widely cited articles and book chapters provide several other examples of the actual use of AgNPs. Table 3 summarizes some of the above-mentioned food packaging AgNP applications

The antimicrobial properties of the packaging materials are dependent on antimicrobial migration from the packaging to the food and/or to the food product headroom. The migration of an active substrate from the substratum is a deliberate process that is required to enforce antimicrobial and protective action against unwanted food contaminants[194]. For these purposes, a controlled release of the antimicrobial agent of the active ingredient determines the efficiency of antimicrobial packaging. The slow and progressive migration of these substances ensures that an adequate antimicrobial concentration of the product is maintained over time[194,195].

Nerin and colleagues[194] have pointed out that antimicrobials need to enter bacterial cells to act, whereas other substances, such as antioxidants, can act even without direct interaction with food and releases of agents. It should be noted that other harmful compounds can be accidentally released into food.

According to the different regulatory authorities in Europe, the USA, Japan and Australia, AgNP protection limits, both for the environment and human health, vary [196]. For example, only silver nitrate is restricted by law within the food and beverage sector in the United States and Japan, with a maximum permitted limits of 0.017 mg/kg for food and 0.1 mg/kg for potable water. Nanosilver is approved in the United States as colloidal solutions and sold as nutrition supplements (e.g. Mesosilver) with reports that they are extremely beneficial to human health.

In the field of medicine, various wound dressings containing nanocrystalline silver or silver ion-releasing systems as well as indoor appliances such as prostheses or catheters are commonly used[196]. The European Union does not recommend silver for medicinal use to date because of the lack of accurate health risk assessment information. EFSA limited the migration of foodstuffs to a maximum of 0,05 mg/kg[196,197].

In addition to silver ions, excessive release from packaging of whole silver nanoparticles can be harmful for human health. Food and drinks made from AgNPs in their packings are known to be the

primary source of nanoparticles ingestion exposure[198]. These nanoparticles undergo different chemical reactions after ingestion, including agglomeration, adsorption and attachment with other nutrient components as well as reactions to acids and digestive enzymes. Internal systemic exposure to NPs can be dangerous because they can pass biological barriers and enter the internal tissues of the body [154].

AgNPs can also accumulate in tissues, which leads to changes in the profiles of body nutrients. Nanoparticles can also introduce toxic agents or viruses adsorbed on their surfaces or induce cellular development of oxyradicals [198,199]. Regulations are therefore necessary in order to mitigate the harmful effects of the use of nanoparticles, although no globally accepted research protocols or standards are yet in place[198].

5. CONCLUSIONS

We concentrated in this study on AgNPs; a nanomaterial very useful in active food packaging, with a specific emphasis on LASiS synthesized AgNPs. Following brief overviews of agnp bioactivity pathways and synthesis methods for silver nanocolloids.

We concentrated on the LASiS method and defined in detail the operating principles of this method and its effect on the yield and quality of the key laser parameters. A brief description has also been suggested of the use of AgNPs in food packaging. Laser ablation is a green process for producing stable Ag nanocolloids in a large range of scattered media without using metal precursors and reducing agents. Highly pure colloids with unique surface properties and no by-products are made. In theory, these features make AgNPs developed by LASiS some of the best antibiotic candidates.

To date, however, efficiency in the industrial sector is inadequate for direct use. The existing world record for LASiS NP is 4 g/h; while this is attractive, this must be increased for use in the industrial sector by LASiS. Methods are currently under development to improve this efficiency level and leverage high scanning speeds. This has been done spatially bypassing laser-induced cavitation bubbles with a high repetition rate and the continuous multi-gram ablation rates for platinum, gold, silver, aluminum, copper and titanium have already been shown.

LASiS needs a lot of energy and its scaling up at the industrial production level approaches the efficiency needed in real-life applications, although more technologic improvements are still needed, mainly in relation to technical laser solutions.

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Chapter –XXXVII

37

SILVER NANOPARTICLES AND ITS APPLICATIONS

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ABSTRACT:

Silver nanoparticles have unique features that can contain many applications such as antimicrobial, anticancer, larvicidal, catalytic and wound healing. The biogenic synthesis and their pharmacological and other possible applications of silver nanoparticles using plants is gaining traction because of its guaranteed rewards. This important analysis aims to provide an insight into the phytomediated synthesis of silver nanoparticles, their extensive use in different fields and their characterization techniques.

1. SILVER NANOPARTICLES

Silver is a soft, white and lustrous metal with a high conductivity of electric and thermal. Owing to its medical and therapeutic advantages, it was recognized long before the discovery that microbes are an agent of infections. It is used in many different ways as lotions, ointments, solutions, foils, sutures and colloids. It is the most important therapeutic agent for infectious diseases and surgical infections in medicine.

The advantages of silver outweigh the risks [1]. Nanoscience is a new interdisciplinary topic which relies on the essential characteristics of artifacts of nanosize [2, 3]. Due to its high surface area and its volume ratio, nanoparticles possess wonderful optical, mechanical, magnetic and catalytic properties than bulk material [4, 5]. Silver and gold metal nanoparticles exhibit various colors due to their SPR phenomenon. It is a collective oscillation of the metal nanoparticles free electrons in resonance with the frequency of light wave interactions which causes the SPR band to be visible and infrared [6].

Various methods are used to manufacture metal nanoparticles, the most common being chemical and physical methods. The above-mentioned processes produce pure and well-defined nanoparticles, but syntheses are chemicals that are harmful, energy-efficient, costly and not biological.

Metal nanoparticles' syntheses have been sought after in the past three decades, but plant extract research based nanosynthesis only mushroomed in the last decade [7– 13].

Due to their physical, chemical and biological properties attributable to catalytic activity and bactericidal effects, silver nanoparticles gained attention [14, 14] and find applications in nanobiotechnological investigations. They are used in wound dressings as antimicrobial agents[16–18] and as topical creams for the prevention of wound infections[20].

2. PUBLICATION SCENARIO

A quest for literature was mainly conducted with silver nanoparticles being coined as a keyword in the Scopus database that generated 20,022 articles. The quest was refined with the following keywords to illuminate the grass synthesis of silver nanoparticles: plant extracts, applications and green syntheses based on the results of the search of silver nanoparticles which produced 990, 847 and 853 articles.

It documents the scenario for the synthesis of silver nanoparticles developed by standard publishers from 1980 to September 2014. Only research papers and reviews published in English in September 2014 are part of the electronic quest. Following concentrated research on the green synthesis of silver nanoparticles,

almost 1000 articles were important for silver nanoparticles and this paper uses only 250 papers German for critical analysis. The trends for publishing silver nanoparticles from the Scopus database on the phytomedial synthesis (2002 through September 2014).

The green synthesis of silver nanoparticles is based on few review articles. There are documents documenting the escalation of metallic metal nanoparticles such as silver, gold, palladium, antimicrobial, catalytic and electrochemical applications [21]. The synthesis of metal nanoparticles, their special properties as well as the rareness of successful method of synthesis to generate homogeneous dimensions and their applicability were highlighted in Kulkarni and Muddapur (2014)[22]. There are various greener pathways for nanoparticles synthesis of nerovalent metals, metal oxides and salts that highlight recent developments [23].

Synthesis of metallic nanoparticles with plant extracts is cheap, easy to scal and environmentally friendly. In the evaluation of its possible uses, various characterization techniques are used [24].

In a recent article [25, 26] we are addressing the processing of silver nanoparticles, applications in the medical, health, and

environmental issues arising from these nanoparticles and mechanisms of action for human improvement. Antimicrobial characteristics of silver nanoparticles and their futuristic approach in research[27], environmental characteristics of silver nanoparticles in the development of synthetic protocols and applications[28], antibacterial characteristics of silver nano-materials, antibacterial mechanisms proposed and potential toxicity of higher organisms[29], existing uses of silver nanoparticles in clinical use.

In measures of oral, ocular and dermal toxicity, the short-term exposure to colloidal AgNPs is not harmful in mice and guinea pigs. For the safe use of colloidal AgNPs, long-term toxicity studies are necessary[31]. A recent paper illustrates the development of greener processes for nanomaterial synthesis, the preparation of functionalized metal particles, progress in core synthesis, surface operation and form regulation and potential challenges for development of greener approaches[32]. Different silver nanoparticles examined for scattering, absorption cross section, extinction, and quadrupolar coupling show that the optical property depends on the size of the Nanoparticles[33].

This study encapsulates the phytomediated synthesis and the various phases of the application of silver nanoparticles. The annual publication analysis showed that research work on the aforementioned subject is steadily increasing and this expected to be more ongoing towards the end of the 21st century.

3. TYPES OF NANOSYNTHESIS

The synthesis of metallic nanoparticles requires the use of chemical, physical and biological means for upward and downward approaches. Silver nanoparticles' biogenic syntheses are listed as below [34]. Several methods of synthesizing silver nanoparticles were employed, including chemical reductions, microwave-assisted syntheses, ultrasound reduction, electrochemical reduction, template process, photo- or photocatalytic reduction, irradiation reduction, the micro-emulsion procedure, as well as the biochemical reduction.

3.1. Chemical Synthesis

A one-pot process was used to reduce AgNO_3 with the use of N_2H_4 alternatively H_2O in the presence of CH_3COONa at room temperature for 2-3 hours, with water as a solvent[35]. A modified

AgClO₄ reductor by NaBH₄ without the addition of any stabilizing agent obtained the size-controlled output of silver nanoparticles (4–8 nm) [36]. Polyethylene glycol, a particle size mediating silver nanoparticles using β-D-glucose, was found to be based on synthesis time within 24–48 hours [37]. In order to synthesize the stabilized silver nanoparticles, gamma rays were used[38]. AgNPs formed by hydrazine, formalin and ascorbic acid (20 nm) by reducing the [Ag(NH₃)₂] + sodium-dodecyl micellar solution (SDS) complex [39].

Silver colloids were generated by the treatment of silver oxalate under micro wave irradiation with polyvinyl pyrrolidone (PVP) and by altering the particle size by several factors[40]. The electrochemical manufacturing of silver nanoparticles by traditional decrease method on a glassy carbon electrode was performed using 1-butyl3-methylimidazolium tetrafluoroborate [41, 42]. AgNPs of 5–10 nm range were obtained with glutathione, an antioxidant, under a microwave irradiation of 30–60 s [43].

The reactions of hydrazine hydrate, sodium citrate as a reductive agent and sodium dodecyl sulphate as a stabilizing agent were obtained in silver nanoparticles (9–30 nm).

The highest antibacterial activity has also been reported at very low levels below 6.74 $\mu\text{g}/\text{mL}$ [44]. Microwave irradiation has acquired the reduction of silver ions by carboxymethyl cellulose sodium hydrolyzate (CMS), while traditional methods have not been used. CMS has no effect on the size distribution, whereas the effect of AgNO_3 is obvious[45]. Anisotropic silver nanoparticles are quickly obtained by microwave-assisted decomposition in a glycol medium of silver oxalate using capping agent polyvinyl pyrrolidone (PVP) [46].

Aqueous-gas reaction of silver nitrate solution and ammonia gas leads to the rapid production of AgNPs of 10 nm [47]. Colloidal AgNP dispersions are generally obtained by methods of chemical decrease[48, 49]. The use of SDBS improves the distribution of AgNPs synthesized by an electrochemical process [50]. A pulsed sonoelectrochemical technique produced silver nanoparticles[51] in silver citrate and polyvinyl pyrrolidone (PVP).

The reduction in sodium borohydride in the presence of dodecanethiol causes silver nanoclusters of dependent size[52].

Radiolytic reduction in citrate and silver ions formed silver nanocrystallites, in which the size and shape of the solution

depended on the citrate ions. Uniform silver nanowires are obtained by a polyol method that is another approach for the processing of large scales[54]. Silver nitrate reduction with alkaline-pH hydroxylamine hydrochloride produces stable, highly SERS-active, particle-size silver colloids of 23-67 nm [55]. A Tollen method used for the production of AgNPs resulted in an electrodeless deposition of silver of a measurement of 20-50 nm and a stable dispersal of the colloid in water or in undermonolayers[56].

Various experiments have been used in the silver soil synthesis with silver nitrate and sodium borohydride to increase the particle size from 20–45 nm to 120–170 nm[57, 58]. Electroreduction in tetrabutyl ammonium salt containing acetonitrile silver ions developed 2-7 nm AgNPs in size. The effect of different electrochemical parameters on the final size of nanoparticles was studied via various kinds of counter electrodes[59]. The decreases of Ag^+ by 1-hydroxyalkyl radical produced by 2-propanol radiolysis and β -irradiation by 1.0 to 10^{-4} M AgClO_4 solution resulted in the generation of long-term, colloidal silver shoals[60]. In the presence of polyethyleneimine agNPs were developed in 7 nm size with unusual narrow Plasmon

absorption band [61]. Monodispersed silver nanoparticles are synthesized in liquid phase using functional reverse AOT micelles and sized precipitation methods [62].

In the absence of light, the silver ions in ethanol are reduced with the nonionic surfactants in the solution [63]. Reverse micelles allow control of the size of nanoparticles of silver sulfide [64]. The agglomeration of the oligomeric clusters of silver atoms (Ag_0 , in Spanish) result in colloidal ag particles [65] by reducing various complexes with silver ions (Ag^+). Spontaneous reduction of silver ions in the presence of nafion and the simple, air saturated 2-propanol solution is obtained by stable silver colloids [66].

4. MICROBE-ASSISTED SYNTHESIS OF NANOSILVER

4.1. Bacterial-Induced Synthesis.

Lactobacillus fermentum suppresses the growth of *P. aeruginosa* in the synthesis of biogenic nanoparticles [67] and monitors the development of biofilm. *Bacillus flexus* synthesized anisotropic nanoparticles formed spherical (12 nm) and triangular (61 nm) nanoparticles [68]. For the production of AgNPs using *Bacillus cereus*, an incubation period of 3 to 5 days is needed at room

temperature[69]. The stability and synthesis of AgNPs rely on psychrophilic supernatants (*Pseudomonas antarctica*, *Pseudomonas proteolytica*, *Pseudomonas meridiana*, *Arthrobacter kerguelensis*, and *Arthrobacter gangotriensis*) or mesophil bacteria (*Bacillus indicus* and *Bacillus cecembensis*)[70] which are free from cell culture. *Bacillus thuringiensis* is the spore crystal mixture used to synthesize AgNPs of 15 nm of mixed (cubic and hexagonal) morphology[71].

The size of AgNP synthesized by *Escherichia coli*, *Klebsiella pneumoniae*, *Escherichia coli*, and *Enterobacter cloacae* that have effectively formed silver Nanoparticles [72, 73] is regulated by parameters such as temperature, pH, and AgNO₃ concentration. The 28-day association of *PlectonemaBoryanum* UTEX 485 and aqueous AgNO₃ led to spherical silver nanoparticles being precipitated[74]. Within five minutes, the silver ions are easily reduced by adding *Enterobacteriaceae* cell filtrate (*Escherichia coli*, *Klebsiella pneumoniae*, and *Enterobacter cloacae*) to the silver nitrate solution [75]. The size and shape of silver-synthesized nano-particles with microbes depend on the interaction between silver ions and bacteria

[76, 77]. The silver-isolated *Pseudomonas stutzeri* AG 259 developed well-defined, silver nanoparticles and distinct morphology within the bacterial periplasmic space[78].

4.2. Fungal-Derived Synthesis.

Polydispersed spherical AgNPs ranging from 17 to 33 nm were synthesized using *Helminthosporium tetramera* cell-free filtrate and demonstrated strong antibacterial activity[79]. *E. coli* has been found to be more vulnerable than *S. aureus* to silver nanoparticles[80]. *Humicola* sp. thermophilic fungus reacted with Ag(+) ions, reduced the precursor solution and led to extracellular nanoparticulate formation[81]. In order to synthesize AgNPs from *Aspergillus niger*, ideal conditions such as temperature 37 to C, pH-6.0, and a 2.0 mM Silver Nitrate substrata concentration are needed [82]. In recent research, the patenting of research into microbial nanoparticle synthesis has also been increased. One such important work is the synthesis of AgNPs (5–50 nm) harnessing *Trichoderma reesei* fungus wet biomass at 28 to 1 hour after 120 hours of continuous shaking [83]. *Bipolaris nodulosa* was used to shape the spherical, semi-pentagonal and hexahedral structures (10–60 nm) of silver

nanoparticles[84].

AgNPs made with *Pleurotus sajorcaju* have strong antibacterial activity in comparison with *Staphylococcus aureus* on *Pseudomonas aeruginosa* and *Escherichia coli* [85]. The treatment of aqueous silver nitrate solution with fungus *Fusarium semitectum*[86] resulted in highly stable and crystalline silver nanoparticles (10–60 nm).

Extracellular mycosynthesis of AgNPs isolated from infected ginger formed by *Fusarium acuminatum* nanoparticles of 5 to 40 nm of size within 15 to 20 minutes. A nitrate-dependent reductase enzyme can reduce the silver ions and have shown effective antibacterial activity against *Staphylococcus aureus*, *Salmonella typhi*, *Staphylococcus epidermidis* and *Escherichia coli*[87]. Nanocrystalline AgNPs of size 13–18 nm were developed using the 5 days of incubation with cell-free aqueous extract of *Trichoderma asperellum*[88].

Aspergillus flavus acquired silver nanoparticles in 72 hours on its cell wall, but was found to be released by ultrasound [89]. Rapid $[\text{Ag}(\text{NH}_3)_2]^+$ to Ag^0 reductions occur when a quantity of $-\text{OH}$ is inserted into the dried *Aeromonas* sp. SH10 cells [90]. Extracellular

synthesis of the well-dispersed AgNPs of 5–25 nm of dimensions was achieved within a few minutes when *Aspergillus fumigatus* were treated for silver ions [91]. The synthesis of silver nanoparticles supported by *Fusarium oxysporum* led to agglomeration[92] whereas traditional halogen-tungsten lamp synthesis provided AgNPs with less aggregation within an hour.[93]

The reduction of silver ions occurs through the enzymes located on *Verticillium* surfaces and the cells multiply even after AgNPs have been formed[94]. The biomimetic conduit to plant species has been therefore developed through the microbially assisted synthesis of silver nanoparticles. The enzymes present in microorganisms reduce silver ions that form silver nanoparticles [95]. These species are vulnerable to increased silver ion concentrations[96]. There are also some problems with nanosilver, which is synthesized by a microorganism, when used in biomedical applications.

5. CONVENTIONAL METHODS OF NANOPARTICLE SYNTHESIS:

A critical picture The exploitation of reduction agents in the synthesis of nanoparticles has opened a critical road to environmental protection and also restricted the use for biological

applications of these noble materials. The use of dangerous chemicals and the amount of money involved in the synthesis process contributes to a thorough energy process that eliminates the environmental friendliness of the traditional methods[97–102]. Chemical synthesis of silver colloids contributes largely to aggregation as the storage time increases[2]. The above problems have suggested the incorporation of the principles of green chemistry into the synthesis of metal nanoparticles. The key components for green nanosynthetic routes are environmentally friendly solvents and reducing and stabilizing agents[103].

6. PLANT-MEDIATED SYNTHESIS

Extracts of *Myrmecodia pendans* (10–20 nm) [104], *Tectona grandis* (30–40 nm) were used to obtain nanosilver of different sizes. [105], *Cuminis Syzygium*, (10–15 nm); *Rhynchochortum ellipticum* (51–73 nm) [106]. [107], *Alternaria alternata* (27–79 nm) *Alternaria alternata* [108] *Citrus maxima* (2,5–5,7 nm) [109], *Desmodium gangeticum* (18–39 nm) [110], *Thevetia peruviana latex* (10–30 nm) [111], *Lycopersicon esculentum* Mill (30–40 nm) [39], *Desmodium gangeticum* (18–39 nm) *Piper pedicellatum*

[112] (2-3 nm) [113], Asian Centella L. (30-50 nm) [113] [114], Bozwellia serrata, Triphala [115], Neem leaves (59 nm) [116] Ocimum sanctum leaf [117], Pomegranate seed (30 nm) [118], Piperitementha (90 nm) [119], Coenigimurraya (10–25 nm) [128], capping substances, etc.

Depending on the type of extracts and the method of preparedness, the size of silver nanoparticles synthesized using antioxidants made of blackberry, blueberry, granates and turmeric extracts was developed between 20 and 500 nm [121]. *P. maderaspatensis* was a good catalyst for the reaction initiation, which quickly produced AgNPs with particles as small as 59 nm within 24 hours[122].

AgNPs synthesized by *Delonixelata* after 24 h incubation display a zeta-potential (-18 mV) value [123]. Thin, large-scale AgNP films were obtained using the SILAR method for guava leaves extract [124]. AgNPs were developed using banana stem extract from different forms, such as truncated octahedron, rhombic dodecahedron, cube, octahedron and octogon structures, which had particle size ranging from 75.50 nm to 1.22 μm [125].

AgNPs were synthesized with the *Potamogetonpectinatus* L and continuous growth occurred as concentrations of silver nitrate were increased, leading finally to polydispersion [126]. Rich extracts of *Rumexhymenosepalus* polyphenol assisted synthesis provided a mix of cubic facial-centered and hexagonally shaped AgNPs of 2-40 nm of size[127]. The optimized conditions for the fast synthesis of *Cissusquadrangularis* mediated silver nanoparticles [128] are stated to be high pH and temperature. The key cause of the reduction of silver ions to AgNPs was water-soluble organics in plant materials[129]. For AgNPs synthesized with *Prunus armeniaca* fruit extract (apricot) in DPPH and ABTS tests, almost 50 percent free radical scavenging activity was observed [130].

Needle shaped AgNPs with a size of 82.46 nm were obtained from the *Coleus forskohlii* root extracts[131].It has been found that *Malva parviflora* produces monodispersed AgNPs in less time than the *Beta vulgaris*, *Anethumgraveolens*, *Allium kurrat* and *Capsicum frutescens*[132]. Water-solvent compounds such as saponins found in a *Memecylonedule* leaf extract have been shown to be responsible for reducing silver ions under incubation at 150 rpm in a dark

shaker, forming primarily square shaped AgNPs between 50 and 90 nm [133]. Sphere-shaped AgNPs (average size 18.2 ± 8.9 nm) were produced with *Vitex negundo* methane leaf extract and demonstrated against both Gram positive and Gram negative bacteria antibacterial activity[134].

The change in the size distribution and the decreased synthesis of AgNPs in protein deprived fractions indicated that *Chlamydomonas reinhardtii* cell proteins have been involved in the biosynthesis of AgNPs[135]. The extracts from the tissue culture of the marsh plant *Sesuviumportulacastrum* L., extracted from callus and leaves, have been used for agNP synthesis and stabilized by polyvinyl alcohol[136]. The reduction of AgNO₃ by eugenol in the clove extract takes place because of the inductive effect of methoxy and allyl groups in the ortho and proton-releasing-OH Group positions of one eugenol molecule. Following this, the resonant structure develops in the anionic form of eugenol[137].

The heterocyclic polyol and water soluble components present in the *Cinnamomumcamphora* leaf broth are decrease of silver ions[138]. The bifunctional tripeptide (DDY-OMe) in *Chlorella*

vulgaris Asp residues, with one Tyr residue and two carboxylic groups, produces small Ag nanoplates of good yield [139]. Emblica officinalis extract[140] was used to make highly stable silver and gold nanoparticles in sizes 10–20 nm and 15–25 nm, respectively. The removal of the metal ions made easier by the reduction of sugars and terpenoids in the leaf broth Azadirachta indica[141] constituted pure silver, gold, and bimetallic nanoparticles.

7. VARIOUS METHODS OF SYNTHESIS OF SILVER NANOPARTICLES

A variety of methods for synthesizing silver nanoparticles are used. A detailed investigation of the literature discovered various methods of manufacturing silver nanoparticles.

7.1. Synthesis at Room Temperature.

Applying the agntheradentatum, nanoparticles were generated at room temperature within 10 minutes and nanoparticles were shown to have antibacterial activity at a 50 ppm concentration against E. coli, P. aeruginosa, K. pneumonia and E. faecalis [142]. The flavonoids and proteins in the leaf extract from Tephrosiapurpurea are the most important factors for AgNP

formation. AgNPs were found to be 16 nm in size, with the XRD results in good agreement[143]. In 10 min by reducing silver ion by an aqueous extract of *Alternanthera sessilis*, the AgNPs (30 nm) were produced and it was found that the proteins and ascorbic acid are responsible for the synthesis[144].

AgNPs synthesised by using *Mangifera indica*, *Eucalyptus teretikornis*, *Carica papaya*, and *Musa paradisiaca* leaf extracts, at ambient temperatures, resulted in various shapes and dimensions: 50-65 nm (ovular), 60-150 nm (oval), 25–40 nm, and 10-50 nm, respectively (round and irregular)[145]. The total reduction of silver ions by aqueous *Padina tetrastrum* extract was observed at room temperature 72 hours after shaking [146].

In the synthesis of silver nanoparticles 10–70 nm in size [147] environmental benign aqueous extract of *A. dubius* was used as an efficient capping and reducing agent.

Rapid synthesis by a bryophyte, *Fissidens minutus*, of silver nanoparticles was obtained during room temperature [148]. Metallic agnps (10 nm) were produced at room temperature with aqueous sorghum extract within a few minutes [149].

AgNP (20 nm) and hexagonal (10-50 nm) shapes were derived from *Argemone mexicana* extract at room temperature after 4 hours and found to be extremely toxic to pathogenic bacteria and fungi at 30 ppm[150]. Cubic AgNPs 50-150 nm is synthesized by the Aquatic Solution of Silver Nitrate (AgNO_3) using the Eucalyptus Hybrid Leaf Methanolic Extract at ambient temperature[151]. The polydispersed AgNPs (5–30 nm) were produced by reducing the use of *Mentha piperita* silver ions within 15 minutes at room temperature [152].

7.2. Synthesis at Higher Temperature.

The silver ions were reduced to AgNPs by heating for 20 min the root aqueous extract mix of *Withaniasomnifera* and the aqueous $\text{Ag}(\text{NO}_3)_2$ with 60–80 livres C [153]. Comparative studies of several *Amaranthus polygonoides* methods in AgNP syntheses showed higher temperature results in fast synthesis[154]. The visibility of prominent reddish brown color was observed at 60 to C within 20 minutes, indicating the development of Agnihotra with the use of marine *Gracilariacorticata* algae [155].

The reduction capacity of *Cacumen platycladi* to reduce sugars and flavonoids was increased at 90 to C and leads to the formation

of AgNPs (18.4 nm) with a small distribution of sizes[156].

The 0.25 M AgNO₃ solution for Cycas leaf extract solution was maintained on the steam bath for 10 min, developed spherical form AgNPs with a diameter of 2–6 nm[157]. Continuous stirrings of Allium cepa Silver nitrate Extract 50-60 by C resulted in medium-sized AgNPs (33.6 nm), with complete *E. coli* and *Salmonella typhimurium* inhibition at 50 µg/mL [158]. Nanosilver 10–20 nm was developed for 4 h in an oil bath with constant mixing for silver nitrate and latex from *Jatropha curcas* [159]. The temperature increase to 95 pounds C reinforces the reaction of *Magnolia kobus* leaf broth and silver nitrate, which yield agNPs up to 90 percent within 11 minutes [160].

7.3. Synthesis Using Microwave Irradiation

Citrus fruit scales (green, grapefruit, tangelo, lemon and lime), used to synthesize microwave-assisted AgNPs showed orange peel extract to provide silver nanoparticles in 15 minutes compared to other extracts [161]. Sphere-shaped AgNPs of 15–20 nm synthesized with microwave irradiation with *Acacia farnesiana* (sweet acacia), showed a stronger inhibitory activity against *E. coli*, *S. aureus*, *B. subtilis*, and *P. aeruginosa* [162].

Cuminum cyminum seed and silver nitrate solution ratio 1: 10 radiated to AgNP for 120 seconds in a domestic microwave [163]. A microwave-assisted AgNP synthesis was obtained by an extract of *Cymbopogon citratus* at 8.0 pH in 8–10 min when it is irradiated to 90 watts [164]. In order to reduce silver ions to silver nanoparticles, microwave irradiation is best considered. This process produces smaller, uniformly distributed particles [165].

7.4. Synthesis by Sonication.

In comparison to room and higher temperature conditions, rapid synthesis of silver nanoparticles using *portulaca oleracea* was observed in sonication process and found to be less than 60 nm[166]. Due to the acceleration effect in chemical dynamics and reaction speeds, AgNPs derived from *Pisonia grandis* were found to be consistent in sonicity. Ultrasonic energy may have interfered with the chemical synthesis route by producing free radicals[167].

7.5. Light Induced Synthesis.

Poly-dispersed silver pellets 8–10 nm were quickly synthesized with *Cynodondactylon* leaf extract under sunlight from aqueous silver nitrate[168].

Solanum trilobatum Linn extract was used to improve the antidandruff effect against mushroom pathogens (*Pityrosporum ovale* and *Pityrosporum folliculitis*) [15–20 nm] in the sunlight and mixed with shampoo. AgNPs decreased significantly to around 10–50 nm by irradiation of silver nitrate and euphorbia milii solution with xenon lamps after ultrashort laser pulses [170].

8. PHARMACOLOGICAL APPLICATIONS

8.1. Antimicrobial Activity.

The highly powerful antibacterial activity of Silver Nanoparticles synthesized by *Abutilon* indium leaf extract was seen on *Staphylococcus aureus* (16.8 mm), *Bacillus subtilis* (18.3 mm), *Salmonella typhi* (14.5 mm) and *Escherichia coli* (17.2 mm) [171].

The *Ipomea carnea*-AgNPs impregnation with cellulose acetate membrane was structured into a 14 mm area of *Mycobacterium smegmatis* inhibition [172]. *Flavobacterium branchiophilum* was more sensitive than the two other fish bacterial pathogens *Aeromonas hydrophila* and *Pseudomonas fluorescens* [173], shown by the mediated AgNPs from *Boerhaavia diffusa*. ANPs with Lingoberry and Cranberry Juices supported against *S. aureus*, *B.*

subtilis and *B. cereus* have been found to be more active and to be less active in combating *C. albicans* and food borne by *B. cereus*[174].

Inflorescence *Cocos nucifera* was greatly inhibited by the growth of *V. alginolyticus*, *K. pneumoniae*, *P. aeruginosa*, *B. subtilis*, and *P. shigelloides*. Microscopy reveals the binding nature of AgNPs to the bacterial cell wall [175]. AgNPs synthesized with lemon peel extract demonstrated maximum inhibition zone $12 \pm 0.3SD$, $11 \pm 0,5SD$ with *T. mentagrophytes* and *C. albicans*, respectively, and no *T. rubrum* activity[176]. A stronger antibacterial activity against *Escherichia coli* (12 mm) and *Pseudomonas aeruginosa* (18 mm) was observed by Triangular,

Hexagonal and Sphere AgNPs between 78 nm and 98 nm of leaf-extracts of *Caesalpinia coriaria*[177]. *P. oleracea*-mediated AgNPs can result from *C. albicans* and *S. cerevisiae* apoptosis due to the generation of reactive oxygen species and the decreased hydroxy radical development initiated by phytoconstituents capped in synthesized AgNPs[178].

In vivo study of biochemical and histological parameters shows that AgNPs synthesized using *Leucas aspera* have antibacterial effect

on fish models (*Aeromonas hydrophila* and *Catlacatla*) [179]. *Sphaeranthusamaranthoides* synthesized silver nanoparticles have been shown to improve antimicrobial activity as a result of destabilisation of the external membrane, preventing bacterial breathing and depletion of ATP intracellular contributes to denaturation of the cell wall of the bacterial cell. The difference in the inhibition of growth in Gram + V and Gram - V bacteria may be caused by cell membrane permeability [180]. AgNPs synthesized using leaf extract from *vincarosea* showed promising inhibition at 10 μ L concentration of *Staphylococcus aureus*, *Lactobacillus*, *Escherichia coli* and *Pseudomonas fluorescens*[181].

The *Mukiascabrella* synthesized agnetic pathogens *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and *Acinetobacter*, respectively, showed 81.81%, 90%, and 63.23% of antibacterial activity against nosocomial grams. For the AgNPs synthesized with *Citrus sinensis* and *Centellaasiatica* against *Pseudomonas aeruginosas*, the highest zone of inhibition (16mm) was obtained compared to that of AgNPs provided with *Syzygiumcumini* and *Solanum trilobatum*[183]. *Datura alba* (Nees)

leaf-derived silver nanoparticles showed better inhibitory zones (20 mm), and cell deaths are stated to be associated with protein denaturation and bacterial cell wall rupture[184]. *Clostridium diphtheriae* is killed.

AgNPs synthesized using *Solanum Xanthocarpum* berry methanol extract suggest stronger anti-*H. pylori* activity and non-competitive inhibition from Lineweaver-Burk plots [185] have been concluded. *Desmodium triflorum* nanoparticles helped to inhibit growth of *Staphylococcus* and *E. coli* by 62% and 88% respectively at 24-hour concentrations of 14–60 mg/cm³, while 100 µg/cm³ showed almost 100% inhibition[186]. Gelidieleacerosic extract Synthesized AgNPs are highly active in fungal species with a concentration of 50 µL, compared to the normal antifungal agent clotrimazole (187) against *Mucor indicus* (22,3 mm) and *Trichoderma reesei* (17,2 mm)

For *Ocimum sanctum* leaf extract helped AgNPs for *Proteus vulgaris* and *Vibrio cholerae* the maximum inhibitor zones (25 and 27 mm) were observed. The *Vitex negundo* leaf extract nanoparticles showed a minimum rate of inhibition against the abovementioned

bacterial pathogens[188]. Silver nanoparticles with leaf broth *Gliricidia sepium* showed 3 mm of *Staphylococcus* inhibition area and 2 mm with *Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* at concentration of 50 μL [189].

8.2. Larvicidal Activity.

The maximal effectiveness of LC50 values for *Leucas aspera* assisted synthesized AgNPs was 8.5632, 10.0361, 14.4689, 13.4579, 17.4108 and 27.4936 mg/L and LC90 values 21.5685, 93.03928, 39.6385, 42.2029, 31.3009 and 53.2576 mg/L, respectively, against 4th *A. aegypti* instar larvae [190]. AgNPs synthesized with *Drypetes roxburghii* (wall.) showed 100% mortality in second instar *Anopheles stephensi* larvae at 5 ppm and 100% mortality in all *Culex quinquefasciatus* and *Anopheles stephensi* instars, respectively, at double concentrations [191]. AgNPs 25 – 30 nm synthesized with the aqueous *Nerium oleander* leaf extract were shown to have the highest mortality against both larvae and *Anopheles stephensi* pupae [192].

The larvae were exposed to various *Pedilanthus tithymaloides*-AgNP concentrations and demonstrated 100% mortality from the first to the fourth sample and *A. aegypti* pupae after 24 hours. AgNPs have

been detected as a lethal concentration (LC50) of 0.029, 0.027, 0.047, 0.086, and 0.018 percent, without control mortality, for larvae and pupal stages[193]. Significant activity against the vector mosquitoes *A. stephensi*, *A. aegypti* and *C. quinquefasciatus* was reported to be reported for synthesized AgNPs with *Sidaacuta*[194]. The IC50 values for the antiplasmodial activity of the AgNPs synthesized with the use of aqueous Ashoka and Neem extracts are 8 and 30 $\mu\text{g/mL}$ for *Plasmodium falciparum*, respectively[195].

In *Poecilia reticulata* after 24, 48, and 72 h exposure, Vincarosee synthesized AgNPs showed noticeable toxicity, but have a potential to control *A. stephensi* and *C. quinquefasciatus*[196]. The highest larval mortality values of LC50 against larvae and pupae were shown by the *euphorbia hirta* synthesized agnp [197]. The adulticidal and larvicidal operation of *C. quadrangularis* synthesized AgNPs was 100% mortal against *H. maculata* and *R.(B.) microplus*[198]. According to the study, *Anopheles subpictus* and *Culex tritaeniorhynchus* have significant larvicidal activities of synthesized AgNPs using the aqueous extract of *Ecliptaprostrata*[199].

8.3. Anticancer Activity.

Silver nanoparticles synthesized with *Acalypha indica* Linn display a cell inhibition of human breast cancer cells (MDA-MB-231) of just 40% [200]. The 50% viability of MCF-7 cells at 5 $\mu\text{g}/\text{mL}$ for *Dendrophthoe falcata* (L.f) Ettingsh [201] agNPs is lost. Nanoparticles made from *Sterculias foetida* (L.) seed extract demonstrated a cellular fragmentation of the DNA against the HeLa carcinoma cell lines [202].

After 24 h incubation, the *Datura innoxia*-AgNPs inhibited 50 percent proliferation of the human breast cancer cell line MCF7 by stopping cells cycle phase development and reducing the DNA synthesis to inducing apoptosis, at 20 $\mu\text{g}/\text{mL}$ [203]. The cytotoxic tests of *Chrysanthemum indicum*-AgNPs demonstrated no toxicity to 3T3 mouse embryo fibroblast cells at 25 $\mu\text{g}/\text{mL}$ [204].

For AgNPs synthesized using *Phytolacca decandra*, *Gelsemium sempervirens*, *Hydrastis canadensis* and *Thuja occidentalis*, variations in their degree of anticancer activity against A375 skin melanoma cells were observed[205]. AgNPs derived from *Ficus religiosa* were successful in 50 $\mu\text{g}/\text{mL}$ against the mice induced by DAL model (30–35 g) [206]. Dosage-dependent response of silver

nanoparticles synthesized with *Origanum vulgare* to human lung cancer A549 (LD50–100 $\mu\text{g}/\text{mL}$) [207]. Full apoptosis (95%), with 25 $\mu\text{L}/\text{mL}$ *Alternanthera sessile* supported AgNPs for prostate cancer cells (PC3) was observed, whereas a 99% breast cancer cell growth inhibition (MCF-7) was obtained [208].

Albizia adianthifolium leaf extract synthesized agNPs(AA-AgNPs), showed a cell viability of 21% and 73% for A549, and a typical peripheral lymphocyte of 117% and 109% for the exposure to 10 $\mu\text{g}/\text{mL}$ and 50 $\mu\text{g}/\text{mL}$, respectively, after 6 h exposure. This shows that the AgNPs are not harmful to normal PLs[209] cells. A549 cells were obtained at 43 $\mu\text{g}/\text{mL}$ from AA-AgNPs with 50% inhibition cell and induces ROS death resulting in apoptosis[210]. For MCF-7 cells treated with *Sesbania grandiflora* mediated AgNPs (20 $\mu\text{g}/\text{mL}$) after 48h in Hoechst staining, nuclear condensation, cell shrinkage and fragmentation are observing. These modifications suggest that the cleavage of the substrates leads to activation of the DNA repair [211].

There has been a cell death (100 per cent) of HeLa cell line with 100 μg of AgNPs synthesized with *Morinda citrifolia* root [212]. Longer exposures to *Eucalyptus chapmaniana* AgNPs (0.02 mmol/mL)

caused 85% cell death after an incubation of 24 hours [213]. The viability of A375 cells (50 percent) is found at different levels of AgNPs, synthesized by *Phytolacdecandra*, *Gelsemium sempervirens*, *Hydrastis canadensis*, and *Thujaoccidentalis* [205]. AgNPs made of Aloe, Magnolia, and Eucalyptus leaves extracts at 2 to 4 ppm concentrations have been found noncytotoxic to human embryonic kidney 293 cells, as analyzed by automated InQ Plus device[214].

After 6 h of treatment with *Rosmarinus officinalis*-AgNPs 2 mM, the viability of HL-60 cells was reduced to 44% and cell mortality increased to 80% following 24 h of incubation. Cytotoxicity was extremely sensitive to the dimensions of the nanoparticles formed with the herb leaf of *Iresine* and the measurements of viability decreased with increased doses of HeLa cell line [216] (25–300 $\mu\text{g}/\text{mL}$). The synthesis of silver nanoparticles can be caused by piperidin, piperlongumine, and piperlonguminine in *Piper Longum* which have a major cytotoxic effect (94.02%) at 500 $\mu\text{g}/\text{mL}$ on HEP-2 lines [218].

The *Euphorbia nivulia* stem latex capped AgNPs solubilizes AgNPs into water and serves as a bio-consistent vehicle for carrying

nanosilver to human carcinoma (A549)[218]. Aloe Vera-conjugated AgNPs treated with HRDF cells were not shown to be cytotoxic, but have good antibacterial activity in *E. coli* even at very low levels[219].

8.4. Wound Healing Activity.

The bacterial growth of *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* has been impeded by silver nanoparticles synthesizing in situ in a network of peptide fibers using UV radiation. AgNPs containing HDFa cell hydrogels showed no substantial cell viability influence[220]. AgNPs extracted from the extract root of *Arnebianobilis* for wound healing in the excision animal model have beneficial effects on the antimicrobial ability of the animals and have provided a novel therapeutic guideline for the treatment of wounds in clinical practice[221]. *Indigoferaaspalathoides* mediated AgNPs were studied after an excision in animal models for wound-healing applications [222]. AgNPs extracted from *Chrysanthemum morifolium* applied to a clinical ultrasound gel used on an ultrasound probe showed a bactericidal behavior that contributes to the instrument's sterility[223].

In the in vitro analysis of the Acticoat Flex 3 dressing based on AgNP, it was found that agNPS significantly reduce mitochondrial activity and cellular staining techniques display nuclear integrity with no signs of cellular death[224].

Applying it to a 3D fibroblast cell culture and to a real partial burning patient. AgNPs lead to the distinction of fibroblasts into myofibroblasts, thus improving the effectiveness of wound healing[225]. The decrease in wound inflammation with regulation of liver and kidney functions was observed during the skin wound healing with its antimicrobial properties as the positive effects of silver nanoparticles [226]. AgNPs play a role during wound healing in dermal contraction and in epidermal reepitheliation, thus leading to an increased wound closure rate[227].

AgNPs made extracellularly with the fungus *Aspergillus niger* are reported to modulate cytokines involved in the excision rat model wound healing [228]. An average 3.35 days reduction was observed in wound healing for the agnp integrated into the cotton fabric and dressings and also improved bacterial clearance from contaminated wounds without any adverse effects[229–236]. Silver nanoparticles

have antimicrobial properties that reduce the inflammation of wounds and modulate fibrogenic cytokines[19].

8.5. Medicinal Textiles and Devices.

AgNPs made from cotton cloth, synthesized by *A. dubium* and transpiratory pad samples showed high resistance to sweat bacterium *Corynebacterium*[237]. Antimicrobial activity against *Pseudomonas aeruginosa* has been shown by the antibacterial activities of gauze cloth discs incorporated in AgNPs formed by green mature thalli *Anthoceros*[238]. The minimum bactericidal concentration for *Escherichia coli* BL-21 strain exhibits curcuma longa tuber powder capped silver nanoparticles at 50 mg/L. The immobilization of cotton cloths with sterile water has shown improved bactericidal efficacy compared to immobilized polyvinylidene fluoride cloth [239]. The introduction of *Azadirachta indica* into cotton fabric contributes to antibacterial effects against *E. coli*[240].

9. MISCELLANEOUS APPLICATIONS

Manilkarazapota extract mediated agnp synthesis and exhibited acaricidal activity with *Rhipicephalus microplus* at LC50 3,44

mg/L[241]. AgNPs synthesized with the extract of *Jatropha gossypifolia* demonstrated higher levels of amebicidal activity against *Acanthamoeba castellanii* [242]. The nonlinear coefficient of refraction and absorption of AgNPs synthesized using the Z-scan technique, with the ns laser pulses, was superior to the optical nonlinearity compared to the *coriandrum sativum* extracts synthesized using other methods [243].

9.1. Water Treatment.

Stable agNPs synthesized using the *Anacardium occidentale* fresh leaf extract in tap water at 80 to C bud as a novel sensing probe [Cr(VI)] for chromium ions[244]. Bacteria decreased when 100 mL of water was treated after 6 h and increased when the concentration of silver nanoparticles made with *Prosopis juliflora* leaf extract (10 mg) increased with increasing incubation times [245].

9.2. Catalytic Activity.

In reducing Methylene Blue (MB) by NaBH₄, the size depends on the catalytic activity of the synthesized AgNPs using *Kashayam*, *Guggulutiktham* [246]. In contrast to glassy carbon and metallic Ag electrode, *Acacia nilotica* pod mediated AgNP's edited glassy carbon

electrode has demonstrated higher catalytic activity in reducing benzyl chloride[247]. Spectrophotometrically, photocatalytic degradation of methyl orange has been calculated using *Ulva lactuca* synthesized AgNPs under visible illumination as a nanocatalyst [248]. The synthesized AgNPs with *Gloriosa superba* extract work through the effect of electron relays and effect the degrade of methylene blue at the end of the 30 minutes [249]. The excellent catalytic activity of polydispersed silver nanoparticles developed using *triticumaestivum*(khapalighahu) extracts[250] is rapidly reduced by hydrogen peroxide. The reduction in the presence of *BreyniaRhamnoides*-AgNP and NaBH_4 from 4-NP to 4-aminophenol (4-AP) is performed effectively and has been determined to rely on the size of nanoparticles or the stem extract concentration[251].

10. RECENT TECHNIQUES IN THE SYNTHESIS OF NANOPARTICLES

10.1. Pulsed Laser Ablation Techniques.

Compared to other physical and chemical techniques, it is a basic technique used in the production of nanomaterials such as noble metals, alloys, oxides and semiconductors. This approach

focuses on the surface of the target material submerged in the Liquid, and the production of a pulsed laser (nano, pico, or femto second). Pulsed laser ablation in liquid (PLAL) is characterized primarily by the development in one stage of well described nanoparticles without any subsequent thermal treatment [252–254].

Scale of agNPs of between 15.1 and 4.3 nm were synthesized with a laser removal of the Ag target from deionized water at a relatively high laser fluence of 15 J/cm², which increased linearly with a rise in the thickness of the water layer and a maximum value of 14 mm [255].

AgNPs were developed by means of a removal of a pure Ag plate for 30 minutes using A Q-Switched Nd: YAG pulsed laser ($\lambda = 532$ nm, 360 mJ/pulse) in the organic compound (ethylene glycol) and biopolymer (chitosan), respectively[256]. For the synthesis of AgNPs (6–12 nm), laser ablation was used for high pure silver bulk in distilled water by maximizing the effect of laser fluid[257].

Fragmentation of AGNPs was shown to be highly efficient at 355 nm Laser Light absorption, synthesizing the ablation by laser (Nd: YAG, $\lambda = 1064$ nm) of a silver target immersed in different NaCl

solutions as well as the water concentration showed[258].

11. CONCLUSION

The above overview covers the numerous methods for the synthesis and range of applications of silver nanoparticles. The analysis highlights plant-assisted synthesis research work on AgNPs, an emerging area in the field of nanotechnology. The steady rise in publications on the above-mentioned subject was discussed in the interests of future researchers. With these exotic silver nanoparticles, new insights into pharmacological applications such as anticancer, larvicidal, medical textiles and equipment are gleaned. These biogenic silver nanoparticles would therefore make a major contribution to the field of bionanomedicine.

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Chapter –XXXVIII

38

MACHINE LEARNING FOR CYBER SECURITY

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ABSTRACT:

Cybercrime proliferates anywhere targeting all forms of computer weakness. Ethical hackers pay greater attention to vulnerability assessment and propose mitigation methodologies. In the field of cyber security, the development of successful techniques has become an urgent demand. Cyber security machine learning has become a major concern lately because of the usefulness of machine learning and deep learning in cyber security problems. Machine learning methods have been used in computer security problems, such as intrusion detection, malware recognition and detection, spam detection and phishing detection. The ever-changing nature of cyber threats continually challenges researchers to investigate with the perfect combination of profound knowledge of cyber security and data science. In this paper, we present the latest state of the art computer apps and their cyber security potential. An study of machine learning algorithms is provided for most common cyber security threats.

Keywords: Cyber security, Malware detection, Machine learning, deep learning.

1 INTRODUCTION

The cyberspace has been a centerpiece for the creation of cyber attacks since the advent of Internet technology. Technological advancements further allow hackers to discover vulnerabilities and develop viruses and malware that constantly threaten the cyber security industry. Cybersecurity requires safe computer and communication environment with the right innovations and processes to guard against attack, unauthorized access, alteration or annihilation of PCs, systems, projects and knowledge.

These frameworks are composed of network protection and host security systems with firewalls, virus detection softwares, etc. Machine training has proven itself able to solve the most common problems in various fields such as image processing, health applications, physical science, computer biology, robotics, financial predictions, audio processing, medical diagnostics, video processing, and text processing[1]. In particular, machine learning methods are often used to create efficient solutions effectively in the field of cybersecurity.

Machine learning has excellent potential and is thus an effective method for defenders in the detection of different forms of cyber-attacks. ESET carried out a survey on machine learning, in which 80% of participants claimed that machine learning would help their organization detect and react more quickly to threats[9].

2 MACHINE LEARNING TECHNIQUES:

2.1 Regression:

In regression, a dependent function is calculated by learning from current information related to past events and this knowledge is used to manage new events on the basis of the values of the independent features. Fraud detection can be resolved by regression in cybersecurity. Once a model is learned from the previous transaction database, it identifies fraudulent transactions, based on observed features of current transactions.

Machine learning provides linear regression, polynomial regression, vector support machines, decision tree, random forest and other regression analysis approaches. VenkateshJaganathan[2] et.al used many methods of regression to predict the effect of attacks. You have used the Overall CVSS (Common Vulnerability Scoring

System) value as a dependent variable and the X1(number of vulnerabilities) as two independent variables (Average Input Network Traffic). For IoT safety accidents, DariaLavrova[3] et.al suggested a multiple regression model. They could find known and unknown attacks with this technique.

2.2 Classification:

Classification is another commonly used supervisory teaching job. In cyber security, the ML-based classifiers effectively perform spam detection and discriminate against specific e-mail messages as spam or not. Spam filter models can distinguish spam from non-spam messages. Logistic Regression, K-Nearest Neighbors, Vector Support Machine, Naïve Bayes, Decision Tree, and Forest Classification are machine classification learning techniques. The broad range of historical data available on labels has made deep learning classification models involving Restricted Boltzmann Machines (RBM), CNN, Recurrent Neural Networks (RNN) and Long-Short Term Memory (LSTM) cells more effective for the resolution of complex tasks with feature extraction and a densely linked neural network. The applicability of the aforementioned monitoring machine

learning techniques is dependent on the availability of massive data collection.

2.3 Clustering:

Both regression and classification are supervised learning models, which include labeling data. Clustering is an unmonitored learning model that draws general patterns from the data even if the data are not named. Groups of related events are a cluster because they have common characteristics that form a particular pattern. Clustering can be used in cyber protection for forensic research, identification of anomalies, analysis of malware, etc. Some of the techniques used in cyber security are K-means, KMedoids, DBSCAN, Gaussian Mixture Model, Agglomerative clustering and ML-clustering. Self-organizing maps (SOMs) based on the neural network can also be used for clustering.

3 CYBER SECURITY ISSUES:

The four major areas where Machine Learning algorithms play a crucial role are Intrusion Detection Systems, Malware analysis, Mobile (Android) malware detection and Spam Detection.

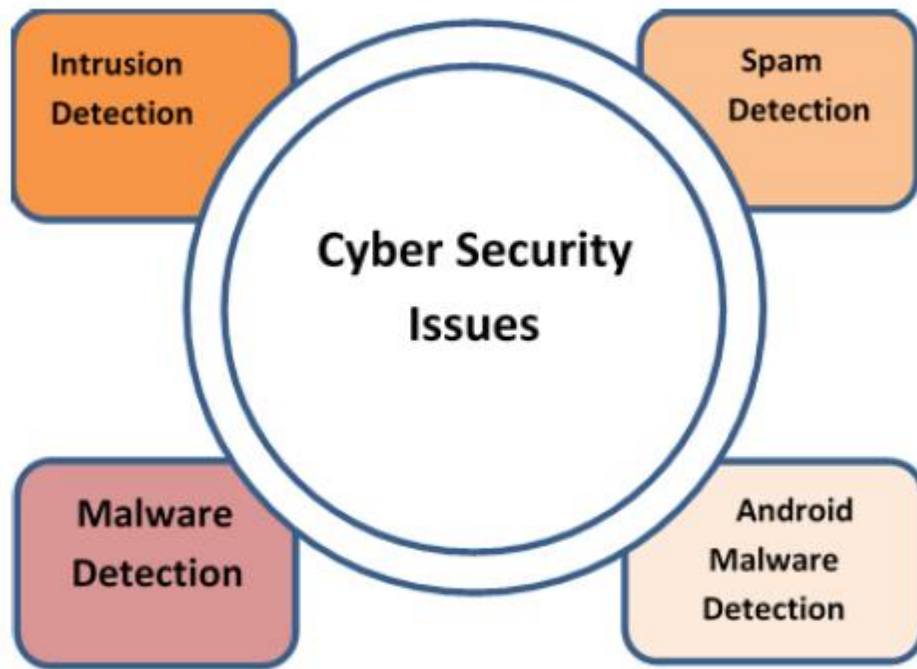


Figure 1: Cyber security issues

3.1 Intrusion Detection:

Intrusion detection systems appear when secure information is compromised by malicious software or policy violations. Intrusion can be observed in a variety of ways. The methods are usually known as either signature or anomaly-based. All packets are contrasted with the signatures of established malicious threats in the signature method. Network traffic is controlled against a defined baseline of normality with the anomaly approach. Saroj Kr. Biswas [4] has shown that techniques focused on machine learning have a significant role to play in a successful intrusion detection system.

A mixture of feature selection methods was used and good results were obtained. R. Vinaya Kumar [5] et.al proposed the framework to evaluate network, host level operations, and scale-hybrid-IDS-AlertNet system. This model was developed by deep neural networks (DNNs). They developed a scalable architecture focused on large-data approaches and the computer platform for Apache Spark cluster. Different experiments were carried out using DNNs with age 1000 and learning rates from 0,01 to 0,5 on various publicly accessible data sets such as CICIDS 2017, KDDCup 99, UNSW-NB15, NSL-KDD, WSN-DS.

Traditional machine learning algorithms were also used for comparisons. The Deep Belief Networks for Intrusion Detection, which Md.ZahangirAlom [6] suggested, were compared to the SVM. The characteristics are extracted from the training collection with a two-layer Boltzmann restricted machine (RBM). The IDS based on deep belief networks could exceed the SVM model and achieve a precision of 97.5 percent. J. Kim[7] et.al used KDD Cup 1999 dataset, a particular form of recurrent neural networks known as the LSTM model for the IDS training.

They examined the effect on the attack detection rate of learning rate and the number of neurons in the hidden layer. They carried out multiple experiments with different learning rates and hidden layer sizes and achieved 98.88 percent detection rate. Anna L. Buczak et.al [8] claimed that data (pcap, NetFlow or any other network data) play an important role in the application of the ML/DM intrusion detection approach.

They also noticed that the availability of branded data is somewhat different. N. Shone[10] et.al proposed an intrusion detection network operating deep learning model with the combination of ML and DL approaches. You also suggested a non-symmetric deep autoencoder (NDAE) for the NSL-KDD datasets KDD Cup '99.

3.2 Malware Detection:

Malware is coined from "software malware," in brief, is a particular category of software for cyber threats. It is usually used for illicit activities such as robbing data or bypassing access controls, or damaging the host machine and so on. The word malware is widely used for different forms of malicious programmes, including viruses,

Trojan horses, worms, bugs, adware, bots, rootkits, spyware, Ransomware, keypads, backdoor, etc. Each of these forms of malware has many families. For instance, ransomware can be classified as the family of Charger, Jisut, Koler, Pletor, RansomBO, family of Svpeng, Simplocker, etc. These malicious programs can be embedded in various formats such as UNIX ELF files, windows PE files, and (Portable Executables with .exe, dll, efi.). Document malware programs may be incorporated into.doc,.pdf,.rtf files. Malware can also be used as extensions and plug-ins to common web browsers and software platforms.

The malware classification and detection scheme based on the ngram method was introduced by Dolly Uppal[11] et.al. They have used a pre-modeled program to monitor sample execution and recorded API calls.

After the feature vector was created, different machine learning algorithms were applied and the best results were achieved with the SVM classification. MozammelChowdhury [12] et.al suggested a malware detection neural network approach. The PE headers were extracted using the n-gram method and experimented with the

expanded collection of features and achieved 97% accuracy with ANN. In a different perspective, Bowen Sun [13] and.al suggested a malware classification model using static features. In 3 viewpoints they extracted static features, including PE features, bytecode and assembler code features.

They compared the performance of eight classifiers, the best of which produced an output of 93.56 percent. Mahmoud Kalash [14] and.al have suggested a CNN classification for malware. They represented 25 families of malware binaries in gray scale and used CNN for classification. They experimented with two well known data sets — KeepMaling' and KeysMicrosoft'— and announced that the accuracy of both datasets was 98.52 percent, 99.97 percent, respectively.

3.3 Android Malware Detection:

Android is the most popular mobile platform and is therefore highly targeted by developers of mobile malware. As the number of android malware types increases every day, detecting and classifying mobile malware variants is increasingly difficult. Researchers make a variety of attempts to detect smartphone malware.

On static features of Android applications DroidMat [15] applied k-means clustering and K-NN algorithms. Applying computer algorithms like SVM, Random Forest, K-NN, Naive Bayes and Decision Trees, Arp et coll. [16], Varsha et al. [18], Sharma and Dash [18] have extracted static features from the Android apps and have achieved good results. AntiMalDroid[19],Droid Dolphin[20] applied vector support machines to dynamic functions removed from malware apps (logged sequence of behaviors as features) and achieved good accuracy.

A multilevel classification fusion approach for Android Malware Detection is proposed by Suleiman Y. Yerima [21] et al. They suggested four algorithms based on accuracy, reminder and accuracy. They merged 4 classifiers to achieve a better detection rate on the basis of their ranking algorithms. Their model performance was assessed using three datasets and their retrieval rate was good.

3.4 Spam Detection:

Spam identification is also one of the greatest cyber security issues. Spam is an unwanted bulk message that is commonly used for ads. Spam usually means e-mail spam, but it may also be a post

on social networking sites and other blogging channels. Spam messages waste a precious amount of time. Often users receive spam mails which are disguised as a genuine message from a bank to trap users. Answering such spam messages can cause severe financial loss. Many researchers have implemented machine learning techniques for spam detection. Muhammad N. Marsono[22] et al used a technique for Naïve Bayes' classification to identify spam messages between incoming emails and achieved good results.

The K-NN model was implemented by James Clark [23] et al. for automatic email classification. Jancy S. The hybrid spam detection system based on the classification Naive Bayes and Markov Random Field approach was proposed by SickoryDaisy[24]. They assessed their model on the basis of their accuracy, time usage, and argued that the hybrid solution performs better than the basic procedures. SreekanthMadisetty [25] et.al suggested a spam classification model ensemble on Twitter.

They have created profound models of learning based on CNNs. They inserted various word inputs into numerical form before training the CNN model in textual form.

For word embedding and one feature-based model for spam detection, the user used 5 CNNs (CNN + Twitter Glove, CNN + Google News, CNN + Edinburgh, CNN + H Spam, CNN + Random). Mehul Gupta [26] and.al compared different machine learning and SMS detection deep learning strategies on two different datasets.

The results of 8 different classifiers were compared and showed that CNN Classifier achieved the accuracy for both datasets of 99.19% and 98.25%. Figure 2 provides a summary of algorithms for machine learning to solve different cybersecurity problems.

While most of the researchers used all the algorithms for all four cybersecurity problems, we did sum up only suitable cyber security models. Intrusion detection can be solved with good techniques of selection and deep learning models such as recurring neural networks (RNNs).

Malware detection (PC) can be effectively solved by ANNs and CNNs. Samples of malware are first converted to images, then CNN is applied. Small machine learning algorithms and various fusion models can solve Android malware detection. Small computer models such as Naïve Bayes and K-NN models and profound educational

models such as CNN can efficiently handle the identification of spam.

	<i>Cyber security issue</i>	<i>Proposed Approaches</i>
Machine Learning for cyber Security	Intrusion Detection	<ul style="list-style-type: none"> ○ Feature selection techniques and ML [4] ○ Hybrid-IDS-AlertNet system (DNNs)[5] ○ Deep Belief Networks [6] ○ Recurrent Neural Networks [7] ○ Non-Symmetric Autoencoder [10]
	Malware Detection	<ul style="list-style-type: none"> ○ N-gram method [11] ○ Artificial Neural Network (ANN)[12] ○ Static features extraction and Linear classifiers [13] ○ CNN on malware images [14]
	Android Malware Detection	<ul style="list-style-type: none"> ○ Shallow machine learning algorithms on static features [15],[16],[17],[18] ○ SVM on dynamic features [19],[20] ○ Classifier fusion [21]
	Spam Detection	<ul style="list-style-type: none"> ○ Naïve Bayes [22] ○ K-NN [23] for automated email classification ○ Naïve Bayes & Markov Random Filed [24] ○ Ensemble model (CNN+Word Embeddings) [25] ○ ML & DL models [26]

Figure 2: Machine Learning for cyber security

4 CONCLUSION

Machine learning methods are commonly used to solve different forms of cybersecurity problems. Advances in machine learning and in-depth learning have promising solutions to cyber security problems. However, it is necessary to identify which algorithm is appropriate for which application. To retain the solution resilient against malware attacks and reach high detection rates, multi-layered approaches are essential.

The selection of a specific model is an important factor in the resolution of cyber security problems. In this paper, the authors examined state-of-the-art cyber security mechanisms. It is not necessary to overestimate the autonomous capacity of machine learning and deep learning algorithms. The combination of human oversight and machine learning technology leads to the desired cybersecurity goals.

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Chapter –XXXIX

39

SYNTHESIS, CHARACTERIZATION AND APPLICATIONS OF COPPER NANOPARTICLES

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ABSTRACT: -

The research article provided a more complete review-based investigation on the ways to fabricate copper nanoparticles (CuNPs). Nanoparticles have found applications in a variety of present-day businesses and techniques of synthesis are highlighted. The synthesis of the nanoparticles has been categorized according to where they originated as physical, chemical, or biological. In addition to synthesis, the CuNPs are defined by their XRD, IR, and TEM characterization. a variety of studies that have reviewed physiochemical properties like TG, WAX, and EDAX have been performed By using the XRD and electron diffraction, copper clusters are discovered. Applications in the chemical, physical, as well as in the biological are thoroughly discussed in this essay.

Keywords: Nanoparticles; Copper; Antimicrobial; semiconductors; Catalysis.

1. INTRODUCTION:

One of the main areas of use for nano particles is in technology. In general, chemical composition, scale, shape, and physical structure have a significant impact on the electronic, optical, and catalytic properties of nanoparticles. If you make the nanoparticles from plants, it is possible to sustain cell culture for a longer period of time with much lower cost and additional benefits. tube (such as carbon nanotubes, also known as single- and multi-walled carbon nanotubes) have an incredibly large range of size from 1 and 100 nm and are covered by an interfacial layer.

In this configuration, the organic molecules, inorganic molecules, and ions interact with one another in a natural way. This coating of organic molecules is generally known as a "stabilizer." Although biologic macromolecules interact with all other molecules, it is estimated that only 7 nanometer particles could be used as a cure for cancer. 8 The category of nanoparticles is dependent on their structure: single, two-dimensional, and three-dimensional. The above examples of classifications are sensor units, carbon nanotubes, and Quantum Dots. 9

2. METAL NANOPARTICLES:

The size, shape, and form of the nanoparticles can be precisely determined by well-defined polymers such as dendrimers. 10 Nanoparticles of metal are most often used in catalysis, magnetism, magnetics, and optics. farms had hired laborers for the day when we arrived, but the buildings and machinery weren't in service; 6 remained vacant; of the original ten, seven have been up and running; and running, but four are not; and six have been built; Six of the original seven companies had hired employees for the day when we arrived; four have been in operation while the others have been constructed.

3. MAGNETIC NANOPARTICLES:

As the nanoparticles are under 5 to 500 nm in diameter, they can be used for their catalytic qualities. The uses for which magnetic resonance imaging (MRI), tumescent specific targeting, Nanofluidics, and cation sensors and environmental remediation are applied include biomedicine, Magnetic Resonance Imaging (MRi), and locating specific tissues, and remedies, respectively. Modifying the magnetic fields can affect them. On average, this alloy customarily

accommodates two components: both chemical and magnetic inclusions are found in it. 14

4. ATTENTIVENESS TOWARDS COPPER NANOPARTICLES

The CuO particles engender apoptosis, both of which have an effect on the proliferation of HeLa cells (cervical cancer cells). HeLa cells show some cytotoxicity in response to CuO NPs As a result of its physical and chemical properties, it is widely used in a wide range of applications. Since they are inexpensive, they have a big effect on electronic circuits. Copper nanoparticles have a high surface area to volume ratio, and are thus capable of interacting strongly with other materials Both the kinase and the phosphatase operate as receptors, catalysts, and anti-toxins over the long term.

Thanks to their minute size, the copper particles were able to penetrate thick bacterial cell walls, making bacteria like E.coli and S. aureye-infected completely incapable of working. 16 Using nanoparticles of copper, engineers discovered remarkable properties in catalysts, lubricants, and thermal transfer fluids Nano-fluids and in lasers, CDs, DVDs, and fiber optic applications In principle, it's simple to produce copper nanoparticles of different sizes.

Some of them use polyol reaction, supercritical CO₂ decomposition of organometallic precursors, and water/oil microemulsion techniques. When fabricating nanomaterials, including single-walled carbon nanotubes, 22-25 copper particles can be used as a catalyst. It has an incredible antifungal and antibacterial ability. If his mask does not mislead, his insults will; if his pronouncements are not audacious, he will be inclined to foul up; if his theories are not incorrect, he will be most malignant; if his analysis does not deserve praise, he will be vindictive; if his arguments are not in doubt, he will be inaccurate; if his thesis is false, he will be inexact; if his conclusions are not creative, he will be obstructive.

The plasmon peak of the nanoparticles of copper was calculated to be about the wavelength of 570 nm. 29 Copper nanoparticles can be produced in a variety of different forms, including photochemistry, wet chemical reduction, and electrode discharges that take place in an a solution of electrolysis. Should a physician reveal some medical results which may lead to his patient's death with someone who has the capability of re-stating these facts?

For example, a revelation that the patient has only two weeks to live? Or should he withhold this knowledge from others who could steal it or publish it to it, who do little to support the patient's well-being? The morphology, scale, surface charge, and the fact that they are nanoparticles are present on the surface of the particles are being studied. This research is done using cutting-edge techniques such as SEM, AFM, and TEM (TEM).

The distribution and the number of charge on the particle both affects the overall physical stability, as well as the size of the particle. An electron microscope is used in the study of nanoparticles, as well as their scale, form and shape morphology. 35 For a variety of different applications including vaccine delivery, nucleic acid, peptide, and peptide, the copper nanoparticles are used, including modulation of gene expression, internalization, and mutation-specific RNA efficacy. 35

5. ORIGIN:

Such molecules may have antimicrobial properties, but it is only on the Nano scale that is detectable, which means they occur in very small quantities.

The most important feature of copper nanoparticles is their antimicrobial qualities, and this has been found to be particularly true for these particles. They function as an antimicrobial because of their leaching action. 36 The nanoparticles can be formed, for example, when the compound water or air reacts with the wire, such as when copper is exposed to oxygen or to deoxygenated. 37 Regardless of the techniques used, at present, copper nanostructures still cannot be used on a wide scale. This can be accomplished using a facile reduction process. 38

6. TYPES OF SYNTHESSES:

BIOLOGICAL SYNTHESIS:

It is possible to combine copper nanoparticles with low volatile acrylic monomer and disperse them using ultrasound, and copolymerize them to a mild adhesive. Upon application of the ultraviolet light, acrylic functionalized copper particles are synthesized, which are dried under a vacuum to create acrylic-coated copper nanoparticles. 39 Copper nanoparticles can be produced in a single reaction in the reduced form using the stabilizing agent Hydrazine and the reducing agent Psidiumguajava leaf extract, which

is microwaved. A basic solution of copper sulfate with hydrazine hydrate is combined with the extract and stirred for two minutes to maintain a pH of 5. Changes from yellowish-grey to bright green following exposure to the solution to microwave energy for two minutes. The transformation from orange to brick red takes place when CuPS is created. 40 Copper in vivo can't efficiently be delivered because of low biocompatibility. we have found a way to solve this by using biodegradable copper-tolerant bacteria like the microorganism isolated from a copper mine.

This microorganism resisted copper ion concentrations up to ten milliemes. The culture is centrifuged, the biomass is then separated, and the supernatant is then placed through a spin filter to eliminate additional smaller particles. The filtrate is calibrated, filtered, and incubated to acquire the Nano-particles. 41 To manufacture CuNP templates, a precise template design and screening is needed. Nano-partic copper ribbons can be synthesized by making hairpin DNA, with a prototype of poly T DNA, and then synthesizing ribonucleic double-helix.

This solution is made nonhairpin by combining it with an equimolar volume of MOPS (4M). The solution is prepared by adding ascorbic acid to the CuPs, then incubated for several hours. 42 Only in one step using green synthesis methods can copper nanoparticles be formed. An incubation is accomplished by having an *Impatiens balsatum* leaf extract mixed with copper sulfate solution and taking the time to record absorption spectra of the resulting solution at set intervals.

With red colour to emerge, it is a sign that copper particles are forming. 43 Isolating the endophytic microorganisms from seaweed extracts When the actinomyces have been properly synthesized, they must be isolated and centrifuged. This method involves mixing the supernatant with copper sulphate and leaving it in a mixer overnight. They are distinguished and assessed for their anti-microbial capabilities. 44

Nanocoatines can be synthesized by combining the copper chloride solution with the reactant and refluxing the mixture to inhibit growth of Gram (+) and Gram (+) (-). 45 A metallic cupric solution, also known as cupric acetate.

It can be made by combining 0.001 milliliters of syngium solution with 1000 ml of eco-friendly water. Since copper-nickel nanowohlite complexes form a pale green, the coloration changes from blue to pale bluish green reflects the formation. They are further processed by running at 10,000 revolutions per minute. the synthesized nanoparticles have the property of possessing high zeotropic stability 46

7. CHEMICAL SYNTHESIS:

2-ethanol reduction gives hydrazine hydrazide and copper (II) acetate as the product. "Breathable" encapsulation is done in an inert environment. For synthesizing CuNPs, the process is the same as with water as the use of a solvent. 47 It is possible to generate nanoparticles from carboxylic acid copper chloride (CHC) by two methods:

Reduction process, centrifuged, cleaned, and dried in a vacuum Can be achieved using a sonochemical process in which CHC is irradiated and then spun in a centrifuge, afterwards subjected to ultrasonic washing and drying Nano-composite development includes the use of polyamide (about three to ten nanometers in

thickness) A polyamide is treated with copper ions in a hydrogen atmosphere 49 modified flame spray can be used to synthesize copper naphthenol Fine black colored nanopores are formed, and then removed from the solution using glass filters. 50 Aqueous-phase poly(N-vinylpyrrole) (P) can be used in a sonochemical way by using a sonolysis catalyst with copper nanoparticles (Haas et al., 2006).

Alumina, which is used to fortify copper nanoparticids, can be synthesized aerographically. Aluminium oxide and copper(II) acetyl acetate are stirred together to create an aerogel. drying yields finely-dispersed nanoparticles of this aerogel 52 0.6.2 moles of copper (II) in 60 mM 1,2-hexanediol to obtain 20 mL of the resulting solution Lithium mixture is heated, the capping agents are allowed to cool, and then solubilized. The solvent was drained, then the Nanopart was washed and dried. Further work was performed on the yield of the nanoparticles. 53 The precursors of copper (II) acetate in a thermally decomposed state can be used to prepare copper (II) acetate nanoparticles and Nanodrast. As exchange of ligands is carried out, Nano-stable particles have been shown to have low dispersion and stability. 54 copper oxide-water adhesion

To fabricate nano-fluid, CuO nanoparticles can be prepared in an SDR. Reactants like sodium carbonate and copper (II)sulphosphate continuously give rise to nano-particles which then undergo calcination at 500 C to form a clay-like compound which, when it cools, goes on to form copper oxide or Copper Complex. 55

The ablation yields 532 and 1064 nanometer nanoparticles. NPs are available in aqueous ligand solutions, either in water or acetone. 1, 10-phenline and 4,40-bipidine can be adsorbed on the metal N atoms. 56.

It is possible to synthesize copper nanoparticles by adding gelatin while reducing the CuCl₂ to the solution 10% of gelatin is blended with a solution of 0.1% CuCl After milli-Q water is applied, the gelatin solution becomes viscous, and copper chloride is distributed evenly in the mix, the concentration of the copper salt solution is 5.0 mM. Ammonia concentrations are reduced by a few drops and the colour of the solution changes from green to blue. This synthesis is then completed by adding 5.0 M hydrazine, capped, and left undisturbed. 57

While acacia gum can be used as a colloidal capping agent, hydrazine hydrate is used to prepare a reducing solution and copper sulphate is used as a copper precursor, in aqueous solutions the development of colloidal particles can be accomplished by using hydrazine. 58 The solution of copper sulfate is copper applied to an aqueous. The combination of ascorbic acid and PVP were found to be useful as an additive for reducing agent and surfactant.

The three preparations are thoroughly mixed together, and the particles generated by a magnetic stirrer are allowed to settle. The dispersion of copper sulfate ascorate in as well as reduction results in the formation of nanoparticles.

Thus, the synthesis of water-stable colloidal nanoparticles is defined in this report. 59 The modified polyol process can be used to produce copper nanoparticles. Because of this, they have strong anti-oxidation properties. There is L-ascorbic acid, copper(II) hydroxide and PEG-2000 for the precursor, reductant and protector. 60 When copper nano-cyanate is synthesized, it is generated by combining graphite and methanol dissolved in acetic acid.

The resulting solution was dehydrated in a hydrogen atmosphere and dried in the presence of acetone, deionized water, and distilled using a rotary evaporator under a vacuum. 61

The copper nitrate/hydrazine complex (high ratio) can be formed at room temperature with a high metal CuP solution that has a relatively low iron concentration. As the suspension turns yellow, the substance is now starting to nucleate copper particles. 62 1-step preparation of copper nanoparticles can be carried out as follows: Copper chloride is added to an a 1% copper sulfate solution dropwise with deionized water and allowed to stir for some time before reacting. The color of the solution changed from yellow to orange to illustrate the development of copper Nanoballs, indicative of the fact that copper ions have formed. 63

Copper nanoparticles can be synthesized in a flow and flow tube reactor. Appropriate reducing agents are selected and their consequences discovered. Very little formaldehyde is needed for the production of Cu NPs using supercritical hydrothermal processes. 64 Bio option water, copper sulfate pentahydrate, and nitric acid are employed as carbon sources, as well as a metal catalyst, and

deionization is used for purification. Copper sulfate and distilled water are first heated, stirred and subjected to thermal treatment to argon, where the particles are cooled and sintered. Encapsulated CuN were created using the Kraft Lin synthetic method 65 or a chemical methods are used to synthesize a copper foam in which AEROS (A) are utilized strong reductants, including sodium Bisulfate, are mixed with water Decomposition yields copper nanoparticles 66

Copper Nano-particles have shown to be conductive. by photolysis of copper(II) acetate photocatalysis a film could be made. Many recent studies show that the high electrical conductivity and metallic luster of CuNP are unavoidable during successive deposition. For several films, decomposition occurs when they are exposed to the sunlight. 67 and the reducing agent, a reagent copper (II) acetate is placed in a beaker, and a chemical called thioamide is added.

The resulting solution is allowed to stand until the desired concentration is obtained. Carbon-dioxide nanoparticles start to expand and can be stirred with a bit of CuSO_4NO_3 solution, and as

the suspension grows, they are placed in an Erlenmeyer flask with an appropriate for magnetic stirring. as a consequence, a CuS nanoparticles are formed on the carbon. 68 The octadecyl reducing method yields nanoparticles in a colloidal state, with octine as the stabilizer. Copper ions are reduced with octadecylene and ODS is allowed to be added to the solution in the reactor at room temperature.

The color of the solution turns to black because copper nanoparticles have formed. 69 In this process, CuO nanoparticles are synthesized as follows: Nanopaline nanoparticles are made in a centrifuge using 1000rpm of colloidal copper and hydrated. It is possible to produce metallic bismuthinite (copper(II) bimate) nanocomposite by the following process: Initially, the $\text{Cu}(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$ solution was mixed and stirred along with a quantity of nitrate and phosphate solutions.

Any time after this, the precipitation of the ammonium hydroxide is given an electrolytic bath, it is exposed to three electrodes and then it is placed on a glass carbon electrode where the nanoparticles are formed (GCE).

An easily and inexpensive method of making copper nanoparticles utilizes stabilizing them in polyvinyl alcohol. Nanoparticles exist in two forms; (i) in the form of a gel, (ii) as a flexible plastic. The L-histidine can be synthesized using Cu^{2+} and acetic acid, followed by magnetic stirring. If ascorbic acid is used as a reducing and protective agent, fluorescent Cu^0 can be synthesized at low cost. 74 like caripápeo papaya leaf extracts, and Cu^0 and Cu^0 and NO_2^- are employed as reducing agents conditions have been developed to produce small size metallic (Ag) nanoparticles 75

Since nanoparticles of copper are synthesized in a fluoropolymer matrix, Plasmonics maintain their qualities by keeping their properties from being diminished by contact with metal oxidation. 76 In the case of polymeric matrices, synthesis may be used to synthesize particles with a narrower size distribution and these can be stabilized under mild conditions.

It was performed by spectrophotometric techniques, during which the solution of copper ions was dried and quantified. The NaBH_4 solution is applied to the soaked samples and stirred. They are rinsed, cleaned, and heated at 100°C for 2 hours to help separate the

strips of cellulose acetate. 77 water-soluble mixtures.

8. PHYSICAL SYNTHESIS:

Many things can affect the development of copper nanoparticles, such as pH, metal ion concentration, polymers, and the surfactant concentration. Gamma irradiation is used to control the growth of nanoparticles to limit their production. It is possible to produce nano-molecules in amounts up to 17 nm by capping the resin.

This is a radiolabelation process that yields the nanoparticles in a pure form, without introducing impurities, and completely reduces them. The 80-spherical copper Nano-particles can be synthesized using sonochemical methods that have been scale-controlled in aqueous media. Both increasing the formation rate of copper nanoparticles and reducing deposition can be accomplished with the aid of the polymer (Poly(vinylpyrrolidone (PVP) is) as a stabilizer. 51 Microcell approach results in the formation of pyramidal copper nanoparticles.

A thin layer of gold-infused-anisotropic material can be formed by immersing the material in a copper-infused solution. About 70%

of the Copper nanoparticles are formed on a copper substrate. If the precursor, surfactant, and the treatment time are varied, then the morphology of the Copper Nano-particles depends on the concentration. Eighteen copper n-oxoicacid can be synthesized by the thermal decomposition process, and synthesized in two hours from brochantite, the precursor, at 750o C.

This processing method uses less time, inexpensive raw materials, and simple machinery. Because of these benefits, this process is extensively used in the manufacturing industry. 82 approximate amounts by the process of wire addition in an argon. In principle, the shape and current density of the Nano-particles can be adjusted to increase the energy output. 83 Cellulase is used to create spherically-coppericnano-droplets under alkaline conditions. You may be able to get a substance by the hybrid reaction, which slows down bacterial growth by 80% to 95% after three days. 84

9. CHARACTERIZATION:

Applied characterisation experiments have been conducted, and several different methods have been utilized in the study of the morphology of copper nanoparticles.

Most of the various variables including temperature, duration of irradiation, period of irradiation, and the amount of stabilizing and reducing agent were also examined. Further, the breakdown of contaminants intensifies the Catalyst's catalytic activity. 40 When several characteristics, including zero potential, polydispersity index, and particle size distribution are all found, they work together to improve creativity. Scanning electron microscopy (SEM), TEM, and microscopy showed that the morphology of the particles was consistent with uniformity. 41

Fluorescence of the CuNPs was examined, and the results discovered that both the polypeptide sequence and the stem sequence contributed to the enhancement of fluorescence. 42 X-ray diffraction, ultra-violet-visible light and scanning electron microscopy were used to investigate the morphology, crystallinity, and density of the synthesized nanoparticles.

These researchers have conducted empirical studies on mercury sensing and photocatalysis. 43 As it is synthesized from CuCl_2 , the morphology of the resulting nanoparticles appears to be spherical, their particle size is found to be about 10 nm. The size and shape of the nanoparticles are established through electron microscopy

techniques including Field Emission Scanning Electron Microscopy (FESEM), ultraviolet-visible and transmission electron microscopy (TEM). 46 This allows the synthesized copper ions to stay stable under room temperature. 80

Adjusting different parameters like the temperature, power level, deposition rate, and current level will adjust the particle size. Nanoparticle homogeneity can be increased by regulating the size. Synthesis of uniform copper nanoparticle clusters is based mainly on the PVP-stabilized cathode-to-to-solution transfer rate of PVP nanoparticles. 51 For use in both washing and an external lubricant, an electrolyte also has been found to have a dual purpose: it's been discovered that surfactants found in the electrolyte (as a template and as a stabilizer).

Studies like Electron Microscopy, FOURIER experiments, as well as Scanning and FOURI microscopy find that the nano particles have a ball shape, with a ball-like diameter of 36.34 nm, using Scherrer's equation. The examination of the powder reveals that it is primarily composed of copper, but has a negligible amount of oxygen. 83 Marine endophyticlphes were synthesized to determine their

antibacterial efficacy against various pathogenic bacteria. The FTIR analysis showed that the stabilization and capping had been successful. The EDX and TEM experiments showed that the particle was indeed synthesized and also indicated that it was spherical and was between 3 and 6 microns in diameter. 44

10. VARIOUS CHARACTERIZATION TECHNIQUES FOR COPPER NANOPARTICLES:

X-ray Diffraction is a type of recording technique for Diffraction; that is, an instrument that is used to measure the intensity of X-rays. X-ray diffraction and/diffraction analysis experiments reveal the Nano-sized particles to be approximately spherical in shape with a diameter of 15 nanometers. 40 X-ray diffraction methods have shown the existence of the crystal structure. 41

XRD is a technique that is used to determine the overall morphology and crystalline structure of synthesized nanoparticles 46 Using this diffraction analysis, they verified that the phases of the synthesized particles are similar to those of covellite. 79 Most researchers agree that the scattering patterns were recorded using monochromatic Cu K α radiation ($\lambda = 1.54 \text{ \AA}$). 60

XRD analysis of the results show that the cuprides have formed. To assess the magnetic strength, the three pairs of peaks at 43 (111), 50 (200) and 74 (220) were observed. The maximum oxidation reading for one of copper-nickel oxides was at 74o (311). 59

According to XRD, the synthesized findings, the substance is a metallic compound with an FCC structure. 78 in the range of 30 to 750 degrees was accomplished with XRD scanning and diffraction patterns showing that the CuS particles showed a pattern of the hexagonal covellite process Copper crystallite was estimated to be around 20nm in size. It has 20% copper as per the X-ray diffraction study. 84

11. SCANNING ELECTRON MICROSCOPY (SEM):

This showed that the Nano-structures produced self-assembly due to agglomeration on their surface morphology. 79 the SEM discovered cubic and hexagonal shapes. 78 The scanning electron microscope (SEM) images indicated that the average size of the particles to be 30 nanometers. 76 and a length of 856 ± 5 nanometers and a diameter of 235 nanometers to make sure the copper had not been replaced in the synthesized nanoparticle 82

Raman spectroscopy:

Broad peak wavelength and excitation wavelength are obtained at 470 nm and 353 nm respectively.⁷⁹

Field Emission Scanning Electron Microscope (FE-SEM):

It summarizes the copper nanoparticles' size and morphology. A multiphase characterization suggested that the topography was uniform and smooth. The particles were determined to be approximately 100-200 nm in size. Field emission scanning electron microscopy (FESEM) was used to validate the distribution of polycrystalline Nano-particles (200-500nm in a regenerated matrix).

84

Laser Particle Analyzer:

Copper nanoparticles are characterized by their size distribution with the Malvern ZetNanose Z90 instrument. X-ray fluorescence The multifunctional PHI-5702 is used to acquire the spectra by bombarding the target with a source of X-rays from the AI. 60

Fourier Transform Infrared Spectroscopy (FTIR):

The Thermo Nicolet IR200 is useful for performing FTIR. The FTIR spectroscopic morphology studies show that the different functional groups of the copper nanoparticles have an activity in regard to maintain stability of Protein structure has been established by Fourier transform IR spectroscopy. measurements are made on samples that have been freeze-dried. 46 The observed binding energy bands were in the range of 3549-3298 cm^{-1} with a particular feature at 1624 cm^{-1} 59 Once it is in its pure form, its spectral distribution does not occur. 78

Vertex 70 FTIR Spectra were observed at 4000 to 1000 cm^{-1} with a Vista Fluoriteq FT-R Spectrometer. 60 Using an FT-IR, the scanning range was found to be 4000 cm^{-1} to 400 cm^{-1} (3 s), with an interval of three seconds. 65 The peculiar structural arrangement of the particles' surfaces was found using FTIR spectroscopy, and an absorption band appeared at 1633 cm^{-1} . 73 This shows that the optical distance of NPs varies with pH from the Avogadro Energy scale of 3.27 eV to 3.66 eV. 79

UltraViolet Visible spectroscopy (UV-VIS):

The UV-Vis spectrometer MultiSpec-15 is a perfect device for measuring absorbance and fluorescence. With wavelengths between 561 and 572 nm, the UV-Vis spectra resembles surface plasmon resonance. 40 The wavelengths used to record the spectra ranged from 300 to 800 nanometers with the Shimadzu UV-3600 spectrophotometer. 60 have been recorded as being observed in the range of 200-700nm-nm in the absence of PVP, and an extreme absorbance peak of 265nm was observed when PVP was present with a concentration of 0.53 59 Changes in the UV-visible spectrophotometry are employed to follow and investigate the spectral absorption changes.

Surface Plasmon Resonance (SPR):

characterization of the Nano-particles is determined, including morphology, surface plasmon resonance (SPR), and spectroscopic In the red regions, peak wavelength of 575–620 nm and wavelength 350–370 nm have been located. 41 The SPR peak wavelengths were obtained at 590 nm for the uncoated particles and 585 nm for the composite. 76

12. TRANSMISSION ELECTRON MICROSCOPY (TEM):

They were reported to be spherical with a diameter of 15 nm according to the transmission electron microscopy. TEM imaging reveals the homogeneity of the copper particles were collected. Using the model system with the Phillips electron microscope, the approximate size of the nanoparticles can be calculated to be 20 nanometers.

With a power of 7,500x, a magnification of 2Å 59 The results of the scanning electron microscopy micrographs showed that the particles are circular, while the shell around them is elliptical in shape.

The particles vary in size from 2 to 33 nanometers in diameter. The TEM analysis confirms the synthesis of the copper particles has been completed. as a result of this, it is also noted, the particles are thought to be approximately 2nm in size. based on transmission electron microscopy, the copper particles are between 17 and 18 nanometers in size.

13. HR-TEM:

Suggests that CuNPs are synthesized in the FCC lattice at an accelerating rate in the x direction 45 The JEM 2100F HR-TEM particle size distribution was analyzed with the aid of Image J software. 65

Electron Spin Resonance:

The electron spin resonance confirms the purity of the produced copper particles.60

Wide Angle X-ray Diffraction (WAXD):

The observed large X-ray diffraction of the Copper Nano-part provides evidence for (111), (200) and (220) crystalline Copper. They also have a Purity Grade FCC metallic copper phase. 83

14. APPLICATIONS:

Copper nano-particles can be applied to anything from daily-use items to industrial finishes and are particularly useful for creating anti-bacterial paints. They have anti-fouling properties, helping to keep the boat free of dirt in open-water conditions. Due to their biocidal properties, the synthesized copper Nanoparticles are used as biocides.

Agar-well diffusion dosage of CuNPT inhibits growths the development of gram-negative and gram-positive bacteria, but does not kill it. Since they possess radical scavenging activity, they have demonstrated anti-oxid ability as well. Additionally, they are highly conductive in water and ethylene glycol. Synthesis of air-resistant copper nanoparticles allows CuNPs to be used in biological and industrial applications 40

When copper-based medicines are biosynthesizers are mixed with existing medications, they are used to treat cardiovascular and anemia problems, as well as osteoporosis and osteopenia. They are also used as a dietary supplement, enzyme co-factor, microbicidal, antimicrobial, and also in enzyme therapy against different cancers. 41

Nano-engineered DNA hairpin versions were synthesized and demonstrated to be very sensitive for NAD calculation. Fluorescent-coated CuO polymers are used in biochemical sensing as well as other applications, as noted previously. 42 Nano-particles synthesized from *I. balamina* can degrade toxic compounds through the photocatalytic effect of the green technique are also used for

mercury testing up to a level of 1 ppm. The due to their low toxicity, they are also used in wastewater treatment. 43

Pathogenic bacteria, with the actinomycetes synthesis, nanoparticles of copper exhibited better control since the Copper Nano-Clusters were better able to maintain electron exchange and destroy the pathogens including *Staphylococcus saprophonicus*, *Pseudomonas aeruginosa*, and *Staphylococcus epidermis*, they also had better control properties. 45 Syzygium-based copper nanoparticles demonstrated an antimicrobial radius of 8 and 6 millimeters, respectively. 46

15. CHEMICAL APPLICATIONS:

Since they have more catalytic activity than commercial powder, these metallic copper nanoparticles are employed in increasing the rate of Ullmann's reaction, and in preparation of binary alloys. 48 Copper thus synthesized is used in the synthesis of many pharmaceuticals. 52

For catalysis and for sensing chemicals, the cuNPs thus formed can be utilized. Synthesized Nano-bodies are stable in water and have antifungalmic properties. 54

For gram-negative bacteria, CuNPs with high antimicrobial potency showed cytotoxicity, flow cytometry for seeded plates, and phase microscopy. CuNPs show better bacteriostatic activity than other antibiotics.

When applied topically, they also exhibited some antifungal properties. The chemical reduction method can be used to synthesize a colloidal copper with greater potency than the colloidal method. This CuO antibody preparation may be particularly useful in areas of interest to researchers in the biological and clinical fields.

They are also used in assaying for both DNA hybridization and for the metallochloride test. Many binetic Ag-Cu NPs are useful in biosensor research, for sensors, and in electronics. Nano-copper compounds are used as a catalyst in alkylation and azide reactions. Sulfureptit has excellent Gram- and Gram-positive bacteriocidal activity against gram (+) and - Gram-negative bacteria. 72 Copper nanoparticles are used as a fluorophoreactive reagent to evaluate the cyanide ion concentrations. 74 Bismutholite NPs are highly effective in purification of water, rendering them uncontaminated. 75

When the Copper Nitrate Solution is dispensed into the polyol solution, Copper conductive ink will be formed. This ink is also ideal for circuit printing. Thus, these can be thought of as a cheap printed circuit boards. 60 The nanoparticles may be distributed in a fluid that is more suitable for heat transfer to enhance the heat transfer characteristics. Nusselt number and heat transfer coefficient were found to vary linearly with the Cu(s) concentration. 59 Because of this, copper nanoparticles obtained in this way can be used in place of silver nanoparticle replacements. 76 The synthetic CuNps is a sensor for detecting ferric ions. 73

Physical Applications:

However, both mono and bimetric nanoparticles increase the catalytic activity, and consequently the electrical conductivity. 60 A synthesis of Nano-particle diameter control results in several different applications, including hydrocarbon conversion, scanning electron microscopy, and for use in sensors. 81 In the FTIR-wiring process, the fingerprint identification of the nanoparticles is aided by Fourier transform Infrared Spectroscopy (FTIR). 83

This synthesis leads to the design of materials that are fit for a wide variety of applications including the packaging of food, clothes, as well as chemical reactions. 84

17. CONCLUSION:

Copper Nano-structured materials have developed a unique potential and continue to attract attention with their unsurpassed properties. Magnetic, food, electronic, biocal, and pharmaceutical, as well as drugs, and cosmetics, have distinct properties and have applications, whereas copper nanoparticles have numerous diverse purposes. Studies have shown that copper nanoparticles are effective and fascinating green catalysts. Several new applications have been brought forward that employ the Nano-particles.

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Chapter –XL

40

CYBER SECURITY CHALLENGES AND ITS EMERGNING TRENDS ON LATEST TECHNOLOGIES

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ABSTRACT

Cyber Security is important in the field of IT. On data security has been one of the most pressing issues of the day. By day, though, when we talk about online security, we think of criminals or things that happen, one thing in particular, and that is an increase in cybercrimes. Different governments and businesses are doing a number of things to combat online fraud. Other interventions, aside from those related to defense, still rankle many. The key goal of this paper is to address new cybersecurity problems. We are also involved in cutting-edge news on cyber security, principles, as well as discovering emerging strategies, and technologies that are reshaping the sector.

Keywords: cyber security, cyber crime, cyber ethics, social media, cloud computing, android apps.

1. INTRODUCTION

One man may now be able to send and receive any kind of data by email, but did he ever think of sending his data safely, without any of it getting into the wrong hands? Cyber security is the key. The Internet is the most quickly developing technology in any single day's

life. Even today, modern and evolving innovations are affecting the way men look. And because of these new technologies, private information is being exposed every day. today, about 60% of total commercial transactions are performed on the internet, which necessitated a premium security for trustworthy and user-friendly transactions As a result, the war against cybercrime has reached new heights.

There are also additional forms of cyber protection, such as the cyber, such as ensuring information security as well as the reach of the industry doesn't broaden to include that area.

Mobile computing, internet banking, virtual banking, and other modern technology like cloud computing all require strong security measures. And because getting access to these kinds of information has now become crucial, a person's protection is of utmost importance. It is vital to enhance cyber security while preserving critical infrastructures for each nation's security and national prosperity. Security has become an important consideration in developing new Internet services and measures, and safeguarding Internet users alike. Cybercrime is only going to be overcome if a

systematic and secure approach is taken. Even though technology cannot guarantee the safety of a crime-free society, law enforcement authorities have to be given the power to investigate and prosecute it mustnToday, nations and governments are enacting legislation to protect critical information from being lost in the electronic age. Every citizen is responsible for maintaining his or her own cyber security, and every person needs to be well educated about it.

2. CYBER CRIME

The word "cybercrime" has a broadened to include any operation that depends on computers, no matter how old or new, to commit a crime or commit an offense. Cyber crime is described as the violation of state or federal law that happens when a computer is used to store evidence of an offense in some way. The growing list of cybercrimes includes network intrusions as well as well as cyber-based forms of identity, harassment, bullying, and terrorism. For most people, cybercrime can be seen as using a device to steal personal data or contraband or using malevolent programs to interrupt their everyday operations. Cyber crimes will continue to take on more and more significance as time goes on.

3. CYBER SECURITY

Privacy and data protection are still two of the top considerations of data management. Our current environment is one where everything, including information, is held digitally or cybernetically. On social networking sites, people are able to communicate with friends and family without fear of embarrassment or fear of judgement. Unfortunately, for home users, social media remains a favorite hunting ground for cyber-criminals, who will take more of an interest in it, they appear to try to steal their personal data. Thus, in order to fully participate in online banking, you must not only use social networking but also adopt all of the safety measures that are necessary.

In the past six months, Malaysia saw a significant increase in the number of cases of cyber attacks reported to Cyber Security compared to the first half of 2012. as crime is rising, so is the need for more effective security measures. the study of U.S. healthcare and technology executives conducted by Silicon Valley discovered that they feel data security and business continuity are at risk from cyber attacks

- 98% of organizations are either retaining or increasing their online digital security budgets, with half of them dedicating an additional resources to online attacks
- Most businesses are taking precautions against hacking for when they know it's going to happen, not hoping it doesn't
- Around one-third of those interviewed are more secure in their data and less certain about their partners' security measures.

So we'll have to expect more attacks on Android-based devices, but not on the scale of previous ones. The fact tablets are also vulnerable to the same malware because they run on the same OS as smart phones. There will be an upward trend in malware for Macs, but it will not be as great as with PCs. With Windows 8, you can code for all devices (PCs, laptops, and mobile phones), this would result in malicious software apps being developed for Android, including on Google Play.

4. TRENDS CHANGING CYBER SECURITY

Here mentioned below are some of the trends that are having a huge impact on cyber security.

4.1 Web servers:

The danger of web applications attacking to harvest or infect other websites remain. Distributing malicious code through a compromised server is popular among internet criminals. In other words, data-stealing attacks draw media attention, but have the ability to do more harm.

Now, we need to emphasize servers and applications running on the internet, in order to shield them from attacks. Website servers make excellent sources of pilfered data for these cyber criminals. It is also often prudent to use a more reliable browser during critical transactions.

4.2 Cloud computing and its services

Recently, all small, mid-sized and large enterprises have begun to use cloud computing. She went on to say the earth is on its way to being covered by clouds, in other words. With respect to cyber security, this new innovation poses a major challenge because of the way that traffic circulates.

Consequently, the controls on web apps and services in the cloud would also need to change to avoid data loss. Nevertheless,

there are numerous problems with cloud computing models still to be solved in terms of security. As cloud computing grows, so do the threats.

4.3 APT's and targeted attacks

It has been dubbed "new level of cyber crime" by security experts APT (advanced persistent threat). Web filtering and IPS systems have previously have provided critical pieces of the security puzzle that have helped protect against attacks such as the ones above for years (mostly after the initial compromise).

As threats become more pervasive and become obfuscated, networks must collaborate with security tools to spot and stop them. Thus, we must strengthen our security measures to protect against potential attacks.

4.4 Mobile Networks

Nowadays, we can communicate with others no matter where they are. Mobile networks face major security risks. Firewall and other security measures are not as effective as previously because people use devices such as tablets, PCs, smart phones, and laptops. It is important that we consider the security problems presented by

mobile networks often. It is important to take special precautions when protecting these kinds of mobile networks.

4.5 IPv6: New internet protocol

IPv6 is the latest, and will support the backbone of our networks and the Internet as a whole. The protection of IPv6 is more than just a porting of IPv4 capabilities; it's a critical part of network security as well. At the same time that IPV6 offers more addresses, some significant improvements to protocol policy need to be made. Keep using an IPv4 address where you can in order to minimize the potential threat of online criminal activity.

4.6 Encryption of the code

The method of encoding messages so that eavesdroppers and hackers can't understand them is called encryption. Encryption transforms the message or information into an incomprehensible cipher. Eavesdropping or snooping information is normally requires using an encryption key, which defines how the message should be encoded. Encryption is at the most basic level of security; it safeguards both your privacy and the integrity of your data. the more you use encryption, the more difficult it becomes In addition to its

primary function of protecting data during contact, encryption is often used to secure data during transmission, such as data in transit (e.g. the Internet, telephones, wireless mics, etc). One way to do this is to ensure that your software stays safe is to encrypt the data.

Thus, the developments described above are shaping the future of cyber security. It is mentioned in Fig 1 below

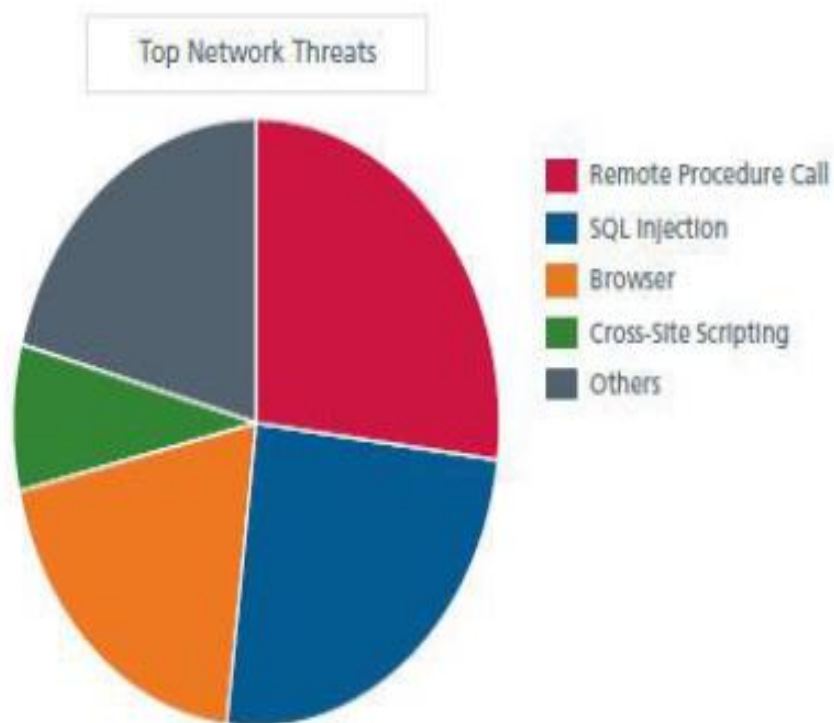


Fig -1

The above pie chart shows about the major threats for networks and cyber security.

5. ROLE OF SOCIAL MEDIA IN CYBER SECURITY

The greater our connectedness, the more we need privacy from each other. Without a question, social media plays a significant role in today's security threats. The social media use among staff is growing at an astonishing rate, and with it is the danger of cybercrime. More and more of the public are using social media, which makes it a massive terrain for hackers to acquire personal information and earn money in the black market.

Because of the speed with which we divulge our private details, businesses must be just as fast in blocking attacks, answering questions, and mitigating security breaches. Anyone is quick to divulge their details when they're courted by these social hackers, so they use them as a means to gather the bait. As a result, people have to be particularly mindful of their details online. Individual companies must be able to provide information in order to use social media. Social media gives the same amount of control to everyone: it gives everyone the right to share commercially sensitive information, as well as false information, which can be just as much of a problem.

Erroneous knowledge spread of ideas through social media has been listed as one of the increasing risks named in the Global Risks 2013 study.

While social media has been used to commit some acts of criminal activity, businesses cannot afford to halt their use of social media due to its key role in making the company public aware of their presence. It is vital that they act before anything happens in order to prevent an incident from occurring, though, and find a solution before the harm gets to them. It is, however, important for organizations to grasp the fact that social conversations do have a high degree of risk, and are given priority, and have safe security solutions in order to reduce it. It is important to employ the proper social media strategies to cope with it.

6. CYBER SECURITY TECHNIQUES

6.1 Access control and password security

Username and passwords have long been the cornerstone of information security. This may be one of the first tactics that we implement with relation to online security.

6.2 Authentication of data

An encrypted document cannot be accessed until it has been authenticated and has not been updated from an untrusted source. Anti-virus software may generally authenticates these documents. Thus, successful anti-virus software is needed to keep the devices safe from viruses as well.

6.3 Malware scanners

This is program that searches for viruses and malware in all the files and documents in the system. Viruses, Trojan horses, and worms are all malware types.

6.4 Firewalls

A firewall is a software or hardware filter that protects you from Internet attacks. All messages that reach or leave the internet are examined to ensure they meet security standards before being sent or received. In this way, firewalls are indispensable for detecting malware.

6.5 Anti-virus software

software that detects, avoids, and disables malicious software
Many antivirus applications automatically upgrade and provide an

auto-update feature that is used to identify new viruses as soon as soon as they are detected. You must have an anti-virus program on any computer you use.

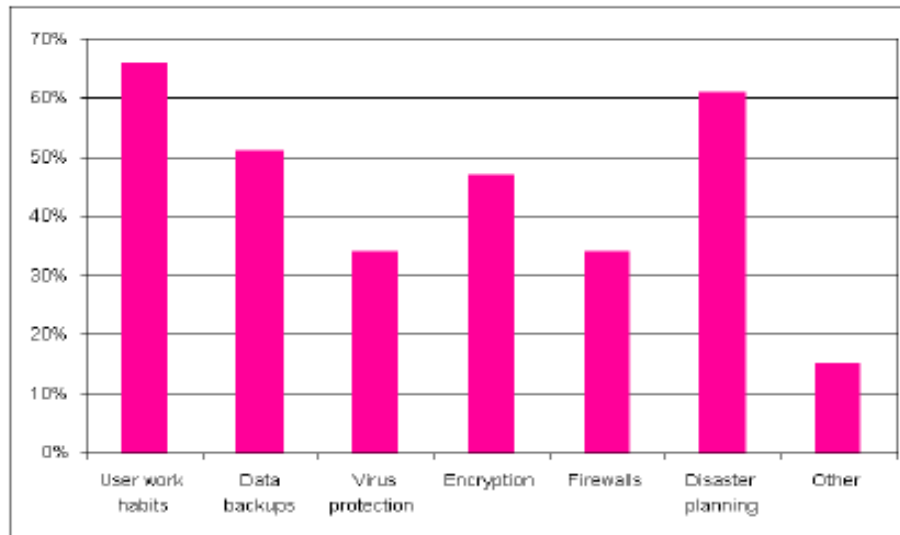


Table II: Techniques on cyber security

7 CYBER ETHICS

Cyber ethics is simply the principles of the internet written in computer code. When we uphold strong cyber ethics, we stand to profit from the internet. the above is just a couple of the wonderful things that they had to say

- Interact with others on the Internet Email and texting make it simple to keep in contact with friends and family, chat with employers, and

talk about projects or get the details you need for faraway places, and send information to the entire country or half way around the world

- Treat all with respect online. Try not to call names, especially hurtful things, if you can.
- For any given subject, the Internet is considered to be the world's largest library of information, so misusing this information is impossible to avoid.
- Do not let others use your passwords as a means of doing anything that.
- Don't infect others' systems.
- Keep your personal details safe; if you're not careful, it can be misused and get you into trouble.
- When you're online, don't pretend to be anyone else, and don't even think about creating fake identities to dodge the trouble you could find yourself in.
- Do not tamper with or copy any copyrighted material until permission is given. All should abide by these internet ethics when using the internet. We've all learned proper laws since the beginning of cyber space.

8. CONCLUSION

As more and more transactions are being made online, security is becoming a major problem for machines, regardless of the type of network they are used on. The hackers get smarter every year, as a result, and so does the security of the information. Latest and disruptive innovations are affecting both the infrastructure security and the need for new platforms and information on a daily basis. There are no permanent solutions to dealing with cybercrime, but we should strive to make it as safe as possible for the future.

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Chapter -XLI

41

APPLICATIONS OF NANOTECHNOLOGY IN COMPUTERS

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ABSTRACT

Nanotechnology has many applications in almost every area in today's world. Either medical or electrical nanotechnology in any branch is commonly used. While nanotechnology deals with materials and material synthesis, it is also helpful for computers and apps. This paper focuses on several nanotechnology applications related to computers. Since nanomaterials are more powerful and smaller, computer chips (memory chips, IC's) can be smaller according to requirements. These chips may have wide less sized storage spaces. These chips are flexible and easy to repair on the CPU, eventually affecting the machine's memory and making the computer very powerful.

Keywords: Nanotechnology, Nanomaterials, Computer chips, Memory

1. INTRODUCTION

Nanotechnology and quantum theory attract scientists' interest due to the growing need for broad access to data and the storage of information. Researchers use nanoelectronics to create new devices to resolve the problem of storage and the use of information. The

semiconductor industry has been rising quite rapidly over the decades because of the use of nanomaterials. It is noted that devices or computers created by this phenomenon provide quick access to data and high accuracy. Bio sensors and non-connecting transistors are both designed to have a major effect on life. Simulation and modeling software offers space for new minimal loss experiments. As we live in the age of advanced nanotechnology, it gives the ideas for the machines or structures imaginable as we have seen in science fiction films such as avengers or interstate[1].

Combining nanotechnology with computing opens up a wide area of study for developers. Eric Drexler is a man behind this production. Due to Feynman's speech he started researching nanotechnology. This definition has been finalized by Drexler for several years. This allows the production of high-speed, durable computers, less energy consumption in computing and data storage. It also contributes to improving the efficiency and performance of devices using quantum technology[2]

2. WHAT IS QUANTUM COMPUTING?

Phenomenon of quantum mechanics and physics is used in quantum computing techniques. It is the future of the highest quality data centres. These machines will in future measure the data at high speed. It is based on the logic that uses the quantum bits rather than binary bits[2].

Quantum bits, also called Qubits, are the 0's and 1's probabilities, rather than a binary digit method, which accesses data with 1 or 0. Over 50 years of science and technology research with quantum theory phenomena turn quantum computing from theory to reality. Data can be accessed via the cloud in today's world and many thousands have made it easy to use, random access and high speed and performance.

In terms of nanoelectronics and computing science, quantum theory is growing Quantum computers could someday bring breakthroughs in numerous disciplines like engineering, medicine and discovery of drugs, artificial intelligences, fast computer equipment [4].

3. NANO MATERIALS WHICH ARE RELATED TO COMPUTERS SCIENCE

3.1. Quantum Dot Leds

Quantum dots are semiconductor materials generally referred to as "artificial atoms." QDs have optical characteristics in which they emit in a visible range and infrared absorption. Quantum dot LEDs will generate almost any color in a CIE diagram, providing additional color choices. QDs used shorter wavelengths to give any wavelength visible light. A layer of quantum points is positioned between the nano-range P-channel and N-channel materials.

When exposed to an electric field, electrons and trions pass through the quantum dot sheet, thereby helping to excite electrons and form exciting conditions to emit light of QD [3-7].

Applications of Nanotechnology in Computers

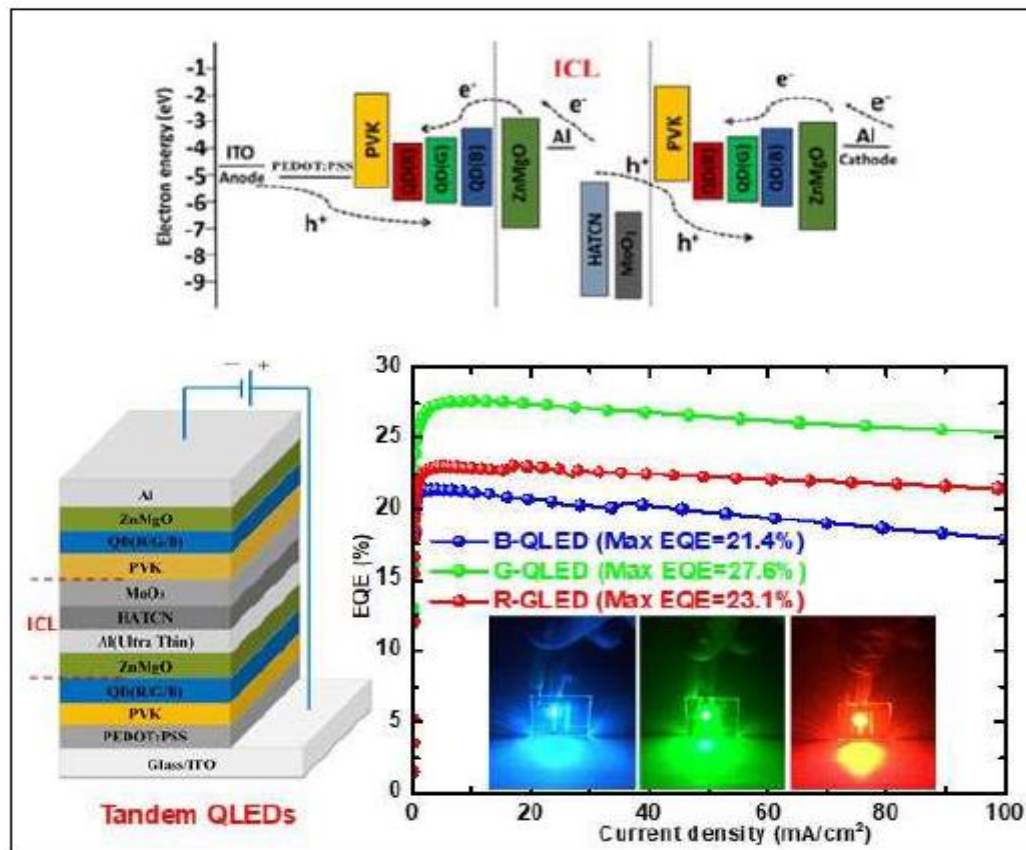
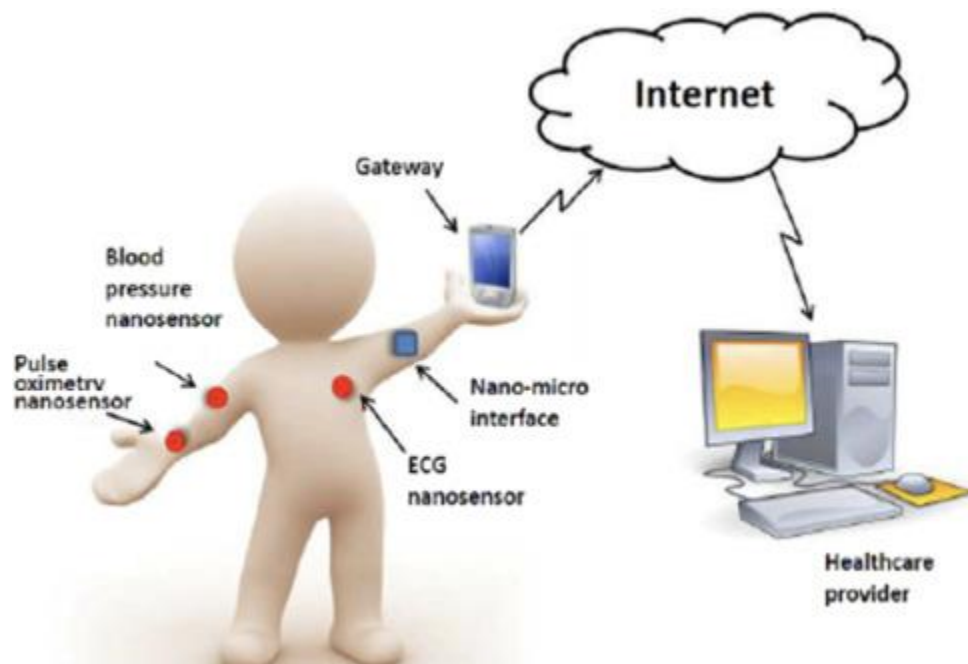


Figure 1 Quantum-dot LEDs [4]

3.2. Carbon nanotube field effect transistor (CNTFET)

Silicon MOSFET is a silicon dioxide composite unit. This MOSFET has a high input impedance but also a limited lifetime and requires repeated calibration. CNTFET is used to solve this problem. The FET uses ultra-thin gate dielectric transistors with low voltage operation [9]. According to IBM research, the contact played an important role in defining nano transistor performance. Transistors

of the field effect of carbon nanotube (CNTFETs) create as a channel of carbon semi-conductive nanotubes. Nanotubes may be used to produce channels (p-channel and n-channel) modules. The structure of CNTFETs is very similar to MOSFETs. CNTFET has high current drive, high transductivity, high temperature tolerance and good covalent link[3].



The magnetic random access memory allows computers to boot easily and quickly. As MRAM consists of materials that have nanometer-range properties for magnetic tunnel connections. Due to this data, a device shutdown can be easily and instantly saved.

3.3. Race Tracks Nanowires

Racetrack memory is a system that depends instead of magnitude on electron spin. The spin current is used to transfer data. In magnetic regions commonly known as domains, a data is processed. Racetracks can access data faster than hard disk drives. Materials including Iron and Nickel alloys are used to produce nanowires for racetrack equipment. These materials offer the devices features to improvise the areal density for efficient computer storage. As these nanowires are magnetic, they can travel together with wire due to the effect of current domains. This technique reads data using fixed sensors so that this procedure is called racetrack memory [10].

3.4. Silicon Dioxide Memory Sandwiches

This technique involves placing a nanowire between the two electrodes and using the voltage. When the voltage is applied, nanowire resistance can be modified in a given place. Anywhere the nanowire is mounted serves as a memory cell.

This method is employed because of its unique function, as though the status of the memory cell does not alter between conductive and non-conductive process [11-12].

4. NAND MULTIPLEXING

Recent nanotechnology and nanomaterials have attracted interest from researchers and scientists because of their compatibility, their smaller size and their different characteristics. Technology is moving quickly from micro derivatives to nano, so we also needed rapid calculation techniques. One solution for this is NAND Multiplexing[13]. According to Von Neumann's theory of architecture, defect tolerance efficient systems are extremely useful for fast calculations. NAND multiplexing is a technique that uses NAND logical gate (NOT-AND).

NAND Gate is an essential building block for all logical gates, meaning that NAND Gate allows all logical gates to be installed. Different operations can be performed using NAND gaterMultiplxers on the same computer. At Nano-Scale we needed high precision and low power units. In accordance with the rule of De-Morgans and Moore, NAND-Multiplxers provides better results with less errors[14].

5. SPINTRONICS

Advanced research in computer nanotechnology opens up a new field of research called spintronics. It creates new materials and

devices that affect the spin polarized current.

Spin logic in ultra-low energy logic circuits like nano or high-speed switches. spinning logic. Spin logic operates at electron angular momentum i.e. $-1/2$ or $1/2$.



6. CONCLUSIONS AND FUTURE SCOPES

Nanotechnology is an enabling technology which affects electronics and computer technology, medicine, materials and manufacture, catalysis, energy and transport. Nano-computing can be characterized as computer-based nanotechnology and divided into

sub-components - Electronic Nano-Computing, Mechanical Nano-Computing, Quantum-Nano Computing, etc. Nanotechnology and Nano-production would enable us to go beyond our natural limits and to operate directly at the molecular and atomic level of material in which the characteristics are definite and can be changed. Nanoelectronics and nanosciences will be used as the building blocks for future computing systems, including nano devices and supercomputer materials with nanometer dimensions

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Chapter –XLII

42

NANOTECHNOLOGY APPLICATIONS IN SCIENCE AND ENGINEERING

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ABSTRACT:

Nanotechnology is making a major contribution to improving and even revolutionizing many sectors of technology and industry: information, electricity, environmental sciences, medicine, home-ground protection, food safety and transport, among others. Recent advances in chemistry, physics, materials sciences and biotechnology are used by nanotechnology at present to produce new materials with special properties because their structures have been determined on nanometer scale. This paper summarizes the different nanotechnology applications of the last few decades.

Keywords: Nanotechnology, Environmental Science, Agriculture, Food safety, Engineering.

1. INTRODUCTION

The challenge of meeting the world's energy demand is exacerbated by the increasing need to protect our climate. Many scientists are exploring ways to establish safe, affordable and renewable sources of energy as well as ways of reducing energy use and environmental toxicity.

Nanotechnology-based prototype solar panels are more effective than conventional designs for turning sunlight into electricity, which would promise cheap solar power in the future. Cheaper to produce and easier to mount, nanostructured solar cells can use print-like production processes and can be made in flexible rollers rather than separate sheets.

Nanotechnology improves the efficiency of fuel production from standard and low-grade raw petroleum materials through better catalyzing as well as through increased combustion efficiency and reduced friction in vehicles and power plants (Low et al., 2015). The goal of enzyme nano-biogenesis is to convert cellulose to ethanol for fuel from wood chips, maize stalks (not just kernels like today) and unfertilized, perennial grasses (Chaturvedi and Dave, 2014). Figure 1 demonstrates some nanotechnology use.

Many modern batteries that have a lower flammability, faster charge, more powerful, light weight and higher power density, holding the electrical charge longer, have a use of nanotechnology (Jalaja et al., 2016; Najim et al., 2015; Maine et al., 2014).

In an environmentally good production method, one new form of lithium-ion battery uses a common, non-toxic virus. Nanostructured materials are used to significantly develop the hydrogen membrane and storage materials and catalysts necessary to implement fuel cells for alternative transport technologies. Researchers are also developing a clean, lightweight fuel tank for hydrogen. Nano science-based options are being explored to turn waste heat into usable energy in machines, cars and homes (Pratsinis, 2016; Sabet et al., 2016).

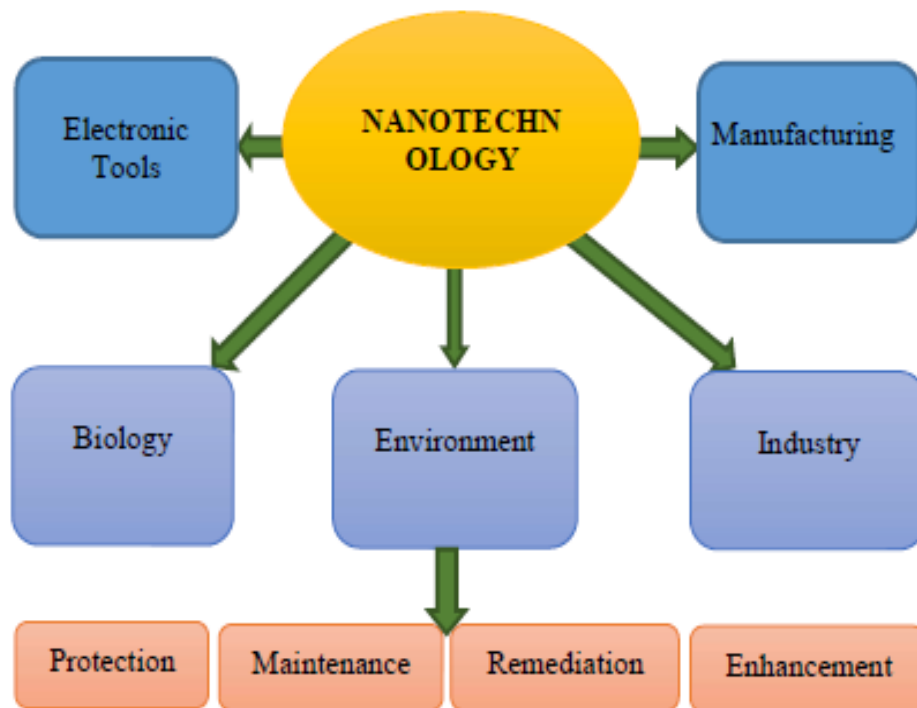


Figure 1. Application of nanotechnology in science and environmental science (Jalaja et al., 2016).

Researchers create thin-film solar electric panels that are mounted into computer cases and flexibly woven piezoelectric nanowires into clothing to provide usable energy on-site from light, friction and/or body heat to power mobile electronic devices. The number and type of application of energy efficiency products are growing.

In addition to those listed above, there are more efficient lighting systems to greatly lower energy consumption for illumination; lighter and stronger transport chassis materials; lower electrical energy consumption in advanced electronics; low-friction nano-engineered lubricants for all types of higher efficiency equipment, pumps and fans; smart light-responsive coating In addition, to the use of lighter vehicles and less fuel-efficient equipment and renewable fuels and energy sources, many eco-friendly nanotechnology applications include materials for supplying clean water from contaminated water sources for applications both large and portable, as well as for detecting and cleaning environmental pollutants.

Nanotechnology can help address the need for cost-effective, safe drinking water by quickly detecting impurities and filtering and

water purification (Rabbani et al., 2016; Sobolev and Shah, 2015; Mishra et al., 2012).

Nanoparticles can be used one day as chemicals to clean industrial water pollutants in groundwater at much lower costs than approaches requiring the draining of water out of the ground for treatment. Nanotechnology can revolutionize a wide variety of medical and biotechnology instruments and procedures to be more customized, compact, cheaper, safer and easier to administer. Below are several examples of substantial improvement in these fields.

Nanotechnology was used to diagnose or build up plaque in the arteries at an early stage. Researchers have created an imagery technology to calculate the volume of a plaque directly accumulated antibody-nanoparticle complex. Clinical scientists will track the plaque formation and its disappearance after treatment. Gold nanoparticles can be used to detect alzheimer's early stage (Fan et al., 2016; Sadeghi et al., 2016; Tarafdar et al., 2015).

2. SENSORS AND MEDICINE APPLICATION

Molecular early detection imagery where sensitive nano-sensors (e.g. nanocantilevers, nanowires and nano-channels) can identify

and reporting capabilities of genetic and molecular events, thereby providing opportunities for the detection of unusual molecular signals that are associated with malignancy.vMolecular imaging Multifunctional therapy where a nanoparticle acts as a platform for facilitating its precise targeting of cells of cancer and providing a powerful therapy to minimize the risk of normal tissue. Research enables micro-fluidic chip-based nano laboratories to control and manipulate individual cells and nano-scale samples to track cells and molecules' movements in their environment. Nano-bio structures, medical applications and health applications.

Nanotechnology can revolutionize a wide range of medical methods and procedures in order to be more customized, compact, affordable, more secure and easier to administer. Below are some examples of significant progress in these areas (George, 2015, Ng et al., 2015; Weiss, 2015; Yashveer et al., 2014; Schulte et al., 2014; Boisseau and Loubaton, 2011).

Quantum dots are semiconducting nanocrystals that improve medical diagnostics biological imaging. When illuminated with ultraviolet light they emit a wide variety of bright colours, so that

various types of cells and biological activities can be located and identified. These crystals give up to 1,000 times as many optical colorants as traditional dyes used in many biological tests like MRIs and provide substantially more detail. Multifunctional therapies where a nanoparagon is a platform for its particular targeting of cancer cells and for the provision of potent care, reducing the risk to normal tissues (Adam et al., 2015, Milliron, 2014, Peterson et al., 2014, Schnitzenbaumer and Dukovic, 2014).

Research enablers such as microfluid chip-based nano-labs that track and manipulate individual cell and nano-scale samples to track cell and molecular activity when moving around in their surroundings. Research is ongoing to use nanotechnology to stimulate growth of nerve cells, for example in damaged spinal cord or brain cells. One way is to fill the gap between existing cells with a nanostructured gel and stimulate the development of new cells. In the optical nerves of hamsters there is early work on this. Another way to regenerate damaged spinal nerves is to investigate the use of nano-fiber (Liu et al., 2015, Raspa et al., 2015, Tam et al., 2014, Guo et al., 2014, Kim et al., 2014).

3. FUTURE TRANSPORTATION APPLICATIONS

The nano-engineering and the recycled types of steel, concrete, asphalt and other cemented materials are very important for improving the efficiency, resilience and durability of road and transport infrastructure components while reducing costs. New systems may provide advanced technologies in conventional infrastructure products, such as energy production or transmission. Sensors and devices in nano-scale can provide a cost-effective and continuous structural monitoring over time of bridges, tunnels, railways, parking structures and pavements.

Nano scale sensors and devices can also support an enhanced transportation infrastructure that can communicate with vehicle-based systems to help drivers keep lanes, prevent collisions, customize congestion routes and other such activities (Agzenai et al., 2015; Firoozi et al., 2015; Golestani et al., 2015; Singh and Sangita, 2015, Sobolev, 2015; De Nicola et al., 2015; Chuah et al., 2014; Firoozi et al., 2014; Wong, 2014; Yusoff et al., 2014).

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Environmental security nanotechnology In the last few decades, organic compounds that are extremely toxic have been synthesized and released into the atmosphere for a long period of use directly or indirectly. Pesticides, gasoline, polycyclic aromatic hydrocarbons and polychlorinated biphenyls (PCBs) are among these components (Jones, 2007). Combined chemical compounds are very resistant to biodegradation from native flora compared to organic substances easily degraded by environmental introduction.

Hazardous chemicals have therefore become one of the most critical problems in the contemporary world. Contaminated soil and groundwater control is a significant environmental problem. High levels of a wide variety of pollutants in soils, sediments and ground

and surface waters impact the health of millions of people worldwide (Pereira et al., 2003). Current clean-up technology is not economically and substantially sufficient for solving all clean-up needs today.

Nanotechnology is one of the major developments in science and one of the primary innovations of the present century (Zhang and Elliot, 2006). Nanotechnology may be an effective method for remediating emissions. Several studies have shown that combining nanoparticles with traditional treatment could boost the efficiency of removal of pollutants, such as organic materials.

Nano scale iron particulate matter is extremely successful for processing and deintoxicating a wide range of common environmental pollutants, including chlorinated organic solvents, organochlorine pesticides and PCBs in the zhang study (Rickerby and Morrison 2007). Nanoparticles remain reactive for longer periods to soil and water pollutants and rapid in situ reactions have been observed with TCE decreases of up to 99% within a couple of days after nanoparticles were injected.

Many researchers have shown that engineered nanoparticles such as TiO₂ and ZnO, carbon nanotubes, metallic (e.g. iron, nickel) nanoparticles and amphiphilic polyurethane nanoparticles can be used for water, soil and air treatment.

Environmental science application of nanotechnology is divided into four parts: rehabilitation, protection, maintenance, and upgrading. Of these four, the remediation of the fastest growing group, protecting and maintaining the key component of the use of nanotechnology in environmental science and improving the environment is the smallest part of the categories of nanotechnology applications. Nanoparticles can be used in air and water treatment, green chemistry mesoporous elements, catalytic applications and molecular environmental sciences.

They acquire new chemical, electronic and physical properties along with decreasing the particle size. Improved adsorption and special catalytic properties that can speed oxidation or reducing reactions with different particulate pollutants below 10 nm are advantages (Cosgun et al., 2015). Nanoscale materials have been in early progress reports at a variety of polluted sites. Nanotechnology

can also enhance the environment by powerful pollution control and prevention.

Different nanotechnology implementations were successfully applied on a laboratory scale for environmental treatment. However, these applications mostly need assurance of their efficiency and protection. Traditional remediation methods have shown limited efficiency in reducing the concentration of air, water and soil contaminants. Boehm (Dang et al., 2015) notes that nanomaterials can be more significant and powerful than large particles with same chemicals as filtering media (Yang et al., 1999).

Nanomaterials Remedial Technology Generally, the nanoparticles are smaller than 100 nanometers and contain about 20-15000 atoms in a region crossing the quantum and Newtonian scales. They can be made in various shapes including spheres, rods, wires and tubes from various materials. Nanotechnology is an emerging state-of-the-art technology for environmental problems. As a consequence of the advancement of advanced nanotechnologies, such as nano sorbent, nano catalyst, bioactive nanoparticles, nano structured catalytic membranes and improved filtration of

nanoparticles, all expensive and restricted traditional waste water treatments have been changed.

There are two key attractive properties: Nanoparticles: Firstly, nanoparticles are extremely small (1 - 100 nm), providing a higher per unit mass surface area than traditional process mediums. Secondly, molecular levels modulation in the development of nano particles makes it possible to incorporate on the adsorption surface the desired structural and functional characteristics (for instance, surface area, pores, structure and functional surface groups).

Yang (1999) found activated carbons being used as conventional adsorbents for the removal of dioxins from waste incineration gasses in Europe. In addition, the elimination of chemical contaminations from the contaminated region is a necessary step towards achieving the goal of environmental remediation according to Mahdavian (2010).

Many experiments have concentrated on more efficient materials in a wide variety of adsorbing contaminants. Previously, montmorillonites and bentonites were used to adsorb oils, regarded as the smallest particles, and were able to adsorb enormous

quantities of chemical substances.

Bowman et al. (2003) shows that the process can be separated into two major classes in order to remove contamination. The first method as a sorption by removing the contaminant from the solution because of the contaminant sorption to the medium. In fact, the sorption process is pretty fast, but new materials can ultimately replace the full ability of the compounds. Degradation or transformation materials are an alternative method of process. The contaminant is ideally converted into a non-toxic compound until the substance comes into contact. The degradation reaction is usually kinetically slow compared to sorption reactions and thick material beds may be needed to ensure the appropriate residence time.

In general, the usage of nanomaterial in order to fix the atmosphere considers breaking up contaminants into non-toxic components and absorbing pollutants in order to minimize migration by making the insoluble chemicals. As stated by Liu et al. (2014), MWNT was an effective adsorbent to remove chlorinated aromatic compounds from insulating oil (including pcb). Figure 2 shows the scheme for generating surface acidic groups covalently bound to

MWNT.

Different applications of nanotechnology in the field of environmental remediation on a laboratory scale have been proven successfully, but they still require assurance of their effectiveness and protection in the field in most cases. Different methods and treatment techniques have been used to extract toxins from contaminated soil and water. Adsorption is one of the most common approaches and is currently regarded as a reliable, effective and cost-effective soil and water purification process (Liu et al., 2014).

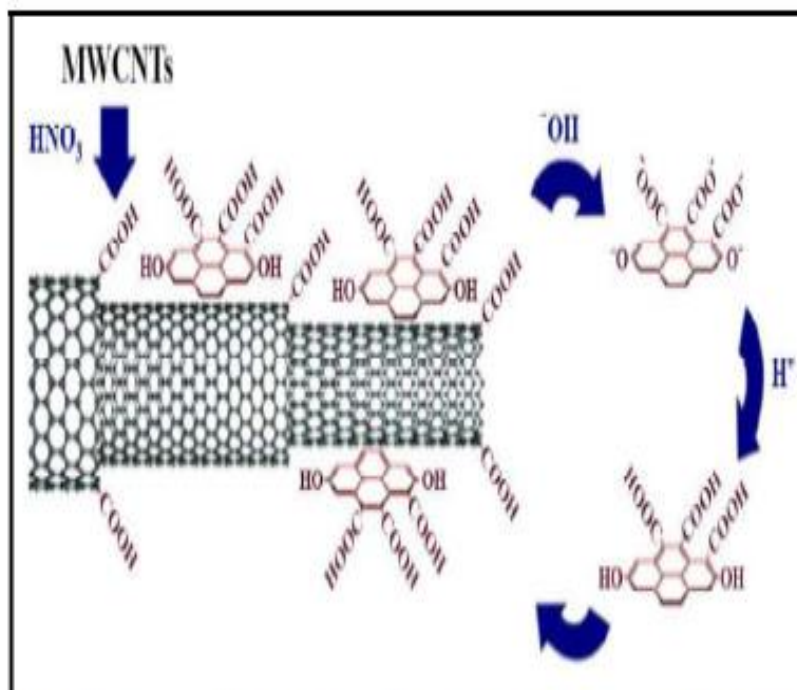


Figure 2. Simplified scheme of the generation of covalently bound surface acidic groups (Liu et al., 2014)

APPLICATION OF NANOTECHNOLOGY IN REMEDIATION

Nanomaterials were also used to remediate polluted groundwater and sub-surface pollution areas at hazardous waste sites. Early treatment remedies for pollution of groundwater were largely pumping and treatment operations. The use of in situ processing technologies is growing due to the comparatively high costs and sometimes lengthy operating times for these remedies.

Since the early 1990s, project managers have manipulated the properties of metal substances such as basic iron in groundwater to degrade chlorinated solvent plumes. For example, the installation of a grain filled with macrovalent iron to form a permeable reactive barrier (PRB) is an in situ treatment technology for chlorinated solvent plumes (Elliot, 2006). Recent research has shown that, under similar environment conditions, nanoscale zerovalent iron (nZVI) may be more efficient and less costly than macroscale ZVI.

For instance, nZVI particles, a common contaminant at Superfund sites, were shown to degrade trichloroethene (TCE), more quickly and fully than larger ZVI particles in laboratory and field scale trials. In addition, nZVI may be directly pumped into a polluted

aquifer and the need to dig a trench and install a PRB is eliminated. Research indicates that nZVI particles can result in faster and more efficient groundwater cleanups than conventional Pump and Treatment Methods or PRBs by injecting into aquifers which are sources of chlorinated hydrocarbon pollution.

The research suggests that nanoparticles like n ZVI, bi-metallic nanoscale particles (BNPs), and Emulsified Zero-Valent Iron (EZVI), in combination with polychlorinated Biphenyls (PCBs), Halogenated Aromatics, Nitroaromatics, can chemically reduce the following pollutants in an effective way: perchloro-ethylene (PEC). The reductive dechlorination and beta elimination are two effective degradation reactions for chlorinated solvents. Beta removal, the most common occurrence when the contaminant comes into direct iron contact, follows the direction [56]. Reductive dechlorination, under the reducing conditions fostered by nZVI in groundwater, follows the direction of PCE alternatively TCE or DCE oscillating between nZVI and ethane (Phenrat, 2007).

Due to their large volume surface area and the presence of a larger number of reactive sites, nanoparticles can be extremely

reactive. This allows increased interaction with contaminants and thereby quickly reduces the levels of contaminants. Nanoparticles can penetrate very small areas of the ground because of their small size and stay suspended in groundwater, allowing particles farther than macro-sized particles and reaching a larger distribution. However, as mentioned in the section 'lamination,' nanoparticles of bare iron may not move too far from the point of injection. It is important to remember that iron nanoparticles are variable even though they have the same chemical composition (Liu et al., 2014). The characteristics of particles such as reactivity, mobility and shelf life which differ depending upon the production process or vendor that supplies the particles (Liu et al., 2014).

In situ use of nanoparticles The application method for nanoparticles is generally site-specific and depends on the type of geology present in the treatment area and the shape in which nanoparticles are injected. Existing wells, piezometers or injection wells are used as the most direct injection path. Recirculation is a procedure that injects nanoparticles into gradient wells when groundwater extracts down gradient. The collected groundwater is

blended and re-injected with additional nanoparticles. They maintain contact with the water in the aquifer and the nZVI and also prevent the settlement of larger agglomerated iron particles, enabling continuous contact with the contaminant.

Research is under way on injected methods that can help preserve nanoparticles' reactivity and improve their access to recalcitrant pollutants by increasing their distribution on the sub-surface. The production of nZVI on-site decreases the amount of iron oxidation, reducing reactivity losses. Green chemistry researchers have successfully developed nZVI in soil columns using a wide variety of plant phenols that allow greater access to the pollutant and generate less dangerous waste in the production process, according to scientists (Hart and Milstein, 2003).

The efficacy of nanoparticles can be limited by site-specific factors, such as the position and design, geological conditions, contaminant concentrations and pollution forms. For example, only two sites using nanoparticles in fractured basement were recorded for this fact sheet, although several pilot studies were carried out.

The pH of the surface can also restrict the efficacy of

nanoparticles since the particles' sorption strength, agglomeration and mobility are all influenced by the pH of groundwater (Elliot, 2006). The ionic strength and cation forms in the groundwater as well as the chemical and physical properties of aquifer materials influence iron nanoparticles' agglomeration and movement (Hart and Milstein, 2003).

APPLICATION OF NANOTECHNOLOGY IN FOOD AND AGRICULTURE

The global population currently stands at nearly 6 billion and 50% live in Asia. A large part of those living in developing countries experience daily food shortages because of environmental effects or political unrest, and there is a food surplus in the developed world. The push is to grow drought and pesticide-resistant plants for developing countries, which also increase yield. The food industry in the developing countries is driven by customer demand for fresher and healthier foods. For example, the UK's food industry is booming at an annual growth rate of 5.2% and the demand for fresh food has risen by 10% in recent years. Nanotechnology's ability to revolutionize medicine, textile and materials. Technologies of

information and communications and energy have been well-published.

In reality, many nanotechnology products, such as antibacterial dressing, transparent sunscreen lotions, stainless fabric, scratch free paint for automobiles and self-cleaning windows, are already on the market. A roadmap of the US Department of Agriculture released in September 2003 discussed the application of nanotechnology to the agricultural and food sectors. The hypothesis is that the entire food industry will be transformed by nanotechnology, changing the production, processing, packaging, transportation and consumption of food. This short study examines the main aspects of these transformations, emphasizes current research and possible potential effects in the agri-food industry.

The EU vision is a "knowledge-based economy" and plans to exploit biotechnology potential in the interests of the EU economy, society and the environment. New challenges are being created in the sector, including a rising demand for nutritious, safe foods; an increasing risk of diseases; and threats from changing weather conditions to agricultural and fisheries production. The development

of a biological economy is therefore a dynamic and demanding process involving the integration of different science branches.

Nanotechnology has the potential to revolutionize the agricultural and food industries by developing new methods for the molecular treatment of diseases, fast identification of diseases, increasing nutrient absorption capacity of plants, etc. Intelligent sensors and intelligent delivery systems can allow the farming industry to fight viruses and other pathogens.

Nanostructured catalysts will be available in the near future to improve pesticide and herbicide efficiency to permit lower doses. In addition, the use of alternate (renewable) sources of power and filters or catalysts to minimize emissions and clean up existing contaminants would indirectly protect the atmosphere. Controlled Environment Agriculture is a widely used agricultural methodology in the USA, Europe and Japan which efficiently employs modern crop management technology (CEA). CEA is an advanced and intensive method of hydroponic farming.

Plants are cultivated in a regulated environment in order to optimize horticultural practices.

The computerized device tracks and controls local conditions such as crop fields. As it currently exists, CEA technology offers an excellent forum for introducing nanotechnology into agriculture. Nanotechnological devices for CEA that offer capacity will greatly improved crops, crop vitality and food safety issues such as microbial or chemical contamination with many monitoring and control systems already in place.

In the second half of the 20th century, the use of pesticides increased, making DDT one of the most powerful and widespread in the world. However, many of them, including DDT, were subsequently found to be highly toxic, impacting human and animal health and, consequently, entire ecosystems. As a result, they were prohibited.

Integrated pesticide management systems, mixing conventional crop rotation methods with methods of biological pesticide control, are becoming common in several countries, such as Tunisia and India, to maintain crop yields.

Nano-scale devices with novel properties may in future be used to make agrarian systems plant health problems clear to the farmer.

Such devices may respond by taking appropriate remedial action to various circumstances. If not, the farmer will be warned of the problem. In this way, intelligent devices function as both a preventive and an early warning mechanism. Such instruments can be used to distribute chemical products in a regulated and targeted manner, much as nano-medicine has implications for human drug delivery. Developments in nanomedicine are now beginning to allow us to treat high precision diseases such as cancer in animals and to achieve a targeted delivery (to specific tissues and organs).

The use of pesticides and herbicides has revolutionized technologies such as encapsulation and controlled release methods. Many companies produce formulations that contain nanoparticles within the range of 100-250 nm that are more efficient than current formulations in water (thus increasing their activity). Other companies use nano-emulsion (nanoparticles) suspensions which may be water or petroleum based and contain pesticidal or herbicide uniform suspensions between 200-400 nm. They can be easily integrated into different media, such as gels, creams, liquids, etc., and are used for preventive measures, treatment and preservation.

New research is also intended to make plants more effective use of water, pesticides and fertilizers to minimize emissions and increase environmental friendliness in agriculture. Agriculture is the backbone of most developing nations, with over 60 percent of the population living on it. Nanotechnology will strengthen our understanding of the biotechnology of different cultures as well as build better systems for monitoring environmental conditions and providing nutrients or pesticides accordingly, thereby enhancing possible yields or nutritional values. It can also provide paths for value-added plants or environmental remediation.

Particle farming is one example of that which produces nanoparticles in given soils for industrial use by cultivating plants. Research has shown, for instance, that alfalfa plants growing into gold-rich soil absorb and accumulate gold nanoparticles in their tissues through their roots. The gold nanoparticles can be isolated mechanically from the tissue of the plant after harvest.

Nanotechnology can also be used for groundwater cleaning. The US company Argonide uses nano-fibers (Nano-Ceram) with 2 nm diameter of aluminum oxide to purify its water. These fibers may be

used to isolate from water viruses, bacteria and protozoan cysts. Similar projects are being carried out elsewhere, particularly in developing countries such as India and South Africa. The Fund has dedicated a substantial share of its \$105 million investment fund on nanotechnology to water purification techniques.

Lehigh University research in the US has shown the possibility of using ultra-fine nanoscale powder made from iron as an effective tool to clear contaminated soil and soil water - a trillion-dollar problem involving over 1000 untreated Superfund sites in the United States, around 150,000 underground storage tank sites (uncontrolled and abandoned sites where dangerous waste is situated) The iron nanoparticles catalyze the renewal and degradation of organic contaminants such as trichloroethene, carbon tetrachloride, dioxins and PCBs into simpler, less harmful carbon compounds.

This could pave the way for a nano-aquaculture that would benefit many farmers worldwide. Further study at CBEN has shown that iron-oxide nanoscale particles are extremely efficient in binding and extracting arsenic from groundwaters (something which affects

the water supply of millions of people in the developing world, and for which there is no effective existing solution).

Nanotechnology has been argued that the concept of waste and contamination can be eliminated (Fryxell et al., 2005). More modestly, nanotechnology is promising a substantial decrease in resource use and emissions, strongly reducing costs for renewable energy converters such as solar cells and making a much-improved technology possible for recycling and detoxification. Nanotechnology has also been argued to make chemical reactions more selective and help increase energy production and reduce toxicity (Fryxell et al., 2005). However, the development of nanotechnology has also triggered debate on the dangers of ultrafine particles (Salata, 2004). This author focuses now on the dangers of nanoparticles as they are actually used in or planned for use in development and goods and on what can be done to minimize their related risks.

Many existing or future applications use fixed nanoparticles and thus are not dispersive necessarily. The use of carbon black for printing and tire manufacturing is a longstanding example. Recent applications include coats, textiles, pottery, membrane, compounds,

glass goods, prostheses, non-static packings, cutting tools, electrical and electronic devices like screens, battery pads and fuel cells, and a range of electronic and electrical equipment. Other uses are medications, personal care goods like cosmetics, quantum dots, and some pilot applications Nanoparticles

CONCLUSION

The study is based on the potential of nanotechnology to be fundamental to a whole new future in the areas of food and agriculture, building materials, mechanical engineering, medicine and electrical engineering. While the reproduction of natural systems is one of the technology's most promising fields, scientists still strive to understand its amazing complexity. In addition, nanotechnology and nanomaterials are a rapidly growing area of research in which new nano-scale properties of materials can be used to help the industry, and there are several capable developments that could potentially modify the service life and life cycle costs of infrastructure for construction to become a new world in the future.

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43

APPLICATIONS OF SILVER NANOPARTICLES IN DIFFERENT FIELDS

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ABSTRACT

The most common nanoparticles used in food and other industries are silver nanoparticles. The treatment of different diseases can eventually be offered by silver nanoparticles. Their incredibly wide surface area allows a large number of ligands to be coordinated. The properties of silver nanoparticles in human therapy are tested in laboratory and animal tests, and possible effectiveness, toxicity and cost are evaluated.

Key words:

Nanoparticle, Silver nanoparticle, Silver nanoparticles applications

INTRODUCTION

Silver is the most widely used commodity in all nanotechnology; Ag's attractive antimicrobial property activity on a nano scale is significantly increased. Accordingly, AgNps has been used in hundreds of personal and technical items ranging from surgical and feeding instruments, water purifiers, fabrics, cosmetics, lens cases, wound dressing, toys for children and mostly tissue regeneration scaffolding. A strong antibacterial agent toxic to fungi, viruses and algas was one of the most beneficial uses of silver.

Nanotechnology defines nanoparticles as a small object or particle, which, for its transport and property, acts as a whole unit. Nano-Technology benefits from increasing the surface area when a solid material becomes very thin, resulting in an increase of surface reactivity and quantum effects. The physical and chemical characteristics of the nanomaterial in larger bulk shape can vary greatly and nano particles are particles with at least 1 to 100 nm of size. In food packaging polymers, silver nanoparticles can be used to improve food's self-life. It was found that microbial growth decreases if AgNps is applied directly to milk.

ELEMENTAL SILVER CHARACTERISTICS AND SOURCES

It is a muddy and ductile transition metal with the appearance of a white metallic luster¹. It offers the highest electrical conductivity and thermal conductivity and the lowest resistance to contact². 28 radioisotopes were characterized, with the majority less than 3 minutes of half-life. The average silver concentration in water is 0.5 ppm, while the soil is around 10 ppm. Naturally, silver is obtained in pure form and is extracted by amalgamation and displacement using metals such as mercury or smelting.

SILVER NANOPARTICLES

Ancient phoenicians have historically been recognised as conservants to put silver coins in water jugs³, the gold standard for preventing widespread bacterial growth of patients with burnt denuded skin was long seen by physicians administering silver-nitrate solution to newborn eyes for the prevention of neonatal conjunctivitis⁴, and ag sulfadiazine creams⁵. Currently the most widely known substance of all nanotechnology products is silver nanoparticles⁶. Whereas AgNps exhibits unusual optical and electrical properties on the Nano scale, AgNps has been most useful for enhanced antibacterial action. The nanoparticles are primarily used in the fields of surgery, food handling, packaging and storage equipment, cleaning of water, textiles and cosmetics.

SYNTHESIS

The manufacture of nanoparticles can generally be divided into two broad approaches:

1) the top down approach, and 2) the bottom-up approach, the ball-frying mechanics, require the balanced erosion of solid mass A solid mass is moistened in smaller sections in the top-down method. One

is to create finer structures or nano powders that are shaped irregularly. However, this approach typically leads to nanomaterials of very large grain dimensions between 200-300nm and contamination by frying media or atmosphere⁷. In the bottom-up method the nanomaterial is formed in four steps into an atomic byatom, in which the precursor is first consolidated into a strong stage, initiates the ion format of several nuclei, grows on the nuclei and finally stabilization ends the process to produce a desired size⁸.

USE OF NANOPARTICLES OF SILVER

In food engineering, nanotechnology plays an important role. Silver nanoparticles (AgNPs) decrease food's microbial impact and enhance food shelf life. Nanotechnology is a state-of-the-art technology to preserve perusable food. This progress in their manufacturing techniques attracted the attention of many industries which wanted to take advantage of the unique properties of silver nanomaterial for use. Silver nanomaterial applications are dispersed, but they can be divided into three key categories: research, industrial and consumer goods.

PROPERTIES OF NANO SILVER

Two major factors lead to substantially different compared to bulk materials for nanoparticles: surface effects and quantum effects

9. The chemical reactivity of materials and their mechanical, optical, electrical and magnetic properties are influenced by these factors. Nano silver has chemical and biological properties attractive to consumer goods, food, textiles and medical industries. Nano silver has also a special optical and physical property that is not present in bulk silver and which has great potential for medical use.

ANTIBACTERIAL PROPERTIES

Nano silver is an effective killing agent for Gram-negative and Gram-positive bacteria¹⁰ against foreign spectrum. Gens including Acinetobacter, Escherichia, Pseudomonas, Salmonella and Vibrio contain gram-negative bacteria. Acinetobacter species are associated with nosocomial infections, i.e. those resulting from treatment in a hospital or healthcare unit and secondary to the original condition of the patient. Gram-positive bacteria include several renowned genetic species, including Bacillus, Clostridium, Enterococcus, Listeria,

Staphylococcus and Streptococcus. Antibiotic-resistant bacteria include strains such as Staphylococcus aureus, which are methicillin-resistant and vancomycin-resistant, and Enterococcus faecium. The antibacterial activity of various antibiotics is enhanced by silver nanoparticles (diameter 5-32 nm, average diameter 22.5 nm)¹. In the presence of silver nanoparticles, antibacterial activity of penicillin G, amoxicillin, erythromycin, clindamycin and vancomycin against Staphylococcus aureus and Escherichia coli increases¹².

ANTIFUNGAL PROPERTIES

Nano silver is a fast-acting efficient fungicide for a wide variety of common fungi including genera such as Aspergillus, Candida and Saccharomyces¹³. The exact mechanisms of action of silver nanoparticles on fungi are not yet clear but similar mechanisms were suggested for fungi¹⁴ as opposed to antibacterial action. Silver nanoparticles (diameter 13.5 ± 2.6 nm) against bovine mastitis isolated yeast ¹⁵ are successful.

ANTIVIRAL PROPERTIES

Silver nanoparticles (diameter 5-20 nm, average diameter ~10 nm) inhibit HIV-1 virus replication¹⁶.

ANTI-GLYCOPROTEIN FILM PROPERTIES

Glycoproteins are proteins containing oligosaccharide chains that are covalently bound to side-chains of polypeptides. These proteins are essential for normal functioning of the immune system including the identification of white blood cells and also play a role in cell interactions. Examples of immune system glycoproteins include molecules like antibodies which interact directly with antigens. For impregnation of silver nanoparticles in the medical class (diameter 10-100 nm), the depot effect and diffusion pressure are available to balance the silver concentration and drive silver through the glycoprotein conditioning film¹⁷.

PLASMONIC HEATING PROPERTIES

Proof-of-principles were shown to be Plasmonic photo activation of hollow polyelectrolyte multilayer capsules combining silver nanoparticles and drug models¹⁸. The use of laser irradiance was remote to activate silver nanoparticles, causing not only absorption of photons but also heat transfer to the surrounding polymer matrix from the nanoparticles. The local heating disrupts the polymer matrix and helps the encapsulated substance to exit the capsule within.

SCIENTIFIC APPLICATIONS

The extraordinary physical, chemical and optical properties of silver nanomaterials for use in different scientific applications. These properties depend significantly on nanomaterial size, form and surface chemistry. Metallic nanoparticles, including Nano silver, display resonance of surface plasmon (SPR) when light is irradiated, which causes SPR peaks within the UV-Vis wavelength range¹⁹. The SPR is the product of the interactions between the light incident and the free electrons in the nanomaterial conduction band. The width and position of the SPR peaks depends on the nanomaterial's height, shape and surface properties²⁰. Silver nanomaterials are commonly used for improved Raman dispersion on the surface (SERS). Raman dispersal by molecules can be improved if research molecules are adsorbed on rough metal surfaces, which improves the sensitivity to distinguish single molecules²¹.

Silver nanomaterials are a good method for sensing applications, including DNA sequence detection, as a result of SPR and SERS²². Laser desorption/ionization mass spectrometry for peptides²³, colorimetric Histidine sensors, human plasma

fibrinogens²⁴, actual membrane transport tests in living microbial cells²⁵, enhanced IR absorption spectroscopy²⁶, colorimetric ammonia concentration measurement sensors²⁷, herbicide detection biosensors²⁸, and medical gluca sensors²⁹. Silver nanomaterial for enhanced metal fluorescence applications is also considered to be used. Fluorophores can change their intrinsic spectral properties through metal nanostructuring. Metallic proximity.

The sensitivity of low quantum yield fluorophores is increased by nano silver. The results include fluorophore quenching at short distances, spatial variations of light field incidents and changes in the rate of radioactive decay³⁰. These features allow the use of nanosilver in applications such as immunoassay and detection of DNA/RNA. As previously stated, its surface properties significantly influence the characteristics of the silver nanomaterial. Modification of the silver surface of the Nano prisms by alkanethiol leads to possible candidates for streptavidin or antibiotin sensing and can also help diagnose Alzheimer's disease³¹.

APPLICATION IN FOOD INDUSTRY

Nanotechnology, using small particulate matter measuring a billionth of a meter, is now used for a variety of applications in dietary supplements, functional food products and food packaging. To provide packaging that protects the food against dust, gas (O₂, CO₂), light, bacteria, humidity, safe, inert, inexpensive to manufacture, easy-to-use and reusable. Melting mixing in a twinscrew extruder was used to produce LDPE nanocomposite films containing Ag and ZnO nanoparticles.

Fresh orange juice was then added to the packages made from films and kept at 4°C. Fresh meat is a commodity which is extremely perishable. Under natural aerobic conditions, bacterial growth limits the shelf life of cooled meat. It will be used to prevent the development of unwanted microorganisms and also to supply a desired food texture, encapsulate food components (e.g. monitor the release of flavours). Tiny molecules detection – fruit maturation, fish spoilage (pH reactive dye reacts with spoilage compounds trim ethylamine, ammonia). 32

OTHER APPLICATIONS

In industry the nanoparticles are often used as a catalyst for the high volume-to-surface ratio of silver nanoparticles that provides high surface energy to promote surface reactivity, such as adsorption and catalysts. They are also used in electronics and electrical applications. Silver nanoparticles are being used as antimicrobial agents, including air-sanitizing sprays, sockets, pillows, slippers, facial-masks, wet wipes, detergents, soap, shampoos, toothpaste, air filters, refrigerator coatings, vacuum cleaners, mobile phones, food storage containers.

CONCLUSION

The specific characteristics of silver nanoparticles make it suitable for a variety of technologies, including biomedical, material, optical, and antimicrobial applications and for use in nanotoxicology. Recent research in the field of food maintenance and handling of silver nanoparticles is underway. The toxicity and other chemical properties of silver nanoparticles are yet to be discovered and are in laboratory phase.

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Chapter –XLIV

44

APPLICATION OF GENETIC ALGORITHMS TO DATA MINING

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ABSTRACT

Data Mining is an automated search for useful and interesting relationships between database attributes. The size and complexity of the target database, both in terms of features set and sample set, are an important obstacle to efficient data mining. Although several algorithms for machine learning have been used for data mining applications. Due to their performance in large scale search and optimization problems, there was a particular interest in using genetic algorithms. This section looks at how GAs are used to boost the efficiency of cluster and classification algorithms in data mining and discusses techniques to improve these approaches.

INTRODUCTION:

Data mining is the concept used to characterize the search of vast databases for useful knowledge that cannot easily be accessed via the traditional query mechanisms. In certain instances, data is extracted to learn unknown or unexpected knowledge (and therefore interesting). To this end, Data Mining applications usually have one or more of the following as their objectives:

Finding Patterns: Patterns are sample clusters that are somehow linked with the attributes of the database. The discovered trends can be understood or guided ("Identify all clusters of 10% or more of the population") ("Find population clusters that have contracted cancer").

Deriving Rules: Rules define the relations between attributes. Clusters therefore provide a good source of laws. In IF/THEN sentences, rules are usually specified. An example of a rule may be: THEN Risk(Cancer) = 0.7 ((Age > 60)AND (Smoker=Very true));

Classifying Unknown Samples: Users also attempt to introduce Data Mining algorithms to categorize new data samples into existing groups (i.e., "What sort of car is most likely to be driven by a 35 year-old white, suburban, single and female teacher?").

THE CURSE OF DIMENSIONALITY

Although Data Mining is a relatively new branch of artificial information, it involves many of the same problems as existing fields such as machinery learning and the recognition of statistical patterns (SPR). The high dimensionality of data is one of the worst of these problems. High dimensionality means the large number of attributes

in a database (nominally 20 or more). A highly dimensional data set causes problems in terms of the combinatorily explosive increase of the search field (Fayyad, Piatetsky-Shapiro, & Smyth 1996). Moreover, as more features are introduced, the growth in the search area increases the number of training samples needed to produce accurate results. The dimensionality curse must be solved to create successful data mining algorithms.

One way to eliminate the dimensionality curse is to reduce the list of attributes to those that are really necessary for distinct classes within the data. This process (called function selection) tries to find the feature set which results in the best performance of classification (i.e., the set that has the fewest mis-classifications). In addition, classification efficiency can be further improved by assigning relative weights to each variable. Each function can then be increased by its assigned weight to optimize the overall performance of the classifying system. Therefore, it will increase the contribution of those features that support separate groups, whereas the contribution of those which do not decrease. The product of this transformation is shown in Figure 1.

Notice that after the transformation is applied, classes in (a) are better separated (b). The process of calculating such a weighting vector is called the extraction of the function. Although a number of traditional algorithms for selecting features, such as forward selection (Lippman 1993), are greedy in nature and cannot be extracted from features.

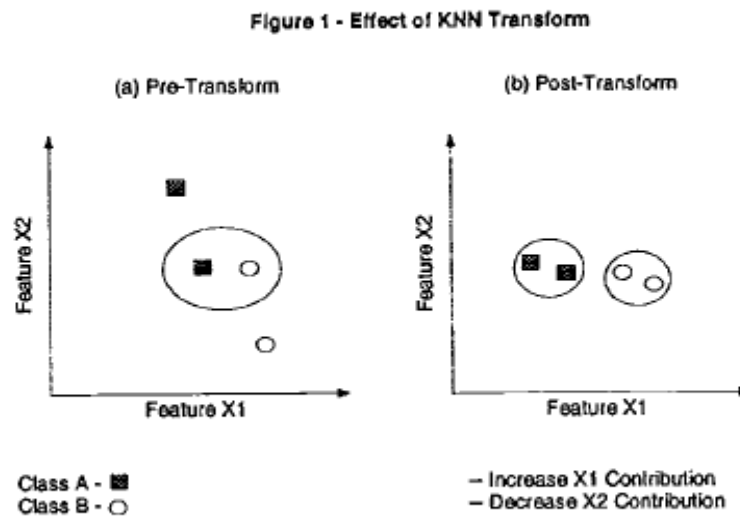


Figure 1: Effect of KNN Transform

Why use Genetic Algorithm--~?

GAs are global search algorithms that operate using evolutionary principles. In tradition, GAs have used binary strings to encode the characteristics of the population of an individual; a

person's binary sections representing a particular feature are known as chromosomes. Binary strings are practical because GA operators like Crossover and Mutate can easily manipulate them.

Binary chromosomes may also be used to display non-binary numbers with forms of entiers and floating points. Given a problem and an individual population, a GA will assess each individual as a possible solution according to a predefined assessment function. The assessment function assigns each person a value of goodness based on how well the individual solves a given problem. This metric is then used to determine which individuals are bred in order to produce the next generation. Crossing existing solutions to create a better solution is the way to breed. In addition, there is a mutation element which will alter existing solutions randomly. Mutation helps to break the GA from local minima, thereby helping to find a solution that is globally optimal.

While GA has no guarantee that it can find an optimal solution, its method of selection and breeding candidate solutions means that it can create a pool of "good" solutions given enough generations. GAs are interesting because they provide an alternative to conventional

ML algorithms that begin to display a combined (and thus low) explosion in broad search areas. GAs were shown to solve problems deemed unwieldy due to an overly wide search area (Punch et al. 1996). Briefly, GAs will help remove the dimension curse.

A HYBRID APPROACH - GAS AND THE K-NEAREST NEIGHBORCLASSIFIER

The Genetic Algorithms (GARAGe) Group at the Michigan State University (MSU) has developed an approach which combines both feature selection and extraction (Punch et al 1993). This technology uses a hybrid approach that combines a GA with a K-Nearest Neighbor (KNN) classifier based on earlier work of (Sklansky&Siedlecki 1989). The KNN algorithm works by assigning a vector to the class that is the closest K-classification samples (Duda&Hart 1973). For instance, if K=5 we allocate class based on the nearest five vector neighbours. From the nearest five neighbors, if three belong to the class A and two to the class B then the vector is assigned to the class A. The KNN technique is non-parametric, as a type of probability density function (PDF) is not needed in advance.

Although KNN is a powerful grading technique, it is not ideal because it typically leads to an error rate that is greater than the minimum possible (Bayes error rate) (Therrien 1989). However, the precision of the KNN algorithm is enhanced by using the function extraction to change the weights of the attributes used to measure the distance between samples. In this case, the distance (D) between different vectors is calculated as follows:

$$D = \sqrt{(X - Y)^t W (X - Y)}$$

where,
X and Y are distinct feature vectors and
W is the weighting vector

The optimal weighting vector (W) for the feature set can be derived using a GA. The weighting vector is modeled by encoding each characteristic in the GA schema as a distinct chromosome. The evaluation function will then calculate the output of individual candidate weighting vectors based on the error of the KNN classification. The KNN error is calculated by multiplying the weighting represented by the GA candidate by each known function vector. If the KNN classifier maps the vector to the wrong class, it's a mistake.

The cumulative KNN error for the candidate weighting vector is calculated when all known vectors are processed. Only the most promising weighting vectors are chosen for GA reproduction. This process increases the weight of features that help to differentiate between classes; on the other hand, weight of irrelevant features decreases (toward zero). The aim is to create a weighting vector that minimizes the KNN classification error in the given training data set.

ALGORITHM IMPROVEMENTS

Although the above solution works, computationally it can be very costly. (Punch et al. 1993) reports that processing a wide feature set (96 features) on a SPARC workstation took 14 days. Obviously, this sort of success in comparison with current greedy strategies is unacceptable. Though results are obtained faster with a parallel configuration, the algorithm can be modified to produce results faster.

The main amendment is to split the GA quest into two stages. The first step performs a binary search (0/1) for the most promising features. The structure for this phase also includes a chromosome encoding the value of K.

The features which minimize the KNN classification error are given a 1 after the first step has been completed; those which are insignificant or harmful to the classification are assigned a 0. The second phase tests each person in its gene pool using the results of the first phase. In this step, each function is encoded in a multi-bit chromosome (in this case four bits are used). The binary value of each chromosome is then calculated by a factor dependent on previous step results.

The idea is to scale good features to improve their contribution (i.e., larger than one) and to reduce their contribution (i.e., less than one). In this point, the optimal K has been used since the first step. Since the search space of the first phase is significantly smaller than the second phase, the first phase needs less generations. The result can then be used to further concentrate the search in the second step for optimum weights. By using the short binary search results in the first iteration, the overall progress of the GA quest can be accelerated.

MINING FOR EDIBLE MUSHROOMS

To test my proposed changes, I have chosen the Mushroom database, an often cited SPR benchmark.

This database (built by the Audobon Society) has 22 features that can help you decide if a mushroom is poisonous or edible; there are 8124 samples in the database in general. The MSU GA/KNN hybrid and my modified version have both been executed against this info. While these two algorithms ultimately reached an error rate of 0% compared to the exercise collection (508 samples), the MSU hybrid took fifteen generations to achieve this outcome (see Table 1). While my algorithm quickly achieved its aim, I allowed it to run for 5 generations to achieve a variety of candidate weighting vectors. During this time a total of eight separate feature sets were produced which achieved a 0.0 percent training error.

Following the completion of the feature extraction process, the Connection Net classification system has been used to handle the selected features in both the training and data sets. Table 2 shows the findings of this experiment. The results achieved in the first three entries in Table 2 are the reduced function collection derived from the hybrid GA/KNN classification. Not all function sets have obviously been equally well performed. The best feature set had a 0.39 percent test error rate, while the worst had a 1.65 percent test

error rate. The lesson is not to settle for the first set of positive results. The GA should be run long enough to obtain a pool of candidates; the best set can be obtained from this by assessing it from the test results.

Table 2 shows how the findings for this dataset compared with other classifier forms. The dataset also used a Gaussian classifier. The classifier was also run with Link Net for each training class with a complete covariance matrix. Great results have been obtained with the complete feature set and a 50/50 sample division between training and test data sets. The findings were much less positive with the derived feature set.

The highest overall result was achieved with the REGAL classification scheme in this data set (Neri&Saitta 1996). REGAL is a hereditary, multi-modal principle student who generates a collection of logical rules for first-order predicates in a given data set. In turn, these rules are used to define the following data samples. Although REGAL could remove the test error entirely, it did so with a much larger workout collection (4000 samples). It should also be noted that the rule set that optimized the performance of REGAL took 164

minutes (using 64 processors). Moreover, REGAL's output was much closer than the updated GA/KNN classifier in the process of a comparable training set (500 samples). Finally, with a substantially reduced training set, a neural network classifying system (Yeung 1991) achieved a 0.9% error rate (300 samples).

CONCLUSION

From the above findings, some essential points can be inferred. Second, the GA/KNN algorithm changed, it can successfully reduce the dimensionality of the data set while improving the accuracy of the classification. Second, the accuracy of classification has been enhanced by using a smaller training data set. This is important because a classification with smaller data sets is more effective with a larger classifier (and testing).

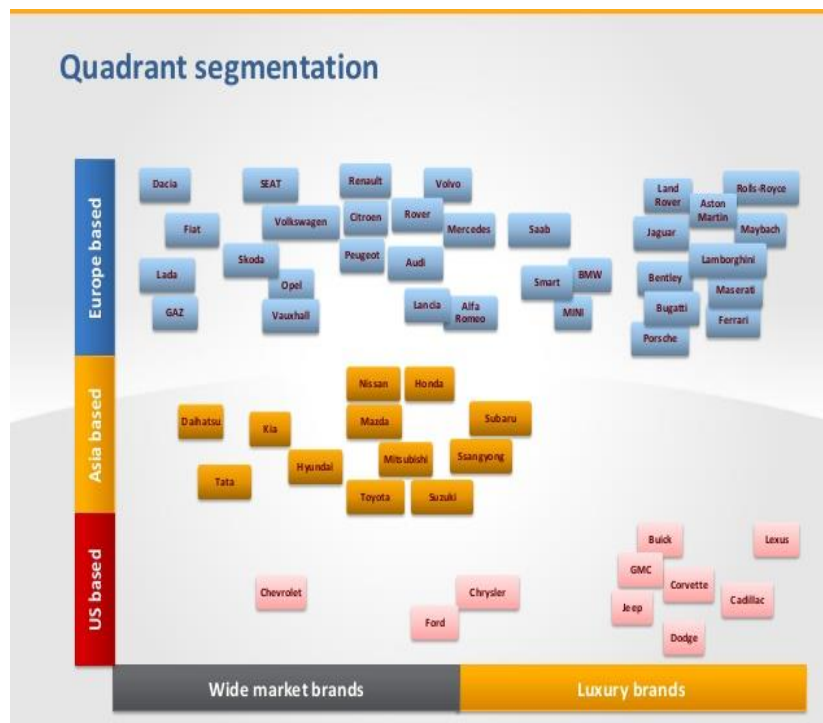
Third, this method has been able to reduce training error faster than the MSU algorithm since the algorithm's initial phase had a smaller search space (compared to the second phase). Furthermore, integrating the K parameter in the GA schema led to improving the accuracy of classification.

Table 2: Mushroom Data Set Results for KNN Classifier

K Value	Feature Set Size	Training/Test Set Size	Training Error (%)	Test Error (%)
K=1	12	508/7616	0.0	0.39
K=1	12	508/7616	0.2	1.65
K=1	10	508/7616	0.59	0.93
K=1	22	508/7616	0.0	0.47
K=3	22	508/7616	0.0	0.54

Table 3: Comparison to Other Classifiers

Classifier Type	Feature Set Size	Training/Test Set Size	Training Error (%)	Test Error (%)
Gaussian	22	4062/4062	0.17	0.221
Gaussian	12	508/7616	2.76	2.991
REGAL (Neri & Saitta 1996)	22	500/7624	N/A	0.42
REGAL	22	4000/4124	N/A	0.00
Neural Network (Yeung 1991)	22	300/7824	N/A	0.92



FUTURE DIRECTIONS

Although the above findings look positive, the fundamental approach has drawbacks for data sets not homogeneous and/or unimodal in a particular class. By using one weighting distribution for all data, we assume that all class distributions have the same fundamental form for a particular set of functions; this is obviously not the case for the majority of real-world data sets.

Furthermore, the distribution of a certain class is always multimodal. For example, different subclasses of poisonous mushrooms may exist, defined by features which are mutually exclusive. The use of a single vector as a transform under these conditions will not yield optimal results. Instead, an approach must be explored for the creation of weighting vectors adapted to each data class and/or subclass.

The use of GAs to perform domain taxonomy substitutions may also increase the selection and classification of features. A taxonomy that describes hierarchical relationships between objects in the domain can be constructed in any domain. The example of such a taxonomy is shown in Figure 2.

This figure shows the hierarchy between the car brand, business and brand origin (foreign vs domestic). The GA functionality could be changed to replace the GM mark of its associated brands when looking for the best feature set. The domestic mark for all car brands manufactured in North America will be an alternative replacement.

Such replacements which reveal clusters that are not detected when the data is viewed using a label lens at the base of the hierarchy of taxonomy. For example, a brand replacement for the brand itself might expose a propensity to buy Japanese cars for 20. As a consequence, the replacement will find a feature set that provides better support to rules. Since a given data set can be defined by several hierarchies, it is important for the quest to take these also into account. Because exploring these relationships significantly increases the size of the search area, it is reasonable to continue to use GAs as the search mechanisms.

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Chapter –XLV

45

HUMAN RESOURCE MANAGEMENT PHILOSOPHY

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ABSTRACT

Human resources management refers to an organization's systematic and cohesive approach to handling human resources. It includes a series of interrelated policies with an ideological and philosophical orientation and forms a business strategy that aims at managing individuals for competitive advantages. The starting point of HRM is the idea of philosophical orientation, helping to identify long-term visionary organizational principles. Philosophy in an organization's management consists of an interconnected collection of beliefs and convictions about how the things are, how the operations should be and how they should be carried out. These assumptions and convictions of those who build an organization (owners) and those who manage it (managers and especially key decision makers). These assumptions and values are often clear and often implicit in decision-makers' minds.

Keywords: Human Resource Management, HRM, Philosophy.

BACKGROUND:

A person's theory originates in two premises – real premises and meaning premises. The factual premises are a descriptive view of how

the world is behaving. They are focused on research and our experiences. Our view of the desirability of such objectives and practices is based on value premises. HR theory focuses on the values and expectations of managers regarding people – their personality, desires, value and approach to work. These convictions and assumptions decide how people are to be handled. Three techniques are available to treat people: Machine strategy and approach to commodities. A humanitarian solution in a commodity approach, an individual is treated like commodity which, as in the old slavery system, can be brought or sold at a price. An individual is viewed as part of the machine when entering the machine and can be mounted like every other part. Both methods regard an individual as a physiological person. An individual is viewed as a human being with a physiological approach.

INTRODUCTION

The management of human resources refers to an organization's strategic and cohesive approach to managing human resources. It comprises a collection of interrelated policies with an ideological and philosophical orientation and forms a business

strategy in which people are managed for competitive advantages

ORGANIZATIONAL PHILOSOPHY AND VISION

The starting point for HRM is to define philosophical orientation which helps in defining visionary long – term concepts of organization its mission, policies as shown in figure 1

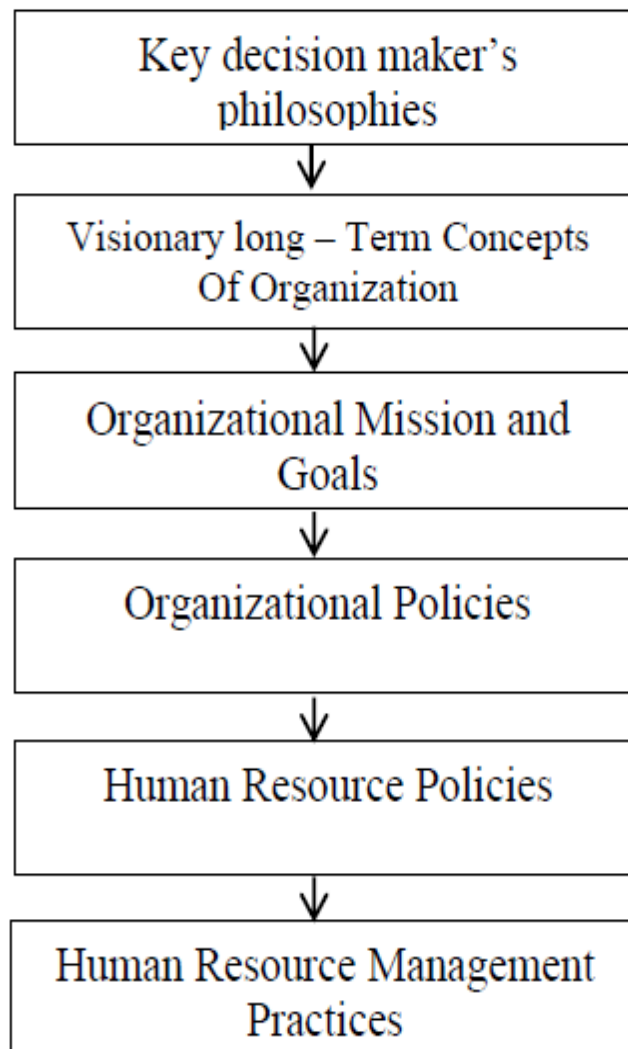


Figure 1: Organizational Philosophy and Vision

The key words of this connection are ideology, vision, mission and policies that can be organized in a hierarchy and eventually define various organizational practices, including HRM practices.

PHILOSOPHY

Philosophy consists of an interconnected collection of assumptions and values in the sense of the management of an organisation about how things are meant for activities. And the way it ought to be. These assumptions and convictions of those who build an organization (owners) and those who manage it (managers and especially key decision makers). These assumptions and values are often clear and often implicit in decision-makers' minds.

A person's theory originates in two premises in two real-world premises and merit premises. Factuals are our descriptive view of the actions of the universe. They are based on empirical results and experiences. Premises of value reflect our perception of the desirability of certain objectives and activities

HUMAN RESOURCE PHILOSOPHY HR

Philosophy revolves around the views and assumptions of management regarding their existence, desires, principles and approach. These convictions and assumptions decide how people are to be handled. Three approaches are available for people: a commodity approach, a computer approach and a humanistic approach. An individual is regarded like a product that can be bought or sold at a price as in the old system of slavery. In the computer method, an individual is treated like every other component of the machine. Both methods regard an individual as a physiological person. In a humanistic approach, an individual is viewed psychologically as a human being. HR philosophy should also take all these human endowments more directly into account; HR philosophy should be founded on the following beliefs:

1. Human beings are the organization's most valuable resource.
2. Human beings may be created to a large degree since they have only partly used creative energies.
3. People feel dedicated to their work in the organisation, if they establish their affiliation with it.

4. People are likely to develop a sense of belonging if the company takes care of them and meets their needs.

5. Human beings contribute to the fullest if they have the chance to explore and exploit their full potential.

6. The company has a duty to build a safe and inspiring working atmosphere marked by transparency, excitement, confidence, shared cooperation`

ITC limited's management style is responsible for the following concerns:

1. Involve their ultimate customers-millions. 1.

2. The tread is concerned with their intermediate clients.

3. Their suppliers' concern—their sources of raw materials and their suppliers.

4. The most valued assets for their staff.

5. The consumers profit from concern for their rivals, who eventually wish fair competition well.

6. Investing public concern for their shareholders

The theory of the company's human resources is founded on the seven cardinal beliefs

1. Self-Managing Resource

We believe that the human being is a fundamental and special resource, in that it is at the same time a source, a resource and the end of all economic and social activities. He is the means and the goal. He is capable, eager and able to evolve in the normal course of evolution.

2. Potential

We believe in people's innate ability. Different potential styles and degrees can be manipulated and used in relation to mission challenges, obligation and dedication.

3. Limitations

We assume that any perceived shortcomings in people are the product of a number of conditions and influences and that the ability to flourish can be resolved with encouragement, knowledge and correction.

4. Quality of Work Life

We assume that ITC, as a business institution, should provide all its members with a high standard of work life. Opportunities for a meaningful airline, employment satisfaction and professionals. By

doing so, ITC members lead to quality of life at the social interface

5. Meritocraci

We believe that people consider meritocracy as a fair and just structure and contribute best under open opportunities and challenges and different performance-based incentives.

6. Membership

We assume that the components of ITC can be harmoniously mixed. Leadership, fellowship and peer ship, in particular.

7. Actualisation

We believe that designing, implementing and updating human resource management programs, improving skills and the environment will allow us as individuals and ITC as a respected corporation to self-actualize.

According to New Webster Dictionary, politics means the art, method and behavior of a nation, the philosophy on which each measure or course of action is centered, which rulers of a nation take with regard to a particular issue, especially in the case of the foreign country. Policies can be described as follows in the organizational context:

ACCORDING TO KOTLER

“Policies describe how the organization handles stakeholders. Employees, customers, vendors, distributors and other critical company staff behave on key issues regularly.”

OBJECTIVES

A program has two goals in every field: general goals and particular goals. The general objectives should express an organizational approach towards a specific field or feature that underlies human resources and their position in achieving long-term organizational objectives. Different goals relate to the specific activities of the sector such as recruiting, growth, assessment, mobility of human resources, incentive programs, industrial relations etc. Different HR policies should be understood and aimed at:

1. To make it possible for the company to have appropriate, qualified and skilled staff at all levels;
2. To have such working conditions that will enable staff to establish a sincere sense of solidarity with the company and to fulfill their tasks as readily and efficiently as possible;

3. Include and build a sense of responsibilities for those specifically involved in human resources, to take a humanistic approach, guaranteeing the security of employees' basic rights and their dignity;
4. Establish conditions for mutual confidence and collaboration between managers and managers at all levels of the organisation;
5. Create conditions for staff development and use of their full ability to support both the company and its own benefit.

THE OBJECTIVES OF HR POLICIES HAVE BEEN DESCRIBED BY PETER DRUCKER AS FOLLOWS

"Management must adjust its policy priorities so that workers do their jobs and perform their duties. It implies that an individual is considered as a property, that is, as something with special psychological properties, abilities and limitations which require equal care in engineering as properties of another source. It also means that the human capital, unlike any other resources, are considered. Personality, civility, control of when, how much and how well you operate, and therefore motivation, participation, happiness, benefits

and rewards, leadership, condition and function. And management and management alone will meet these criteria."

An organization's strategy is somewhat enduring. It is a permanent strategy which offers guidance for management decisions. Policies should therefore be built on a sound basis. If this is not done, the manager will still make decisions. What constitutes a sound policy however, cannot be uniformly prescribed, because circumstances are so different and an entity can differ from others in terms of policy formulation and execution. Any main features of a sound policy

RELATIONSHIP TO ORGANIZATIONAL OBJECTIVES

In the framework of organizational goals, a strategy is formulated. Try to contribute to the achievement of these goals. Therefore, roles or actions that do not contribute to achieving goals should be omitted in the formulation of a policy. For example, if a policy to fill higher positions from within creates obstacles in attracting talent at a higher stage but the company requires it, the policy may be modified, since the organization will be unable to accomplish its goals in the absence of adequate manpower.

PLANNED FORMULATION

A strategy must be the product of deliberate and organized drafting rather than opportunistic decisions taken at the moment. Although the policies of the company are relatively permanent, ad-hocism should be avoided because they create more uncertainty. It is true that it is not possible to fix all problems within the company on the basis of policy, but for repeat issues, well-established policies should emerge.

FAIR AMOUNT OF CLARITY

Regulation should be straightforward as far as possible and should not leave any doubt. When misinterpretation is problematic, the company should have the way to overcome uncertainty. In addition, policy gives some latitude to decision-makers, but it should limit the number of situations where decisions are based on personal opinion. If this happens often, the policy should be closely monitored and appropriate changes should be made.

CONSISTENCY

The strategy should ensure continuity in the functioning of the organization. Sometimes in different functional fields, the

organization formulates policies and each role is associated with other organizational functions. If the policy in one region is inconsistent with another, conflicts may lead to inefficiency. This occurs most often in roles that have close relationships, such as production and marketing or finance and other functions. Policies should also be formulated in an interconnected manner such that policy in each region also contributes to other fields.

A sound strategy combines stability and versatility. On the one hand, a strategy is a long-term proposal which must have continuity so that the participants know what they have to do on specific issues. In the other hand, policy should not be so inflexible that when the need arises it cannot be modified. The old and necessary improvements should be implemented from time to time in a changed situation. This adjustment may take the form of adding, replacing or deleting the current policy.

SOURCES OF HUMAN RESOURCE POLICIES

Human resources management policies can either be clearly and expressly formulated by or suggested by managers, or they can often be enforced by outside organizations. Implicit and imposed laws

can also be formulated. Moreover, there might be circumstances where such policies do not exist, and it may be difficult for the managers involved to reach a decision and seek guidance. Therefore, the policy can be appealed.

FORMULATED POLICY

A formulated policy is defined by the organization to provide its members with guidance. The majority of policies in private sector organizations fall in this group, as each company formulates different policy elements, like HRM. For example, policy flows from higher to lower levels of the organisation. This policy may be general guidelines for the action or may be fully written such that there is no room for definition and interpretation.

IMPLIED POLICY

Policy may often not be explicitly stated advertising the actions of managers, especially at higher levels, providing guidance for actions at lower levels. The company sometimes explicitly stated policies for its logo but is not in a position to implement them. In that event, the behaviour of a decision maker depends on his own rules, biases and whims, consciously or unconsciously. Moreover, the

decision is based on personal perceptions of circumstances and consequential actions in the absence of clear guidelines. These activities can, however, cause confusion within the organization.

IMPOSED POLICY

The policy imposed is the product of the control of certain external agencies. Such agencies can be government agencies that make available HR and other policies to all the public—segmental organisations, parent organisations, overseas parent organizations for multinational corporations operating in a region, apex business house company, or a business association which is affiliated to a specific organization.

These agencies will either provide full guidance on a topic or provide a general policy framework. For example, Banking Service Commissions hire and pick public sector commercial banks, and there is no influence over these aspects for individual banks or a holding company may provide their subsidiary companies with a compensation policy and so on.

APPEALED POLICY

A policy of appeal results from a subordinate manager's appeal

to his superior for a big case. The need for such an appeal could occur because no legislation has protected the case in question. The appeal is taken up and the decision on the case sets a precedent which becomes a policy that provides guidance for the potential decision in similar cases. However, the mostly incomplete and uncoordinated appeal policies. As such, managers should view and revise their policy formulation, communication and interpretation, if regular appeals are made, to make policy recommendations clearer and more precise.

FORMULATION OF HUMAN RESOURCE POLICES

In addition to the HR policies, we have seen various outlets arise. Most HR policies are, however, the product of deliberate and mindful wording. Since a policy is a kind of standing plan, various variables that have an effect on the functionality of the policy should be taken into consideration. A policy formulation for human resources management in an organisation, as seen in Figure 2, follows a series of activities.

HR policy formulation takes into account a variety of variables, such as organizational theory, HR philosophy, external and internal

factors. When all these considerations are considered, in relation to a particular matter there may be a variety of policy alternatives. This alternative is chosen which corresponds to the maximum number of factors, e.g., recruitment growth, compensation, etc. Following the decision, a procedure is implemented and the consequences are known. When the policy is practicable, appropriate modifications are implemented in the long term due to changes in one of the factors affecting HR policies.

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Chapter –XLVI

46

MINING BIG DATA USING GENETIC ALGORITHM

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ABSTRACT

Today, the world's data volumes are rising very quickly day after day, due to the use of internet, smartphones, social networks, etc. This large and complex data collection is known as Big Data. This vast volume of data cannot be captured, processed and analyzed by primitive data base systems. The text processing must be improved so that information or applicable knowledge previously unknown can be extracted from the text. This paper proposes an algorithm for the big data clustering problem by combining the genetic algorithm with some of the existing clustering algorithms. The key idea is to combine the benefits of genetic algorithms with clustering for the processing of large quantities of data. Genetic algorithm is an algorithm used for optimizing outcomes. This article offers an overview of topics such as data mining, genetic algorithms and massive data.

Keywords: Genetic Algorithms, Big Data, Clustering, Chromosomes, Mining.

INTRODUCTION

Due to the developments in information and communication knowledge, companies obtain meaningful information, relevant

knowledge and vision of this enormous data centered on decision-making in the current BMD era. Big data mining means that useful information can be collected from vast and diverse databases or data sources, e.g. big data. Clustering is one of the essential data mining strategies for big data analysis. It is difficult to apply clustering strategies to big data since vast amounts of data are increasing daily. There are a number of clustering techniques, of which the K-means algorithm is the most common.

It is used for data analysis from a dataset. But since we claim that we have plenty of data available because of the big data, clustering algorithms are therefore not very effective. Since large data refers to terabytes and petabytes of data, clustering algorithms at high computer costs are required. We may consider designing an algorithm that can combine the characteristics of certain cluster algorithms and genetic algorithms to process large data.

The method called Mining is used to retrieve any useful information from source data. There are a number of computerized techniques used to retrieve previously unknown or entered data from vast database sets.

Effective data mining enables trends and connections to be uncovered and then this 'fresh' information used to make strategic business decisions based on expertise. There are several algorithms used to extract information from plain text. Genetic algorithms are the algorithms used to solve optimization problems. These algorithms work on inputs based on search. The algorithms ultimately lead to useful solutions for problems of this kind.

2. GENETIC ALGORITHMS

Genetic algorithms are a clan of Darwin's evolutionary theory influenced computational prototypes. According to Darwin, the most adaptable species will live and adapt to changing environments; the rest prefer to die. Darwin also said "through replication, crossover and mutation, an organism's survival can be sustained." GA's fundamental working mechanism is as follows: The algorithm starts with a group of solutions called population (represented by chromosomes). One population solution is taken and used to create a new population (reproduction). This is motivated by hope that the new generation is superior to the old population. This is why they are also called positive search algorithms.

The reproductive prospects are so distributed that those chromosomes that are more likely to replicate than those that are less successful in the solution to the target problem.

They look for the best match through a vast combination of parameters. They will, for instance, look for the right combination of both materials and designs which can result in a stronger, lighter and better final product overall.

As an example, we may consider "Face Recognition Systems" that are used to draw visualization-based drawings. This system is used mostly for investigative purposes where a suspect is sketched based on a description provided by eyewitnesses to the crime. The initial population is nothing more than several facial characteristics that already exist in the system. The characteristics may include a number of noses, ear, lip, eye, etc.

They can vary in colour, size or anything else. As the witness begins to describe, the features that most likely fit can be chosen (Selection). The features selected will follow the cross-over and mutation steps to create more probable characteristics. As in one face and another's mouth, one may choose and cross the line to create a

new person with the characteristics that fit the suspect. The procedure continues until the witness recognizes the last face as he wishes.

3. BIG DATA

Big data is such a concept for data sets that rudimentary data processing application software is insufficient to handle them. Big data is a new time of data study and use. It is an open source technology that leverages scalable, healthy and highly accessible Big Data enterprise platform. Challenges involve the safe, secure collection, storage, analysis, demand, and upgrade of data. Although the word "big data" is relatively recent, the collection and storage of information is ancient for ultimate study.

The relevance of Big Data does not depend on how much data we have, but on how we use it. We should take and evaluate data from any source so that we can find answers that lead to decreased costs and time in intelligent decision-making. Here we try to combine big data with genetic algorithms for powerful data analysis. The explanation for the interest in genetic algorithms is that these technologies is very effective and widely available.

As already stated, Big Data refers to large-scale, complex and growing data sets with many, self-directed sources. In the fields of science and engineering, including physical, biological and biomedical sciences, big data are now expanding rapidly with a rapid networking, data storage and data collection capability.

With the latest Big Data technologies, calculations can be speeded up. In very ordinary cases, when the data load is getting heavy on our system, we add RAM or vacate a certain amount of space by removing certain processes. Big data, instead, brings more applications to the pool and encourages parallelism there. However, this leads to fault tolerance as a result. The more processes, the greater the likelihood of system failures. Fortunately, large data does this automatically by duplicating system data such that data can be redirected to another system if one system fails.

4. DATA MINING

The data sets extract information by means of data mining technology. It is used for data search and analysis. The data to be extracted range from tiny data sets to huge data sets, i.e. large data. In Data Mining, source data will be held in database format, i.e.

tables if relational databases are considered. We just need to use the algorithms to extract data from databases. The Data Mining environment generates large amounts of data.

The information collected in the data mining phase is converted into a user-friendly framework. After extraction and transformation of data, it is loaded into systems from which it can be read. Data mining includes a number of tools, such as genetic algorithms, vector support machines, decision tree, neural network and cluster analysis, for revealing the hidden trends in the vast amounts of the data collection.

In order to handle such multiple data sets, various algorithms are needed that describe different frameworks and approaches used to handle big data. They also describe the different methods built for their analysis. Data mining and text mining are also used synonymously but not correctly. Although both are mining methods, the gap between the two is very slim.

Data mining refers to the extraction method of useful text from databases not identified previously, whereas text mining refers to the extraction of useful and intelligent text data from plain text, i.e.

natural texts. This text does not need to be translated into any other format, unlike data mining.

5. CLUSTERING

Clustering refers to the classification of related objects. It's a way to explore the data, a technique to find trends in the dataset. It falls into the unattended learning category i.e. we don't know beforehand how data can group the data objects together (of similar types). It is one of the most important areas of study in data mining. In clustering, we seek to collect objects in a way that objects with the same attributes belong to the same category and objects in different compartments in different classes.

With the creation of classes, it is easy to distinguish areas where the object space is dense and sparsely filled, and then the distribution patterns can be determined. Without much prior information, we can find relaxing trends directly from data sets. Partitioning is one of the common approaches to clustering. Partitioning works by shifting objects from one cluster to another from a certain stage. For this technique, the number of clusters should be pre-defined (like in kmeans algorithm).

6. GENETIC ALGORITHM FOR CLUSTERING

The large data available to us can be divided into small groups, in which each group can be regarded as a population. By applying genetic operators to the population iteratively, we will find the best solution for the current scenario. Search, as we are all aware, is a problem-solving approach in which the sequence of steps leading to a solution cannot be determined beforehand. It depends on how well and wisely the search operators have been implemented. An optimal search should be able to perform the search both locally and randomly. Random search investigates the whole solution and is able to avoid finding the optimal local level while local search helps to explore all local possibilities and to arrive at the best solution.

As previously mentioned, a genetic algorithm can effectively search the problem area and solve complex problems by simulating natural evolution. It searches and provides almost optimal solutions for an objective optimisation problem function. A chromosome series is referred to as a population in which a chromosome (represented as a string) is a combination of cluster centroids encoding the parameters of the search space.

The first step is to construct a random population that represents various solutions in the search area. Then some chromosomes are chosen according to the fittest survival theory, each of which is allocated to the next generation. Chromosomes are nothing more than binary encoded strings, describing likely optimization solutions. The fitness function (objective function), which gives a measure of solution quality called the fitness value, is then evaluated for each string. A new population of candidates can be generated after recombination (crossover and mutation) is carried out with the selection of a candidate solution. The basic steps of the genetic algorithm for data clustering are therefore individual representation and population initialization, fitness calculation, selection, crossover and mutation. The algorithm for the same is given:

Input:

k: cluster no d: data collection with n objects d:

p: size of population

Tmax: no of iterations maximum

Output:

A number of clusters of K

1) Initialize all chromosomes to have chosen k random centroids from the data collection.

2) $T=1$ T_{max}

i) Allocate object data for each chromosome I a. The cluster with the nearest centroid. b. Cluster k of chromosome centroids I as the mean of their data properties. C. Calculate fitness and chromosome.

(ii) Generate a new chromosome group with GA range, intersection and mutation.

The fitness function F is the spine of a genetic algorithm to work (x). This role focuses primarily on the successive results after application of GA.

Second, it comes from the objective function and is then used in successive genetic treatments such as crossover mutation. Fitness means the quality value that is the degree of individual string reproduction efficiency (chromosomes). Each individual chromosome is measured using fitness functions. The idea was to produce a clustering algorithm based on genetic algorithms which would provide better clustering than the K-means method. However, this

could lead to a little more time complexity. The main advantage of genetic algorithms is that they are easy to parallel. Two common models are used, namely the parallel implementation of GA:

- Coarse-grained parallel GA
- Fine-grained parallel GA

In the first model, each node is divided into a population while each person in the second model is provided with a separate fitness assessment node. For selection and remaining operations, adjacent nodes interact with each other.

6.1 PARALLEL Implementation for Clustering using GAs

At first the input data set is fragmented by the input format according to the block size. Each fragment is then provided to a mapper to carry out the first phase clustering, whose results are transferred to a single reducer for the second phase mapper.

Step 1: Population initialization

Each mapper forms the initial population of persons after the input fragments are received. Each organism is an N-size chromosome. Each chromosome segment is a centroid. Centroids from the obtained data division are randomly selected data points. A

data set is allocated to the cluster of the nearest centroid for every data point in a chromosome cluster. The health is then assessed.

Step 2: Mating & Selection

The methods of crossover and mutation are used for mating. We commonly use arithmetic cross-over to produce two parents from one offspring. The center of the offspring is the arithmetic average of the parents' centre. The technique of swap mutation is used for mutation. In this respect, the data points are complimented by 9. Older descendants are chosen to create a new population. A tournament selection method is used in which the person is selected by carrying out a fitness assessment tournament among several individuals selected by random members of the population.

Step 3: Termination

A new created population replaces the older population which, using a matching and selection method, would again form a newer population. This entire process is repeated repeatedly until the termination condition has been fulfilled. The termination condition may be something like a certain number of iterations or a solution. The most suitable individual of each mapper's final population is

passed on to the reducer. The reducer then performs the second step of clustering the mapping effects of all mappers.

6.2 GENETIC K-MEANS ALGORITHM

We also have an algorithm which combines the benefit of the genetic algorithm with the K-means algorithm in clustering in addition to parallel implementation using genetic algorithms. It should give optimal clustering, better than K-Means, but perhaps a little longer complexity.

The key steps of the GK-means algorithm are:

- 1) Population environment.
- 2) Calculate each individual's fitness by following equation. $(p_i - 1) / (Q - 1)$ I=individual, p=position, Q=total individuals;
- 3) If fitness is satisfied, allocate solution, Else
- 4) Estimation and relocation of sub-population
- 5) The number of the person depends on the rate if, relative to his fitness level $If = \text{fitness } I / \text{fitness } I$
- 6) Population and assets translate human wellbeing.
- 7) Crossover and mutation per sub-population;
- 8) If termination condition meets, stop; otherwise go to phase 5.

The main downside of k-means is that vast volumes of data cannot be processed. If we have a minimum amount of data, k means that it is easy to process but does not provide the desired results for a lot of data. Since we are talking about big data, the solution for our dilemma is definitely not k-means. GK-means instead takes less time and memory to process large data and also produces desired results. The genetic k-means converges steadily to the global best as desired.

7. DISADVANTAGES OF GA

Genetic algorithms are a big challenge on how to deal with constraints. Genetic operators also generate unfeasible offspring when chromosomes are being manipulated. A penalty protocol is used to track the number of unfeasible solutions generated in each generation. This allows the genetic quest for an optimal solution to be implemented. Besides this, there are a few other disadvantages:

- 1) These are difficult for end users to grasp and explain.
- 2) Abstraction of the problem and the means of representing people are very difficult.
- 3) It is a daunting task to decide the best fitness feature.
- 4) Another difficulty is how to crossover and mutate.

5) Another downside is the massive overproduction of individuals and the random character of the quest process.

8. FUTURE SCOPE

The paper compares and discusses the available methods of aggregating data based on genetic algorithms. A more powerful and time-efficient algorithm can be built to efficiently extract broad data to solve all genetic algorithms' challenges. 9.

9. CONCLUSION

This chapter provides the reader with an overview of all the jargons associated with big data analysis. The topics such as Text Mining, Big Data and the idea of Genetic Algorithms, samples, scope, processes, benefits, challenges etc., are all discussed. The paper reviews different techniques for text mining. The paper concludes that since the main emphasis is on big data mining, the algorithm followed must be space-efficient and time-efficient. The paper shows the need for an algorithm that characterizes the characteristics of the Big Data Revolution and proposes a model of big data analysis from the perspective of data mining.

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47

INFORMATION SECURITY TOWARDS CYBER SECURITY

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ABSTRACT

Cyber security is often used contrary to the security of information. In this paper, it says that these 2 ideas are not entirely undifferentiated from the mischief of the fact that there is a generous coverage between information security and cyber security. Moreover, this paper states that cyber security goes beyond the limitation of customary security to assimilate security of data, but also that of different resources, taking into account the individual. The recommendation for the human element typically recognizes the job of people in the security process in information security. In cyber security there are some additional measurements in this attribute, especially for people as cyber ability or as attacks, even if they are reluctant to be interested in a cyber assault. This additional measurement has moral suggestions for society as a whole as the security of certain vulnerability teams can be seen as societal guilt for young modelers.

Keywords: Cyber Security, Cyberspace, ICT Security, Information Security (IS), Vulnerability.

1.INTRODUCTION

Cyber defense acquires meaning and intrigue worldwide. In more than 52 countries constructively, few strategic documents have traditionally released outlining their official positions on cyber crime, cyber security or the cyberspace. The Whitehouse has defined a cyber approach that provides the USA with a cyber-related issues and diagrams jump to deal with the USA's cyber-problem loyalty to individual nations. The UK records cyber security as a top priority and has submitted £652 million for the National Cyber Security transformative program over 4 years.

Nevertheless, not many of these sources seem to qualify for the information security plan, cyber security plan or the relationship between them. The various surveys, cyber security, have been used as a full term. Meanings of this change are, for example, characterized in Mérriam Webster's word reference as 'measures to secure an unapproved access or assault PC or PC framework'[1]. The International Telecommunications Union is distinguished by cyber security. The International Telecommunications Union.

Cyber security assortment for organization, client assets and cyber environment, policy, technology, security safeguards, actions, guides, best practices, tools, security concept, risk management, training and insurance. User assets and organizations include staff, apps, connected computing devices, telecommunications, services, infrastructure and all stored/transmitted information in cyber environments. Cyber security attempts to guarantee the fulfillment and maintenance of possessions of the user's assets against relevant security chances in the cyber environment. The security objectives include:

- Integrity
- Availability
- Confidentiality

This chapter specifically focuses on the fundamental nature of safety as a rule and attempts to establish, through modelling methods, the objectives of cyber security assets in order to implement additional measures that extend beyond the accepted limits of the information security [2]. It is also stated in the present paper that both humans in their own capacity and society can legally be harmed

and affected by the cyber-safety embassy anywhere, although this is not really the situation with data protection where harm is continually reversed.

2. INFORMATION SECURITY IN CYBER

The aim of information security is to ensure consistency and limit business harm by restricting the effects of safety incidents. The protection of information may be described in different ways, as shown below.

1. Information Security Defined:

The international standard characterizes the protection of information as a safeguard for information privacy, accessibility and confidentiality. With regard to ISO/IEC, several structures can be used for data. It can be written or printed very well on the paper, placed electronically, transferred by post, or other electronic technology, appeared in films, discussed etc. Data protection is defined as 'prevention of information & critical components, counting hardware and systems that use, transmit and store that information.' First of all, this must be certain that (IS) is not, but the process, an object or a technology.

The 2nd major attribute to remember is that (IS) is usually defined by attributes or properties that protected information must have [3]. These usually integrate information's availability, confidentiality and honesty, but may assimilate additional qualities [4].

2. Security of Information and the Communication Technology (ICT) Defined:

Innovation insurance depends on the basis on which the information is usually conveyed or processed by communication technology and information security. ICT security is characterized by an international standard as all prospects for the realization, confidentiality, accessibility, transparency, trustworthiness, definition, honesty, non-repudiation, and authenticity of information.

Since (IS) includes the basic information assets insurance, it may well be said that the ICT security is a subpart of the (IS). Consequently, the concept of ICT security is essentially the general definition of information security. However, additional attributes that could be better represented in this context as administrations that

should be provided by safe information assets are included by definition [5].

That include transparency, genuineness, reliability and non-repudiation. Resuchers often refer to the concept of the (IS) as meaning that ensuring genuine knowledge on various threats to a data system focuses on the associated susceptibility and long-term, adversely affected ICT base.

In this case, the technical architecture is also unmistakably taken into account for the advantage of the requirements. As necessary, the ICT protection is a protected asset. This relationship is delineated. Due to the (IS), the ICT provides the basis for storing, communicating and processing information. In that case, this is a resource that needs protection, as depicted in Figure 2.

3. CYBER SECURITY

Many of the present cyber security publications reciprocally use the word cyber security (IS). In the event that cybersecurity is associated with (IS), it is reasonable to assume that cyber security events could also be represented in the text of the attributes used to define the security of information.

For example, a cyber security incident can also lead to a rupture of information access, honesty or confidentiality.

1. Cyber Bullying:

Cyber bullying has been a major concern in today's culture. According to the writer, some recent research indicates that technologies are being used to intimidate, "call aggression, trigger embarrassment and psychological malaise." This may have a "significant and negative impact on those who have been wronged" [7]. The demand to fix cyber bullying has traditionally been identified as a cyber security issue and is also directly cited in the UK's cyber security strategy.

2. Home Automation:

As the ICT progresses in the field of electronics, it has increased to a large number of home automation applications. Numerous such products enable homeowners the use of hot-water geysers, televisions, stoves, refrigerators and home security frameworks with different web-based appliances. Unfortunately, the expanded accommodation of trade with a home through the web presents an increasing threat that somebody will extend unapproved entry into

this structure&because it hurts. This disability can range from "tricks" like shutting off high temp water to actual violations such as disabling safety frameworks to rip the home [8].

3. Digital Media:

One of the companies that has been legally affected by the increasing data sharing is the entertainment industry. Consistently, gigantic measurements of the potential entry are lost for the sharing of illicit videos, music and other advanced media structures.

This illicit contact does not impact really the credibility, availability or secrecy of the popular media; however, it directly affects the money-related wealth of the rightful owners of the rights to such media. The self-verification of illegal activities, such as unjustified duplication of newspapers, is also viewed as a momentum that will make it easier to carry out other unlawful actions in the future [9].

4. Cyber Terrorism:

The fundamental foundation of the USA distinguishes itself as "assets, networks and systems, both virtual and physical, so essential for America that their paralysis or annihilation will

undermine national economic, defense, public safety or health or some other combination of them."

Frameworks conveying water and power, facilitating financial transactions or regulating air traffic is known as 'essential life frameworks' and are legally dependent on basic network infrastructure and communications. The assurance of these basic foundations forms a major part of cyber security and is an important national fundamental to cyber national security strategies [10].

By way of cyberspace, cyber criminals and enemy specialists will pivot the vital framework of the country. The assumption may be to note that the data management accessories are affected by DOS attacks or, more straightforwardly, by a strike on a national power matrix.

This condition is responsible for a specific aspect of cyber security when a person, country or society's interests and their non-data reliance on resources can conceal hazards arising from cyberspace connections. It provides the contrast between cybersecurity and protection of information [11].

4. INFORMATION SECURITY TOWARDS CYBER SECURITY

All protection is connected with the insurance of various risks caused by such intrinsic vulnerabilities.

Security types usually handle security control implementation and selection, which helps reduce the risk of these vulnerabilities. Based on ICT security, the fundamental information technology foundation assets that should be protected appeared. Data security will then again extend this denotation to ensure that any aspect of the information is taken into account. This assimilates the assurance of the covert ICT services and then goes past technology to assimilate data which are not disregarded or communicated using ICT as seen.

Therefore, it is the attestation in this paper that the cyber security concept will be linked but not equivalent to phrase security. ICT and details are the secret source of cyber security vulnerability. Ressource control is still possible to assimilate the data or even communication & information systems in a reliable way. In all cases, the absolute most distinguishing feature of cyber security is the fact that all the advantages to be protected can be guaranteed due to vulnerabilities due to the use of the ICT system to ensure cyberspace

Considering scenarios and discussions already described, the cyber security asset unmistakably requires that the criteria to be guaranteed extend beyond the data's limits as characterized for information security[12].

The knowledge itself may be grouped as the weakness in cases of cyber security. In any situation data trading legally leads to an impact on the need, a person in his or her own capacity or society as a rule, for this condition. Similarly, cyber security, as a development of information security, should be considered in the information security that develops the ICT security plan which ensures information itself, however, as well as its structure as its region. Cyber protection must be linked to guarantees of the association/individual anything other than information or information systems.

The cybersecurity also illustrates the assurance of the people who make use of the advantages in the cyber domain and the compensation of few other services, including those who have their position in society in general, which have been put at risk therefore of vulnerabilities arising from the use of the ICTs.

The connection between these three ideas. The work of ICT increasingly rotates universally in the public domain and the jobs that people do in the core data & ICT security processes are untiringly expanding. In terms of ICT protection, people's work has been greatly restricted to jeopardy. This role expanded in the (IS) to become the undeniably important part of the bear systems and people were vulnerable in this direction [13].

Today, citizens and communities have grown into a part of the assets that must be ensured in cyber security. Despite the fact that people are still considered both vulnerable and dangerous, they are still viewed as an advantage in cyberspace today. Cyber security is unmistakably wider from a concept above than any ICT or information security it integrates. The human element with national attention is assuming a steadily increasing role in cyber security and the current arrangement of international quality and good practices is certainly not enough to protect the cyberspace.

5. CONCLUSION

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compensation of few other services, including those who have their position in society in general, which have been put at risk therefore of vulnerabilities arising from the use of the ICTs.

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Chapter –XLVIII

48

RECOMBINANT DNA TECHNOLOGY AND ITS APPLICATIONS

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Abstract:

Biotechnology which is synonymous with genetic engineering or recombinant DNA (rDNA) is an industrial process that uses the scientific research on DNA for practical applications. rDNA is a form of artificial DNA that is made through the combination or insertion of one or more DNA strands, It offered new opportunities for innovations to produce a wide range of therapeutic products with immediate effect in the medical genetics and biomedicine by modifying microorganisms, animals, and plants to yield medically useful substances. Recombinant DNA technology is playing a vital role in improving health conditions by developing new vaccines and pharmaceuticals. This review gives brief introduction to rDNA and its applications in various fields.

Keywords: Chimeric DNA, restriction enzymes, Transgenic Plants, Gene Therapy.

1. Introduction

Human life is greatly affected by three factors: deficiency of food, health problems, and environmental issues. Food and health are basic human requirements beside a clean and safe environment.

With increasing world's population at a greater rate, human requirements for food are rapidly increasing. Humans require safe-food at reasonable price. Several human related health issues across the globe cause large number of deaths.

Approximately 36 million people die each year from noncommunicable and communicable diseases, such as cardiovascular diseases, cancer, diabetes, AIDS/HIV, tuberculosis, malaria, and several others according to <http://GlobalIssues.org/>. Despite extensive efforts being made, the current world food production is much lower than human requirements, and health facilities are even below standard in the third-world countries. Rapid increase in industrialization has soared up the environmental pollution and industrial wastes are directly allowed to mix with water, which has affected aquatic marines and, indirectly, human-beings. Therefore, these issues urge to be addressed through modern technologies.

Unlike tradition approaches to overcome agriculture, health, and environmental issues through breeding, traditional medicines, and pollutants degradation through conventional techniques

respectively, the genetic engineering utilizes modern tools and approaches, such as molecular cloning and transformation, which are less time consuming and yield more reliable products. For example, compared to conventional breeding that transfers a large number of both specific and nonspecific genes to the recipient, genetic engineering only transfers a small block of desired genes to the target through various approaches, such as biolistic and *Agrobacterium*-mediated transformation [1]. The alteration into plant genomes is brought either by homologous recombination dependent gene targeting or by nuclease-mediated site-specific genome modification. Recombinase mediated site-specific genome integration and oligonucleotide directed mutagenesis can also be used [2].

Recombinant DNA technology is playing a vital role in improving health conditions by developing new vaccines and pharmaceuticals. The treatment strategies are also improved by developing diagnostic kits, monitoring devices, and new therapeutic approaches. Synthesis of synthetic human insulin and erythropoietin by genetically modified bacteria [3] and production of new types of experimental

mutant mice for research purposes are one of the leading examples of genetic engineering in health. Likewise, genetic engineering strategies have been employed to tackle the environmental issues such as converting wastes into biofuels and bioethanol [4–7], cleaning the oil spills, carbon, and other toxic wastes, and detecting arsenic and other contaminants in drinking water. The genetically modified microbes are also effectively used in biomining and bioremediation.

The advent of recombinant DNA technology revolutionized the development in biology and led to a series of dramatic changes. It offered new opportunities for innovations to produce a wide range of therapeutic products with immediate effect in the medical genetics and biomedicine by modifying microorganisms, animals, and plants to yield medically useful substances [8, 9]. Most biotechnology pharmaceuticals are recombinant in nature which plays a key role against human lethal diseases. The pharmaceutical products synthesized through recombinant DNA technology, completely changed the human life in such a way that the U.S. Food and Drug Administration (FDA) approved more recombinant drugs in 1997 than in the previous several years combined, which includes

anemia, AIDS, cancers (Kaposi's sarcoma, leukemia, and colorectal, kidney, and ovarian cancers), hereditary disorders (cystic fibrosis, familial hypercholesterolemia, Gaucher's disease, hemophilia A, severe combined immunodeficiency disease, and Turner's syndrome), diabetic foot ulcers, diphtheria, genital warts, hepatitis B, hepatitis C, human growth hormone deficiency, and multiple sclerosis. Considering the plants develop multigene transfer, site-specific integration and specifically regulated gene expression are crucial advanced approaches [10]. Transcriptional regulation of endogenous genes, their effectiveness in the new locations, and the precise control of transgene expression are major challenges in plant biotechnology which need further developments for them to be used successfully [11].

Human life is greatly threatened by various factors, like food limitations leading to malnutrition, different kinds of lethal diseases, environmental problems caused by the dramatic industrialization and urbanization and many others. Genetic engineering has replaced the conventional strategies and has the greater potential to overcome such challenges. The current review summarized the

major challenges encountered by humans and addresses the role of recombinant DNA technology to overcome aforementioned issues. In line with this, we have detailed the limitations of genetic engineering and possible future directions for researchers to surmount such limitations through modification in the current genetic engineering strategies.

Recombinant DNA (rDNA) molecules are DNA molecules formed by laboratory methods of genetic recombination (such as molecular cloning) to bring together genetic material from multiple sources, creating sequences that would not otherwise be found in the genome. Recombinant DNA was first achieved in 1973 Herbert Boyer, of the University of California at San Francisco, and Stanley Cohen, at Stanford University, who used *E. coli* restriction enzymes to insert foreign DNA into plasmids[12].

Recombinant DNA is the general name for a piece of DNA that has been created by the combination of at least two strands. Recombinant DNA is possible because DNA molecules from all organisms share the same chemical structure, and differ only in the nucleotide sequence within that identical overall structure.

Recombinant DNA molecules are sometimes called chimeric DNA, because they can be made of material from two different species, like the mythical chimera. R-DNA technology uses palindromic sequences and leads to the production of sticky and blunt ends.

The DNA sequences used in the construction of recombinant DNA molecules can originate from any species. For example, plant DNA may be joined to bacterial DNA, or human DNA may be joined with fungal DNA. In addition, DNA sequences that do not occur anywhere in nature may be created by the chemical synthesis of DNA, and incorporated into recombinant molecules. Using recombinant DNA technology and synthetic DNA, literally any DNA sequence may be created and introduced into any of a very wide range of living organisms.

Proteins that can result from the expression of recombinant DNA within living cells are termed recombinant proteins. When recombinant DNA encoding a protein is introduced into a host organism, the recombinant protein is not necessarily produced [13]. Expression of foreign proteins requires the use of specialized expression vectors and often necessitates significant

restructuring by foreign coding sequences [14]. Recombinant DNA differs from genetic recombination in that the former results from artificial methods in the test tube, while the latter is a normal biological process that results in the remixing of existing DNA sequences in essentially all organisms.

The Basics of Recombinant DNA[15]

That's a very good question! rDNA stands for recombinant DNA. Before we get to the "r" part, we need to understand DNA. Those of you with a background in biology probably know about DNA, but a lot of ChemE's haven't seen DNA since high school biology. DNA is the keeper of the all the information needed to recreate an organism. All DNA is made up of a base consisting of sugar, phosphate and one nitrogen base. There are four nitrogen bases, adenine (A), thymine (T), guanine (G), and cytosine (C).

The nitrogenbases are found in pairs, with A & T and G & C paired together. The sequence of the nitrogen bases can be arranged in an infinite ways, and their structure is known as the famous "double helix" which is shown in the image below. The sugar used in DNA is deoxyribose.

The four nitrogen bases are the same for all organisms. This sequence and number of bases is what creates diversity. DNA does not actually make the organism, it only makes proteins. The DNA is transcribed into mRNA and mRNA is translated into protein, and the protein then forms the organism. By changing the DNA sequence, the way in which the protein is formed changes.

This leads to either a different protein, or an inactive protein. Now that we know what DNA is, this is where the recombinant comes in. Recombinant DNA is the general name for taking a piece of one DNA, and combining it with another strand of DNA. Thus, the name recombinant! Recombinant DNA is also sometimes referred to as "chimera." By combining two or more different strands of DNA, scientists are able to create a new strand of DNA. The most common recombinant process involves combining the DNA of two different organisms.

How is Recombinant DNA made?

There are three different methods by which Recombinant DNA is made. They are Transformation, Phage Introduction, and Non-Bacterial Transformation. Each are described separately below.

Transformation

The first step in transformation is to select a piece of DNA to be inserted into a vector. The second step is to cut that piece of DNA with a restriction enzyme and then ligate the DNA insert into the vector with DNA Ligase. The insert contains a selectable marker which allows for identification of recombinant molecules. An antibiotic marker is often used so a host cell without a vector dies when exposed to a certain antibiotic, and the host with the vector will live because it is resistant.

The vector is inserted into a host cell, in a process called transformation. One example of a possible host cell is E. Coli. The host cells must be specially prepared to take up the foreign DNA. Selectable markers can be for antibiotic resistance, color changes, or any other characteristic which can distinguish transformed hosts from untransformed hosts. Different vectors have different properties to make them suitable to different applications. Some properties can include symmetrical cloning sites, size, and high copy number.

Non-Bacterial Transformation

This is a process very similar to Transformation, which was described above. The only difference between the two is non-bacterial does not use bacteria such as E. Coli for the host. In microinjection, the DNA is injected directly into the nucleus of the cell being transformed. In biolistics, the host cells are bombarded with high velocity microprojectiles, such as particles of gold or tungsten that have been coated with DNA.

Phage Introduction

Phage introduction is the process of transfection, which is equivalent to transformation, except a phage is used instead of bacteria. In vitro packaging of a vector is used. This uses lambda or MI3 phages to produce phage plaques which contain recombinants. The recombinants that are created can be identified by differences in the recombinants and non-recombinants using various selection methods.

Working of rDNA

Recombinant DNA works when the host cell expresses protein from the recombinant genes.

A significant amount of recombinant protein will not be produced by the host unless expression factors are added. Protein expression depends upon the gene being surrounded by a collection of signals which provide instructions for the transcription and translation of the gene by the cell. These signals include the promoter, the ribosome binding site, and the terminator.

Expression vectors, in which the foreign DNA is inserted, contain these signals. Signals are species specific. In the case of E. Coli, these signals must be E. Coli signals as E. Coli is unlikely to understand the signals of human promoters and terminators. Problems are encountered if the gene contains introns or contains signals which act as terminators to a bacterial host.

This results in premature termination, and the recombinant protein may not be processed correctly, be folded correctly, or may even be degraded. Production of recombinant proteins in eukaryotic systems generally takes place in yeast and filamentous fungi. The use of animal cells is difficult due to the fact that many need a solid support surface, unlike bacteria, and have complex growth needs.

However, some proteins are too complex to be produced in bacterium, so eukaryotic cells must be used.

Importance rDNA

Recombinant DNA has been gaining in importance over the last few years, and recombinant DNA will only become more important in the 21st century as genetic diseases become more prevalent and agricultural area is reduced. Below are some of the areas where Recombinant DNA will have an impact.

- Better Crops (drought & heat resistance)
- Recombinant Vaccines (Hepatitis B)
- Prevention and cure of sickle cell anemia
- Prevention and cure of cystic fibrosis
- Production of clotting factors
- Production of insulin
- Production of recombinant pharmaceuticals
- Plants that produce their own insecticides
- Germ line and somatic gene therapy [15]

Future Prospectives

Now that we've figured out the basics behind what Recombinant

DNA are, it's time to look at how Recombinant DNA will impact the future. Which industries and fields will be shaped by rDNA? How will rDNA effect the health and lifestyles of RPI students in the next generation? Click over to our rDNA Impact Statement to find out the answer! Recombinant DNA Technology[16].

Recombinant DNA technology is a technique which changes the phenotype of an organism (host) when a genetically altered vector is introduced and integrated into the genome of the organism. So, basically, the process involves the introduction of a foreign piece of DNA structure into the genome which contains our gene of interest. This gene which is introduced is the recombinant gene and the technique is called the recombinant DNA technology.

Inserting the desired gene into the genome of the host is not as easy as it sounds. It involves the selection of the desired gene for administration into the host followed by a selection of the perfect vector with which the gene has to be integrated and recombinant DNA formed. This recombinant DNA then has to be introduced into the host. And at last, it has to be maintained in the host and carried forward to the offsprings.

Recombinant DNA Technology [16]

Tools of Recombinant DNA technology

The tools mainly include the following:

1. The enzymes which include the restriction enzymes – help to cut, the polymerases- help to synthesize and the ligases- help to bind. The restriction enzymes used in recombinant DNA technology play a major role in determining the location at which the desired gene is inserted into the vector genome. They are two types, namely Endonucleases and Exonucleases.

The Endonucleases cut within the DNA strand whereas the Exonucleases remove the nucleotides from the ends of the strands. The restriction endonucleases are sequence-specific which are usually palindromic sequences and cut the DNA at specific points. They scrutinize the length of DNA and make the cut at the specific site called the restriction site. This gives rise to sticky ends in the sequence. The desired genes and the vectors are cut by the same restriction enzymes to obtain the complementary sticky ends, thus making the work of the ligases easy to bind the desired gene to the vector.

2. The vectors – help in carrying and integrating the desired gene. These form a very important part of the tools of recombinant DNA technology as they are the ultimate vehicles that carry forward the desired gene into the host organism. Plasmids and bacteriophages are the most common vectors in recombinant DNA technology that are used as they have very high copy number. The vectors are made up of an origin of replication- This is a sequence of nucleotide from where the replication starts, a selectable marker – constitute genes which show resistance to certain antibiotics like ampicillin; and cloning sites – the sites recognized by the restriction enzymes where desired DNAs are inserted.

3. Host organism – into which the recombinant DNA is introduced. The host is the ultimate tool of recombinant DNA technology which takes in the vector engineered with the desired DNA with the help of the enzymes.

There are a number of ways in which these recombinant DNAs are inserted into the host, namely – microinjection, biolistics or gene gun, alternate cooling and heating, use of calcium ions, etc.

Steps in Recombinant DNA Technology[17]:

- i. Selection and isolation of DNA insert
- ii. Selection of suitable cloning vector
- iii. Introduction of DNA-insert into vector to form rec DNA molecule
- iv. rec DNA molecule is introduced into a suitable host.
- v. Selection of transformed host cells.
- vi. Expression and multiplication of DNA-insert in the host.

(i) Selection and isolation of DNA insert:

First step in rec DNA technology is the selection of a DNA segment of interest which is to be cloned. This desired DNA segment is then isolated enzymatically. This DNA segment of interest is termed as DNA insert or foreign DNA or target DNA or cloned DNA.

(ii) Selection of suitable cloning vector:

A cloning vector is a self-replicating DNA molecule, into which the DNA insert is to be integrated. A suitable cloning vector is selected in the next step of rec DNA technology. Most commonly used vectors are plasmids and bacteriophages.

(iii) Introduction of DNA-insert into vector to form recDNA molecule:

The target DNA or the DNA insert which has been extracted and cleaved enzymatically by the selective restriction endonuclease enzymes [in step (i)] are now ligated (joined) by the enzyme ligase to vector DNA to form a rec DNA molecule which is often called as cloning-vector-insert DNA construct.

(iv) rec DNA molecule is introduced into a suitable host:

Suitable host cells are selected and the rec DNA molecule so formed [in step (iii)] is introduced into these host cells. This process of entry of rec DNA into the host cell is called transformation. Usually selected hosts are bacterial cells like E. coli, however yeast, fungi may also be utilized.

(v) Selection of transformed host cells:

Transformed cells (or recombinant cells) are those host cells which have taken up the recDNA molecule. In this step the transformed cells are separated from the non-transformed cells by using various methods making use of marker genes.

(vi) Expression and Multiplication of DNA insert in the host:

Finally, it is to be ensured that the foreign DNA inserted into the vector DNA is expressing the desired character in the host cells.

Also, the transformed host cells are multiplied to obtain sufficient number of copies. If needed, such genes may also be transferred and expressed into another organism.

Application of recombinant DNA technology [17]

1. Production of Transgenic Plants:By utilizing the tools and techniques of genetic engineering it is possible to produce transgenic plants or the genetically modified plants. Many transgenic plants have been developed with better qualities like resistance to herbicides, insects or viruses or with expression of male sterility etc.

2. Production of Transgenic Animals:By the use of rec DNA technology, desired genes can be inserted into the animal so as to produce the transgenic animal. The method of rec DNA technology aids the animal breeders to increase the speed and range of selective breeding in case of animals. It helps for the production of better farm animals so as to ensure more commercial benefits.

Another commercially important use of transgenic animals is the production of certain proteins and pharmaceutical compounds. Transgenic animals also contribute for studying the gene functions in different animal species. Biotechnologists have successfully

produced transgenic pigs, sheep, rats and cattle.

3. Production of Hormones:By the advent of techniques of rec DNA technology, bacterial cells like E.coli are utilized for the production of different fine chemicals like insulin, somatostatin, somatotropin and p- endorphin. Human Insulin Hormone i.e., Humulin is the first therapeutic product which was produced by the application of rec DNA technology.

4. Production of Vaccines:Vaccines are the chemical preparations containing a pathogen in attenuated (or weakened) or inactive state that may be given to human beings or animals to confer immunity to infection. A number of vaccines have been synthesized biologically through rec DNA technology, these vaccines are effective against numerous serious diseases caused by bacteria, viruses or protozoa. These include vaccines for polio, malaria, cholera, hepatitis, rabies, smallpox, etc. The generation of DNA vaccines has revolutionized the approach of treatment of infectious diseases. DNA-vaccine is the preparation that contains a gene encoding an immunogenic protein from the concerned pathogen.

5. Biosynthesis of Interferon: Interferons are the glycoproteins which are produced in very minute amounts by the virus-infected cells. Interferons have antiviral and even anti-cancerous properties. By recombinant DNA technology method, the gene of human fibroblasts (which produce interferons in human beings) is inserted into the bacterial plasmid. These genetically engineered bacteria are cloned and cultured so that the gene is expressed and the interferons are produced in fairly high quantities. This interferon, so produced, is then extracted and purified.

6. Production of Antibiotics: Antibiotics produced by microorganisms are very effective against different viral, bacterial or protozoan diseases. Some important antibiotics are tetracycline, penicillin, streptomycin, novobiocin, bacitracin, etc. recombinant DNA technology helps in increasing the production of antibiotics by improving the microbial strains through modification of genetic characteristics.

7. Production of Commercially Important Chemicals: Various commercially important chemicals can be produced more efficiently by utilizing the methods of recombinant DNA technology. A few of them are the

alcohols and alcoholic beverages obtained through fermentation; organic acids like citric acid, acetic acid, etc. and vitamins produced by microorganisms.

8. Application in Enzyme Engineering:As we know that the enzymes are encoded by genes, so if there are changes in a gene then definitely the enzyme structure also changes. Enzyme engineering utilizes the same fact and can be explained as the modification of an enzyme structure by inducing alterations in the genes which encode for that particular enzyme.

9. Prevention and Diagnosis of Diseases:Genetic engineering methods and techniques have greatly solved the problem of conventional methods for diagnosis of diseases. It also provides methods for the prevention of a number of diseases like AIDS, cholera, etc. Monoclonal antibodies are useful tools for disease diagnosis. Monoclonal antibodies are produced by using the technique called hybridoma technology.

10. Gene Therapy:Gene therapy is undoubtedly the most beneficial area of genetic engineering for human beings. It involves delivery of specific genes into human body to correct the diseases.

Thus, it is the treatment of diseases by transfer and expression of a gene into the patients' cells so as to ensure the restoration of a normal cellular activity.

11. Practical Applications of Genetic Engineering: recDNA technology has an immense scope in Research and Experimental studies.

It is applied for:

- a. Localizing specific genes.
- b. Sequencing of DNA or genes.
- c. Study of mechanism of gene regulation.
- d. Molecular analysis of various diseases.
- e. Study of mutations in DNA, etc.

12. Applications in forensic science: The applications of recDNA technology (or genetic engineering) in forensic sciences largely depend on the technique called DNA profiling or DNA fingerprinting. It enables us to identify any person by analysing his hair roots, Wood stains, serum, etc. DNA fingerprinting also helps to solve the problems of parentage and to identify the criminals.

13. Biofuel Production: Biofuels are derived from biomass and these are renewable and cost effective. Genetic engineering plays

an essentially important role in a beneficial and largescale production of biofuels like biogas. bio hydrogen biodiesel bio-ethanol., etc. Genetic engineering helps to improve organisms for obtaining higher product yields and product tolerance.

14. Genetically stable high producing microorganisms are being developed by using modern recDNA techniques, which aid in an efficient production of bioenergy.

15. The energy crop plants are those plants which use solar energy in a better way for production of biomass. Genetic improvements of these energy crop plants greatly help for quick and high Product on of biomass which in turn reduces the biofuel production cost. The fermenting microbes which are utilized for biogas production are improved at the genetic level for achieving better result.

16. Environment Protection:Genetic engineering makes its contributions to the environment protection in various ways. Most important to mention are the new approaches utilized for waste treatments and bioremediation Environment protection means the conservation of resources.

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49

CYBER SECURITY USING MACHINE LEARNING TECHNIQUES

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Abstract:

Within the ever rising and rapidly increasing area of cyber security, the reasons why cyber security has such an outdated effect cannot be quantified or justified. Allowing malicious threats to occur at any time or in any form is far from permissible and may cause severe injury. It especially refers to the Byzantine consumer network and uses information from the Internet and companies that cyber security groups find it difficult to protect and contain. Cyber protection is a necessary thought for both individuals and families, and also for corporations, governments and academic institutions operating within a world network or network compass.

With the Machine Learning facility, we are advancing cyber security landscape. These days, businesses are collecting huge quantities of user information. Information is at the core of every important business method that you might think about. This co- includes infrastructure systems that are currently being implemented. The modern high-tech infrastructure, which has network and cyber protection systems, collects huge quantities of data and analysis from almost all the main aspects of mission-critical

systems. Although there is still key operational monitoring and intelligent insight into the current infrastructure, machine learning and AI are gaining speed and gaining tremendous traction in most of today's systems, be it on premises or within a cyber security company.

Keywords: Machine Learning, cyber security, k-means, Random Forest, SVM etc.

I. INTRODUCTION

In the cyber world, cyber-attacks are on the rise. Advanced security steps should be taken to scale back or prevent cyber-attacks. There are some attacks such as D-Dos, Man in the middle, knowledge escape, PROBE, User-To-Root, Remote-To Local. The hackers or intruders use these attacks to unauthorized access to a non-public network, website, information or possibly on our personal computers. Therefore, external or internal hackers use sophisticated techniques or identify ways to tickle or crack any security mechanism in order to protect confidential information, information and money information. Sensitive intrusion munitions can avoid or attempt to handle various inventive hacker attacks.

Cyber security refers to the science of technology, processes and methods designed to prevent attacks, harm or unauthorized access by networks, instruments, programs and information. Cyber safety can also be claimed as security has seen a number of advances in the field of machine learning techniques within the year 2016, such as auto-driven vehicles, language communication processes, health and sensitive virtual assistants. They must be used to find helpful data from various audit datasets used for intrusion detection.

With the help of machine learning techniques, we will use these ideas to enhance defense within the intrusion detection system in cyber security. We must initially feed the information into the learning model of the computer. The model is conditioned by the sample and turns it into a trained model. After we fill the sample, the next step is to use and apply the learning formula in the unit.

In this intrusion detection scheme, machine learning formula plays an important role in increasing security steps. Two types of ML algorithms: supervised learning and unattended learning. They are distinguished by the knowledge they settle (i.e. input).

Supervised learning means algorithms given to a group of

labeled training information to understand what makes the labels different. Unmonitored learning refers to algorithms which provide unmarked training information to infer the classes by themselves. The labelled information is usually uncommon, or even the task of labeled data is terribly exhaustive by itself and we might not be able or willing to see if labels really do exist.

II. RELATED WORK

Cyber analysis assistance was studied as a mixture of ML/DM (machine learning/data mining) at the emerging stages of the building of intrusion detection systems. The machine behavior and traditional network are modelled by anomaly-based techniques and helps identify anomalies as deviations from traditional behavior. Its benefit is that the profiles of conventional activities are tailor-made for each device, program or network, making it difficult for attackers to understand the activities they can undertake unfunded and in an undiscovered way. They feel appealing because of their distinctive willingness to see zero-day attacks.

Hybrid methods combine identification and abuse of anomalies. They are used to increase recognized intrusion detection rates and to

decrease unknown attack rates. Again, intelligent intrusion detection systems can only be developed if good information is available. An information set with a wide range of quality data that imitates real time, only allowing the related intrusion monitoring system to be trained.

A Comprehensive Cybersecurity Audit Model

Today, non-public companies and public institutions struggle with ongoing and complex cyber threats and cyber-attacks. As a general alert, organisations should create and grow a culture and knowledge of cyber security in order to protect them against cyber criminals. Data technology such as IT and data protection, including InfoSec's previously cost-effective audits, seeks to converge on cybersecurity to address cyber-threats, cyber-risks, and cyber-attacks that have developed in an aggressive cyberian [1]. The increase in cyber attacks' diversity and efficiency and thus the cyber threat environment challenges the existing cybersecurity audit models and provides evidence for a brand new cybersafe audit model. This text examines the simplest methods and methodologies of world leaders in the field of cybersecurity protection and auditing. By

analyzing these approaches, their real scope, strengths and limitations is emphasized with a view to a strong and coherent synthesis. This text therefore provides an inspired and detailed cybersecurity audit model as a proposal to be used in organizations and countries for the conduct of cybersecurity audits. The Cybersecurity Audit Model (CSAM) assesses and validates audit, preventive, rhetoric and detective controls in all useful structural fields[2]. CSAM on the Cybersecurity side was checked, applied and validated. A research case study is being carried out to test each model and consequently the results are revealed.

Feature selection to detect botnets using machine learning algorithms

A completely unique technique is provided to attempt to feature options for visual botnets in their Command and Control section (C&C). A major drawback is that researchers have suggested options that they have learned, but there is no method for evaluating these options because some of them may have a lower detection rate than alternatives. In the current target, we discover the feature set supporting botnet connections in their C&C segment, which

maximizes the botnets' detection rate. A genetic formula (GA) has been used and selected as the best detection rate.

We prefer to use the machine learning formula C4.5, which classified connections from or without a botnet. The data sets used in this paper were derived from the ISOT and ISCX repositories [3]. Some experiments were performed to cause the simplest GA and formula C4.5 parameters. Tendency is to conduct joint experiments to ensure the simplest set of options for each (specific) and for each (general) type of botnet analysed. The findings are seen in the tip of the paper, where the characteristics and the detection rate have been reduced considerably over the work conferred.

Intrusion Detection using Deep Belief Network

The problems in neural network intrusion detection, including redundant data, large quantities of data, long term training, are easy to find. A technique of intrusion detection is suggested using the deep belief network (DBN) and probabilistic neural network (PNN). First, the raw data is regenerated to small data while maintaining the basic attributes of the data using DBN's nonlinear wit. Second, the Particle Swarm optimization formula is used in order to achieve the simplest

learning efficiency to maximize the amount of hidden layer nodes per layer. Next, PNN is being used to identify the details of low dimensions [4]. Finally, the data collection of KDD CUP 1999 is used to verify the success of the above tactics. The results show that the tactics exceed the normal PNN, PCA-PNN and non-optimized DBN-PNN.

Machine learning has moved from the laboratory to the forefront of operating systems over the past few years. Amazon, Google and Facebook use regular machine learning to improve customer loyalty, sales or socially link people with new apps and make personal connections easier. The versatile capabilities of machine learning are also available for cybersecurity. Cybersecurity is capable of enhancing machine learning to detect malware, sort incidents, recognize violations and warn organizations to security problems. Machine learning can be used to identify advanced targeting and risks such as recognition of the enterprise, technology vulnerabilities and potentially mutually beneficial vulnerabilities.

Machine learning will change the cybersecurity landscape considerably [5]. In an hour, malware alone can reflect up to 3 million

new samples. Old malware identification and analyzes of malware cannot cope with new attacks and variants. New threats and complicated malware are ready to circumvent network detection and endpoint detection to deliver disturbing cyber-attacks. New techniques such as machine learning can be used to tackle the can downside of malware. This proposition defines the machine learning used to identify and highlight specialized cyber security analysts' malware. The results of our initial research and an analysis of potential machine learning are discussed.

A Comparative Survey on the Influence of Machine Learning Techniques on Intrusion Detection System (IDS)

With the wide growth of laptop networks and the use of users' content, stable and reliable networks are needed. Since it is determined that different forms of network attacks are lifted over time, it is important to establish an efficient supply of automated tools to locate attack detection situations. The Intrusion Detection System is one of the attack systems which detects intrusions from the net. Many approaches to network intrusion detection were identified in the literature. Mining techniques have recently prevailed

to imagine intrusion detection [6]. The features of incoming intrusions were known by using well mined data on the information provided in the network.

When the characteristics of the well-mined knowledge contain an identical entity then it is declared an infringement. Diverse models for intrusion detection have been designed to support this criterion in the recent research and the accuracy is therefore improved. A fast analysis of the earlier methods is carried out. The whole method is divided into approaches to information pre-processing and detection. The preprocessing methods are also divided into feature extraction and have transformation models that support the operating methodology over the options. Detection methods are often known as machine learning and approaches to organic processes.

Improving Cybersecurity Assurance Model

Any time an auditor group takes part in an IT, data security or conformity audit, there are clear phases, such as design, goals and extent, clarified terms of commitments, audit conduct, corroborative evidence, risk assessment, audit results news and follow-up timetable tasks. The design of a cybersecurity audit is not entirely

different from any type of audit. However, due to the quality of several cybersecurity domains this will take a lot of time.

However, most cyber technologies are not examined by the framework of the internal audits. The special framework includes risk/compliance management, the development life cycle, a security programme, the management of third parties, information/asset management, access management, the management of the threat and vulnerability of cybersecurity inspections, the need for assurance by management reviews, cyber risk assessments, information and information. In addition, Deloitte is in line with the trade framework, as are the National Institute of Standard and Technology (NIST), the Information Technology Infrastructure Library (ITIL), the Treadway Commission Sponsoring Organizations' Committee (COSO) and the global standardization organisation (ISO).

Furthermore, there are no methods for live cyber security audits and the issue of cyber security audits is still poorly understood as they turn extremely rapidly. Khan considers that the auditors should cover all relevant sectors of an enterprise to mask a major scope for designing a cybersecurity audit; these areas include client

operations, finance, human resources, IT systems and applications, legal issues, procurement, regulatory affairs, physical safety and any one of the related third parties in relation to the company.

Database Intrusion Detection System Using Octraplet and Machine Learning.

For host systems and networks, several intrusion detection systems are created. However, relatively few notable tasks for intrusion detection are available. One of the latest works released was a technique proposed by Chung et al. for an approach for detecting information intrusion. Here, repeated patterns of knowledge are well-mined and maintained as typical profiles. The biggest drawback is that it does not create roles. The users perform entirely different acts that their functions support. As the only requirement, user profiles cannot be included. Users can perform acts that support roles and are maliciously detected. Real time intrusion detection system assisted time signatures has been proposed by Lee et al. Effective time information systems use time information objects and adjust their values with time [7].

Therefore, a computer dealing is created whenever it is

modified. The time information is modified for a certain period of time. If a deal wants to change the time data that has already been changed by this amount, an alarm will be raised. But the drawback to this strategy is that it focuses only on notifications and not roles. Using log files, Hu Panda uses user profiles. Details and tables frequently accessed and maintained for reference. The issue with this method is that maintaining awareness is unbelievably hard since information dimensions are simply too large and the number of users is increasing dynamically.

Cyber security threats today are too diverse and too quick for strict manual protection. In addition, machine learning offers power and speed to cope with enormous attack volumes with various variations. The \$64000 key to AI's investment in cyber security is, however, to use it with human intelligence, strength, speed, skills and judgment. Artificial intelligence and machine education are also very cool and helpful in cyber security assault detective work. Human work is also carried out with the help of machine learning at a much faster speed and high precision. The implementation of various machine learning techniques will help the United States discover

attacks on cyber security.

III. DISCUSSION AND FINDINGS

The safety companies normally use training methods on giant information sets to "read" what to look at and how to react to completely different items on networks. But the title of machine learning is far too strong and approach may be a natural way of defending antivirus and malware:

- Machine learning will help America stop information leakage, business management intrusion detection and malware detection.
- Machine learning method.
- Machine learning is nowadays allowing companies to work with higher power, precision, agility and intellect.
- This strategy may help unravel security issues.
- The machine learning rule discovers and determines any new unusual pattern or action arising from external intrusions.
- Security holes caused by user allowances or programmers or managers should be very careful.

IV. CONCLUSION

This chapter reflects a study of network security domain

network machine learning and DL unit methods. The literature document, which focused on most of the last four years, presents the latest implementations of the ML and DL units for intrusion detection systems. Unfortunately, the most successful method of intrusion detection has not yet been identified and the study therefore remains. Each approach to implementation of an intrusion detection system has its own advantages and disadvantages, as is evident in the discussion of comparisons of different methods. It is also difficult to use a particular technique to incorporate an intrusion detection scheme. Network intrusion detection data sets are valuable coaching and testing systems tools. Machine learning and DL approaches are not working without the representative information and it is difficult and long to obtain such a dataset.

However, there are some problems with the current public dataset available, for example uneven details or out-of-date content, which makes the likes identical. These problems have mainly limited the event of study in this explicit space. Network info changes in no time bringing a bigger issue to the ML and DL model coaching. The model must be semi-permanent/long-term and easily retrained.

Progressive learning and long learning are the long-term focus of this field's research in the future.

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50

ANTICANCER ACTION OF INSILCO DOCKING AND DRUG DESIGN OF HERBAL LIGANDS

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Abstract

In silico approaches have been widely recognized to be useful for drug discovery. Here, we consider the significance of available databases of medicinal plants and chemo and bioinformatics tools for in silico drug discovery beyond the traditional use of medicines. Whereas computational methods for molecular design are well established in medicinal chemistry research, their application in the field of natural products is still not exhaustively explored. The challenge is which selection criteria and/or multiple filtering tools to apply for a target-oriented isolation of potentially. The amount of available data on the biological activity of the investigated compounds (including herbal medicines) and the number of target macromolecules related to their therapeutic effects increase every year. At the same time, the pool of data on compositions of medicinal plants has also increased. Therefore, the need for use of in silico methods to determine the biological activity of medicinal plants is obvious.

Keywords: In-silico studies, cancer, docking, protein, herbal ligands

Introduction

Natural products have been used in folk medicine for thousands of years. One-third of the Indian population and more than 80% of the population uses herbal medicinal products to promote health and to treat common illnesses such as colds, inflammation, heart diseases, diabetes and central nervous system disorders. It is believed that plant and its chemical constituents interacting with human biological system by altering environmental stresses and adapt to these changes [1]. This type of adaptation is accompanied by unusual phytochemical diversity.

These data confirm the assertion by Dhawan [2] that the study of plants, based on their use in traditional systems of medicine, is a viable and cost-effective strategy for the development of new drugs [3]. Because there are several thousand pharmacological targets and because most natural compounds exhibit pleiotropic effects by interacting with different targets, computational methods are the methods of choice in drug discovery based on natural products [4]. The use of chemo- and bioinformatics methods for the exploration of their pleiotropic pharmacological potential beyond the traditional

uses may be possible with the availability of medicinal plant databases including data on chemical structures and therapeutic uses of phytoconstituents identified over the years from medicinal plants.

In-silico studies are done to identify the exact target of the drug. Which finds a drug for the particular binding site and final stage animal testing can be done for obtaining a conform result. Specific software on a computer allows researchers to analyze enormous data without actually conducting a large number of experiments. It helps to give the existing information to model disease pathway and identifies precise targets of the selected drugs. Later stage in vivo and in vitro studies can be done for obtaining the confirmatory result.

Docking

If the structure of the target has been solved at high resolution with X-ray or NMR and the molecular model of the binding site is precise enough, the best possible starting point in a structure-based drug design is the application of docking algorithms. Molecular docking is a molecular simulation technique widely used to research the interaction between the ligand and target.

The docking process is the virtual simulation of the energetic interaction between the ligand and the target, including the prediction of the best ligand conformation and orientation within the binding site [5].

Docking is a method that predicts the preferred orientation of one small molecule bound to a target, forming a stable complex. It consists of multiple steps. The process begins with the application of docking algorithms that pose small molecules within the active site of the target. Algorithms are complemented by scoring functions that are designed to predict the biological activity through the evaluation of interactions between compounds and potential targets.

Thus, docking programs have mainly three purposes. First, docking programs serve to identify potential ligands from a library of chemical compounds. Second, they can predict the binding mode of potential ligands or known ligands. Finally, using the predicted binding pose, these programs calculate putative binding affinities used as a score to identify those compounds which are more likely to bind the drug target.

Docking programs have shown to be successful in screening large chemical libraries, reducing them into a more manageable subset that is enriched for binders. In cases of true interactions, the predicted ligand pose often correlates well with experimentally solved protein-ligand complexes.

While structure-based methods have led to the identification of novel drugs, binding pose prediction is considered one of its strengths. 22 Since molecular docking plays a central role in predicting protein-ligand interactions it has been extensively used for drug hit discovery and lead Optimization [6-18].

Bioinformatics has, out of necessity, become a key aspect of drug discovery in the genomic revolution, contributing to both target discovery and target validation. The pharmaceutical industry has embraced genomics as a source of drug targets and as a corollary, has recognized that bioinformatics is crucial to exploiting the data produced on a genome-wide scale⁵. Computer-aided drug design (CADD) is a widely used term that represents computational tools and resources for the storage, management analysis and modeling of compounds.

It includes development of digital repositories for the study of chemical interaction relationships, computer programs for designing compounds with interesting physicochemical characteristics, as well as tools for systematic assessment of potential lead candidates before they are synthesized and tested. Over the years, new technologies such as comparative modeling based on natural structural homologues have emerged and began to be exploited in lead design. These, together with advances in combinatorial chemistry, high throughput screening technologies and computational infrastructures, have rapidly bridged the gap between theoretical modeling and medicinal chemistry. CADD now plays a critical role in the search for new molecular entities⁶.

Current focus includes improved design and management of data sources, creation of computer programs to generate huge libraries of pharmacologically interesting compounds, development of new algorithms to assess the potency and selectivity of lead candidates and design of predictive tools to identify potential ADME/Tox liabilities [7]. Bioinformatics is seen as an emerging field with the potential to significantly improve how drugs are found,

brought to the clinical trials and eventually released to the marketplace. Computer - Aided Drug Design (CADD) is a specialized discipline that uses computational methods to simulate drug – receptor interactions. One of those methods is called docking. The site of drug action, which is ultimately responsible for the pharmaceutical effect, is a receptor. Docking allows the scientist to virtually screen a database of compounds and predict the strongest binders based on various scoring functions [8].

Molecular modeling technologies have mainly been developed during the past decades, due to the development of fast computers and are today essential tools in drug development used for protein structure determination, sequence analysis, protein folding, homology modeling, docking studies and pharmacophore determination [9]. Structure-based (direct) drug design is generally performed using a known 3D structure of a specific biological target [10]. Ligand-based (indirect) drug design to correlate physicochemical properties of compounds with their pharmacological activity and the calculated mathematical relationship can predict the activity of novel compounds [11].

Molecular docking is commonly used in the field of drug design to predict the binding of small molecules to biological protein targets. This method gives the possibility to study an active site in detail and can be used for hit identification, virtual screening, binding mode determination and lead optimization.

Generally, the docking methodology is used to fit a compound into an artificial model or to a known three-dimensional binding site, which can be utilized to explore ligand conformation, orientation and feasible molecular interactions such as hydrogen bonding and hydrophobic interactions.

Thus, molecular docking is a powerful tool for the design of ligands toward a specific protein target [12]. 'Docking program' is used to place computer-generated representations of a small molecule into a target structure in a variety of positions, conformations and orientations. Each such docking mode is called a 'pose'. In order to identify the energetically most favorable pose, each pose is evaluated ('scored') based on its complementarity to the target in terms of shape and properties such as electrostatics.

A good score for a given molecule indicates that it is potentially

a good binder [13]. Docking explores the ways in which two molecules, such as drugs and enzyme receptors fit together and dock to each other well. The molecules binding to a receptor inhibit its function and thus act as drug. Complexes were identified via docking and their relative stabilities were evaluated using molecular dynamics and their binding affinities, using free energy simulations [14].

Ligand and structure-based methods

Evidence of computational drug design success in the field of drug development is reflected in a significant number of new drug entities that are currently in clinical evaluation. Computational drug design has emerged to harness different sources of information to facilitate the development of new drugs that modulate the behavior of therapeutically interesting protein targets. Ligand-based methods use the existing knowledge of active compounds against the target to predict new chemical entities that present similar behavior [15-17].

Given a single known active molecule, a library of molecules may be used to derive a pharmacophore model to define the minimum necessary structural characteristics a molecule must

possess in order to bind to the target of interest. Comparison of the active molecule against the library is often performed via fingerprint-based similarity searching, where the molecules are represented as bit strings, indicating the presence/absence of predefined structural descriptors [18].

In contrast, structure-based methods rely on targeting structural information to determine whether a new compound is likely to bind and interact with a receptor. One of the advantages of the structure-based drug design method is that no prior knowledge of active ligands is required [19]. From a drug 3D structure, it is possible to design new ligands that can elicit a therapeutic effect.

Therefore, structure-based approaches contribute to the development of new drugs through the discovery and optimization of the initial lead compound. Currently, the combination of ligand- and structure-based methods has become a common approach in virtual screening since it has been hypothesized that their integration can enhance the strengths and reduce the drawbacks of each method.

In this section, some of the most representative computational approaches used to design, optimize and develop a new drug are

described. Although there are remarkable differences among them, they share a common goal: harvesting potential ligands or hits with the capability to bind to the target from an extensive database of generic small chemical compounds.

To achieve this goal, many essential steps and decisions have to be made in order to eliminate from irrelevant compounds at the beginning, to end up with those that show better potential activity or have side effects and show interaction with other drugs. This process performed with the assistance of computational algorithms is called virtual screening.

The molecular docking approach can be used to model the interaction between a small molecule and a protein at the atomic level, which allow us to characterize the behavior of small molecules in the binding site of target proteins as well as to elucidate fundamental biochemical processes [20].

The docking process involves two basic steps: prediction of the ligand conformation as well as its position and orientation within these sites (usually referred to as pose) and assessment of the binding affinity. These two steps are related to sampling methods and

scoring schemes, respectively, which will be discussed in the theory section.

Knowing the location of the binding site before docking processes significantly increases the docking efficiency. In many cases, the binding site is indeed known before docking ligands into it. Also, one can obtain information about the sites by comparison of the target protein with a family of proteins sharing a similar function or with proteins crystalized with other ligands.

In the absence of knowledge about the binding sites, cavity detection programs or online servers, e.g. GRID [21-22], POCKET [23], Surf Net [24-25], PASS [26] and MMC [27] can be utilized to identify putative active sites within proteins. Docking without any assumption about the binding site is called blind docking.

Drug Design

Drug design, sometimes referred to as rational drug design (or more simply rational design), is the inventive process of finding new medications based on the knowledge of biological targets [28]. Rational drug design can be broadly divided into two categories: development of small molecules with desired properties toward

targets, biomolecules (proteins or nucleic acids), whose functional roles in cellular processes and 3D structural information are known.

This approach in drug design is well established, being applied extensively by the pharmaceutical industries. Another approach is development of small molecules with predefined properties toward targets, whose cellular functions and their structural information may be known or unknown [29]. The identification of a potential drug target is valuable and significant in the research and development of drug molecules at early stages.

Due to the limitation of throughput, accuracy and cost, experimental techniques cannot be applied widely. Therefore, the development of in silico target identification algorithms, as a strategy with the advantage of fast speed and low cost, has been receiving more and more attention worldwide.

It has been of great importance to develop a fast and accurate target identification and prediction method for the discovery of targeted drugs, construction of drug-target interaction network as well as the analysis of small molecule regulating network [30].

The acquisition of chemical compound information [31-32]

A thorough understanding of the effective compounds in medicinal plants is the key to the research and development of medicinal plants. Therefore, the collection of constituent information and the construction of the compound database are highly important for their application. The construction of a compound database can effectively manage the large quantities of compounds found in medicinal plants.

Collection of chemical compound information [33]

The information contained in a medicinal plant is the initial raw material for determining the basis of the herb's pharmacological properties. Compound information was mainly collected from the following sources: (1) separation and purification of the compounds in a local laboratory; (2) literature reports; and (3) small molecule compound databases. Among this three information gathering pathways, the extraction of compounds in a local laboratory is the most direct and convenient method and can provide samples for later experimental studies.

When a single compound is purified from herbs, the relevant information is collected such as its recording number, CAS number, name, source plant, extractive fraction and structure information such as the SMILES code.

Pre-treatment of chemical compounds [34]

The number of compounds collected from medicinal plants is very high; however, the majority lack pharmacological potency. To enhance the efficiency of screening, the first step is to remove these non-potential compounds and refine the included compounds.

Methodology [35]

Biological databases like PubChem, Drug Bank, PDB (Protein Data Bank) and software's like Arguslab and Chemdraw. The PDB (Protein Data Bank) is the single worldwide archive of Structural data of Biological macromolecules, established in Brookhaven National Laboratories (BNL) in 1971 (The Protein Data Bank, 2000). It contains Structural information of the macromolecules determined by X-ray crystallographic, NMR methods etc. Arguslab offers quite good on-screen molecule-building facilities, with a moderate library of useful molecules.

It is a free molecular modeling package that runs under Windows [36].

Types of software for use in computational studies [37]

Ligand based screening programs

Pre-requisite(s) for use: knowledge of compounds with known activity; use: to identify putatively active compounds; tools available: classification/ regression trees (including Random Forest), linear discriminant analysis, artificial neural networks, and support vector machines.

Pharmacophore programs

Can be either ligand-based (LB), or target-based (TB) (the latter being superior/preferable); prerequisite(s) for use: 3D structures of known ligands to chosen targets (LB), or known 3D structures of target protein(s), and ideally known 3D structure(s) of known complex(es)) (TB); use: to identify putative active compounds; programs available: Ligand Scout [38] , Schrödinger's Phase program [39] and Accelrys's Discovery Studio® Catalyst.

Docking programs:

Pre-requisites for use: known 3D structure (s) of target proteins;

use: to ‘dock’ potential small molecule ligands into protein active sites, optimizing their topographical and chemical complementarity, and scoring their interaction. Programs available: FlexX [40] , Gold [41] , Dock [42] , Glide [43] , Mol Dock [44] , Auto Dock [45] and Ligand Fit [46] .

Other relevant types of software tool were identified as: Pattern recognition software: Use: post-screening analyses (involving dimensionality reduction); algorithms employed: principle components analysis, multi-dimensional scaling, self organising maps, and various forms of cluster analysis.

Proteomics and/or genomics data visualization and analysis tools:

Application specific programs for statistical processing and visualization of data output from DNA micro-array experiments, MS proteomics experiments, etc.

Prediction of drug like properties

Drug-like characteristics are a qualitative concept used in drug design for a compound’s utility with respect to factors such as bioavailability, which is estimated based on the molecular structure

characteristics [47]. Certain structure properties indicate that a compound has a higher likelihood of becoming a successful drug. In the past, research on these properties of a drug has been among the most important components of downstream drug development.

In recent years, it has become imperative to integrate the study of drug properties during the early stages of drug discovery. Pharmacologists are interested in the following properties of the drugs, among others: (1) structural characteristics: hydrogen bonding, polar surface area, lipophilicity, shape, molecular weight, and acid dissociation constant (pKa); (2) physicochemical properties: solubility, pH value, permeability and chemical stability; (3) biochemical properties: metabolism, protein binding affinity and transport ability; and (4) pharmacokinetics and toxicity: half-life, bioavailability, drug interactions and half lethal dose, LD50.

According to Lipinski's proposal [48], a small molecule suitable for development as a drug needs the following properties (Lipinski's rule of five, RO5): (1) no more than 5 hydrogen bond donors (the total number of nitrogen-hydrogen and oxygen-hydrogen bonds); (2) no more than 10 hydrogen bond acceptors (all nitrogen or oxygen

atoms); (3) a molecular mass less than 500 Daltons; and (4) an octanol–water partition coefficient logP not greater than (5) Small molecules that satisfy the RO5 criteria have higher bioavailability in the metabolic process of the organism and therefore are more likely to become oral medications.

ADME/T selection

When drug-likeness established from the analyses of the physiochemical properties and structural features of existing drug candidates, the ADME/T (absorption, distribution, metabolism, excretion and toxicity) properties play an important role in the drug filtering. So, we employed the ADME/T selection after other drug-likeness properties evaluated [49-51].

Successful applications in cancer drug discovery [52-55]

The development of new anticancer drugs proves to be a very elaborate, costly and time-consuming process.

CADDD is becoming increasingly important, given the advantage that much less investment in technology, resources, and time are required. Due to the dramatic increase of information available on genomics, small molecules, and protein structures,

computational tools are now being integrated at almost every stage of the drug discovery and development. Given the 3D structure of a target molecule, chemical compounds may have a potentially higher affinity for their target when are designed rationally with the aid of computational methods. In recent years, several cases of successful applications of structure-based drug design have been reported.

The evolution of faster advances in the enormously expanding plant sciences and natural products chemistry discipline demands high-end technological advancements in computational methods, data mining and data management.

The envisioned leads, drug discovery and development, diversity in the broader natural products chemistry towards understanding of the complete influence and impact on the interdisciplinary sciences, broader subject area's structural, functional and various other applications in several domains including medicine and veterinary medicine needs better handling of informational repository, data mining, retrieval as well as the safety, proper, benevolent and beneficial handling of the generated data.

The impact of chemical understandings in various inter-linked sciences is setting new goals for challenges in bio-computing and computational resources management. The immense help from the contributions of natural products chemistry and natural products chemists have started playing its part. The prediction strategies and tools for various natural resources interactions for its probable pathways, products, biomechanics properties, software development, and other advancements in computation methods hold enormous promise for the future. Scopoletin is constituent in *Artemisia annua* L. Scopoletin [56] might serve as the lead compound for drug development.

A study on herbal lead compounds in [57] Prostate Cancer. Another study on [58] Danshen for its anti-cancer effects. Roots of *Rheum undulatum* has having components that are [59] anthraquinone and stilbene derivatives, such as emodin, aloemodin, resveratrol, rhaponticin, and isorhapontin and demonstrate sEH inhibitory, antibacterial, antioxidant, anticancer, and anti-inflammatory activity. *Psoralea corylifolia* plant is used for its anti-tumor effects [60]. Major components in seed is psoralidin. This study

Discover novel lead for non-small cell lung cancer. This study suggests the triptolide in Cancer treatment [61].

Another study on liver tumor treated by FuzhengYiliu decoction. 11 constituents, showed better anticancer activity towards the cell of HepG2 cancer [62]. The X-linked inhibitor of apoptosis as a new molecular target for anticancer drugs used to resist the cancer cells to chemo and radiation therapy [63]. Phytochemical studies on active anti-colorectal cancer compounds Alkannatinctoria and isolated eight quinone compounds. Among that alkannin, angelyl alkannin, 5-methoxyangerylalkannin compounds show strong antiproliferative effects [64].

Conclusion

In silico drug design is a powerful method, especially when used as a tool within a tool, for discovering new drug leads against important anticancer targets.

After a target and a structure of that target are defined, new leads can be designed from chemical principles or chosen from a subset of small molecules that scored well when docked in silico against the anticancer target. Each year, new targets are being

diagnosed, structures of those targets are being determined at an amazing rate, and our capability to capture a quantitative picture of the interactions between macromolecules and ligands is accelerating.

The process of novel drug discovery and development is recognized to be very expensive and time consuming. However, thanks to recent advances in the development of physical and chemical models to simulate bimolecular processes, together with the production of increasingly powerful computational resources, discovering and designing new drugs as anticancer drugs is an affordable task for many research institutions and laboratories today. With the required computational hardware and software, and the expertise in biochemistry, biophysics, and biology, many projects that previously demanded a significant investment in time and money can be done today by a small group of researchers in their workstations. Moreover, challenging projects not even conceivable two decades ago can be today tackled with the access to a supercomputer.

The optimization of these techniques and methods occurs this way naturally in its theoretical feedback signaling system.

Computational models generate useful predictions to be checked with experimental results, and biologists and physicians demand approaches that are more accurate to computational scientists.

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51

HISTORY AND DEVELOPMENT OF PLANT SCIENCE

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Abstract-

Natural sciences deal with the physical world and include astronomy, biology, chemistry, geology, and physics. Applied science is the process of applying scientific knowledge to practical problems, and is used in fields such as engineering, health care, information technology, and early childhood education. Basic science, such as understanding how cells work, is research aimed at understanding fundamental problems. Applied science, such as the medical field, is the application of basic scientific knowledge to solve practical problems. Applied science uses and applies information obtained through basic science.

The first description of the natural world in the West can be traced to Aristotle, who placed man at the pinnacle of God's creation, and later was revitalized in medieval Christian Europe as the concept of natural theology, which justified the application of religion to the discovery and description of new flora and fauna during voyages to the New World. History of technology includes history of invention, development and innovation, as well as history of engineering and applied science.

Historians of technology have varied backgrounds including engineering, economic history, labour history, history of science, sociology, and social history. Since World War II, the history of technology has taken on some of the attributes of a discipline through the establishment of graduate programs and a scholarly journal of international repute. Historians of technology have focused upon several themes including the relationship between science and technology, the nature of invention, development and innovation, the interaction of technology and environment, and gender studies. The beginnings of agriculture are a huge story.

It started in the Fertile Crescent in the modern day Middle East, but people domesticated plants in cultures the world over. Grain species like wheat and rice as well as fruits & vegetables became farmed and selectively bred. As globalization proceeds, we seem to be eating fewer and fewer different plants in our diets. Many plants can get transformed and processed into many different kinds of food. I'll cover more specifics in the history of agriculture in the future. It is an important and ongoing story in the history of plant biology. The future of agriculture matters too, as humans will have to produce

more food on less land than we do now to feed the projected 9 billion people by 2050.

Keywords-Applied science, Historians, agriculture and World War II.

INTRODUCTION-

Natural sciences deal with the physical world and include astronomy, biology, chemistry, geology, and physics. Applied science is the process of applying scientific knowledge to practical problems, and is used in fields such as engineering, health care, information technology, and early childhood education. Basic science, such as understanding how cells work, is research aimed at understanding fundamental problems. Applied science, such as the medical field, is the application of basic scientific knowledge to solve practical problems. Applied science uses and applies information obtained through basic science. The history of science is vast. And even though the term science is recent in human history, humans have always been tinkerers and explorers.

The history of plant science is no less interesting or complex. It is obviously is bigger than a single blog post. The Twitter version of plant science history might say agriculture invented, Mendel

experimented with pea plants, and GMOs get planted. These are the biggest moments most people learn about at some point. As with a lot of history in life science history, the story starts with observations of the natural world. Observations lead to experiments that uncover mechanisms life uses to, well, live. The closer to modern day you get, scientists uncover finer and finer details of how life works. For example, cells, the base unit of life. And the DNA encoded genes in those cells. Genes are the sequences of DNA that store information to build an organism arranged in groups called chromosomes with thousands of genes. Humans have 46 total chromosomes, half from Mom and half from Dad.

The history of botany goes as far as to 4th century B.C.E. The man's curiosity on plants leads too many discoveries in Botany which shaped our current lives in many ways. At present, various sub-fields of botany have already emerged. These include the following: plant pathology, plant ecology, paleobotany, and forensic botany. But despite being established as a discipline, the definition of the term "plant" remains to be vague and still up for more clarifications. Botanists often describe plants in a more inclusive manner with

multi-cellular, eukaryotic organisms that do not have sensory organs, and have, when complete, root, stem, and leaves. 4th Century B.C.E: Both Aristotle and Theophrastus got involved in identifying plants and describing them. Because of his contributions, Theophrastus was hailed as the “Father of botany” because of his two surviving works on plant studies. Although Aristotle also wrote about plants, he received more recognition for his studies of animals. Botanist Dioscorides in A.D. 60: Dioscorides wrote *De Materia Medica*. This work described a thousand medicines, majority of which came from plants. For 1500 years, it remained the guidebook on medicines in the Western world until the invention of the compound microscope.

Applied Sciences are those disciplines that apply existing scientific knowledge to develop practical applications. Mathematics is the study of numbers, equations, functions and geometric shapes and their relationships, either as applied to other disciplines or as abstract concepts. Applied Sciences encompass areas such as engineering, computer science, technology, agricultural science, food science, aquaculture, architecture, etc. Mathematics encompasses

areas such as algebra, applied mathematics, discrete mathematics, foundations of mathematics, geometry, history of mathematics, mathematical analysis, mathematical methods, mathematical object, number theory, probability theory, topology, mathematical biology, etc.

Objectives-

- To study of plant science
- To explain the history of plant science
- To study current situation of plant science
- To explain importance of plant science
- To describe role of plant science in human developpemt

Analysis and Results-

History of technology includes history of invention, development and innovation, as well as history of engineering and applied science. Historians of technology have varied backgrounds including engineering, economic history, labour history, history of science, sociology, and social history. Since World War II, the history of technology has taken on some of the attributes of a discipline through the establishment of graduate programs and a scholarly

journal of international repute. Historians of technology have focused upon several themes including the relationship between science and technology, the nature of invention, development and innovation, the interaction of technology and environment, and gender studies.

Applied science is the use of existing scientific knowledge to practical goals, like technology or inventions. Within natural science, disciplines that are basic science develop basic information to explain and perhaps predict phenomena in the natural world. In contrast, applied science or “technology,” aims to use science to solve real-world problems, making it possible, for example, to improve a crop yield, find a cure for a particular disease, or save animals threatened by a natural disaster. In applied science, the problem is usually defined for the researcher.

Applied science is the use of existing scientific knowledge to practical goals, like technology or inventions. Within natural science, disciplines that are basic science develop basic information to explain and perhaps predict phenomena in the natural world. Applied science is the use of scientific processes and knowledge as the means to achieve a particular practical or useful result.

This includes a broad range of applied science related fields, including engineering and medicine. Applied science can also apply formal science, such as statistics and probability theory, as in epidemiology. Genetic epidemiology is an applied science applying both biological and statistical methods.

The father of modern science is Galileo (15 February 1564–8 January 1642) was an Italian astronomer physicist and engineer. Galileo has been called the father of observational astronomy, the father of modern physics the father of scientific method and the father of modern science Mathematics is considered as the mother of all sciences because it is a tool which solves problems of every other science. Other subjects like biology, Chemistry or Physics is based on simple chemical solutions. All the activities that are taking place in our body or outside are a chemical reaction.

The first description of the natural world in the West can be traced to Aristotle, who placed man at the pinnacle of God's creation, and later was revitalized in medieval Christian Europe as the concept of natural theology, which justified the application of religion to the discovery and description of new flora and fauna during voyages to

the New World. Before Swedish naturalist Carolus Linnaeus (1707–1778) published his taxonomic botanical nomenclature system, Buffon, who was based in Paris, was the prominent Enlightenment botanist. Linnaeus's classification of species as being of equal rank was a paradigm shift from the hierarchical existential order of the traditional, commonly held concept of the Great Chain of Being. When Linnaeus shared his work with Dutch naturalists, among those who accepted his work was Jan Frederik Gronovius (1690–1762), who facilitated the publication of Linnaeus's *Fundamenta* in Holland in 1735, which based plant nomenclature on the number, form, and order of the stamens and pistils.

As an author of a series of books, Linnaeus created a framework for the first objective system to catalog every plant and animal by genera and species, establishing a binomial nomenclature of flora and fauna. Linnaeus published the first edition of *Systema Naturae* in 1735 after completing his doctoral thesis. In this work, Linnaeus proposed a new system of classification order of kingdoms, which included plants, animals, and minerals. Specifically, Linnaeus organized new nested categories of equal status, and every species

known at the time was placed within a genus, order, class, and kingdom.

Another concurrent historical development in France was the writing, editing, and publication of Diderot's Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers (Encyclopaedia, or Classified Dictionary of Sciences, Arts, and Trades), the publisher Le Breton hired their first editor, Jean-Paul de Gua de Malves (1713–1785), a mathematician, to improve upon Ephraim Chambers's (1680–1740) Cyclopaedia (1728) as a model, which was accepted by the traditional regime. Jean-Paul de Gua de Malves recruited fellow mathematician Jean le Rond d'Alembert (1717–1783) as his assistant, who later assumed the coeditorship after de Malves' resignation, with Denis Diderot as editor-in-chief and one of the contributors to the Encyclopédie.

Diderot differentiated the Encyclopédie from Chambers's Cyclopaedia through modernizing the universal map of knowledge by decentralizing theology and reordering reason and natural history at the core. Extensive cross-references heralded open-ended, scholarly conversations in this new general encyclopedia.

The naming of the title Encyclopaedia established the term “encyclopedia” in the lexicon as a compendium of human knowledge. The first volume of the Encyclopédie was published in 1751, and contrary to popular assumption, the contributors, also known as encyclopedists, were not like-minded thinkers from a common occupation or ideology. The eclectic authorship is among the most fascinating aspects of the Encyclopédie.

This multivolume encyclopedia contains articles authored by more than a hundred contributors, including the scientific writings of Paul-Henri Thiry, Baron d’Holbach (1723–1789); Gabriel-François Venel (1723–1775); and Anne Robert Jacques Turgot, Baron de l’Aulne (1727–1781), who later inspired Antoine Lavoisier’s (1743–1794) chemistry discoveries in the eighteenth century. Diderot and d’Alembert used a tree metaphor to connect their perspective of mapped knowledge under the heading “Memory, Reason, and Imagination” instead of using an alphabetized list of articles. In the Encyclopédie, one of the fundamental components of encyclopedic knowledge is the discipline of natural history.

The editors categorized approximately 4,500 of the encyclopedia's more than 70,000 articles under natural history. Diderot was influenced by Buffon's works on natural history, which were cited in the Encyclopédie.

In the mid 1600s, early in the days of the scientific revolution that was set off by Copernicus, Galileo, Kepler, and others was furthered by the ability to look more closely at the living world. The exploration of the solar system with the telescope expanded the universe. But another curious and inventive person, Antonie van Leeuwenhoek, figured out how to augment human vision the other way to look at every day things up close. He looked at drops of pond water, discovering "animalcules", or what we would call microbes.

A contemporary, Robert Hooke, using an Antonie van Leeuwenhoek microscope looked at cork. Up close, it looked to Hooke like little rooms. He was in fact seeing the cell walls of the dead cork cell and he called them cells, after the rooms in monasteries where monks resided. In the early 1800s, Schleiden and Schwann, the former a plant scientist, proposed the idea that all life is cellular- plants, animals, and microbes.

Part of the colonial era was the founding of botanical gardens like Kew in London, England. Through Kew's operations, plants from around the world were cultivated in England.

The Russian plant biologist Nikolai Vavilov researched "centres of origin" of various plants. He mapped where trait diversity of specific plants was greatest. He reasoned that centres of plant origin would have the most diversity where the plants had exist the longest in nature. During plant domestication, humans only took a small subset of plants with limited, but still useful, genetic variation. Vavilov was the father of seed banking.

A practice of collecting seeds of wild as well as commercial plants to keep genetic diversity in storage for the future. Barbara McClintock contributions to basic biology, studied maize chromosomes. Her work provided insight into the mechanisms of trait inheritance between generations. In other words, answering just how the DNA that makes up chromosomes relate to the physical plant we see. She also determined some of the dynamic processes chromosomes undergo. She was further exploring what Mendel had uncovered with his pea plants with better technology.

McClintock showed direct evidence for a hypothesis of ‘crossing over’. Crossing over is the exchange of genetic material (DNA) between two parents’ gametes (sex cells) that occur between similar chromosomes. This phenomenon is why some patterns of inheritance are observed². More famously, McClintock also discovered so called ‘jumping genes’, or transposons³. Transposons are genetic elements that jump around the genome causing direct affects on gene function and physical traits. Transposons do not just exist in plants. They are ubiquitous in the cellular world. Once confirmed, McClintock did end up winning the 1983 Nobel Prize in Physiology or Medicine.

Development of plant science during the 16th Century-

Early 17th century for a brief period, the search for knowledge in the field of Botany temporarily became stagnant. However, the revival of learning during the European Renaissance renewed interest in plants. In 1640 Johannes van Helmont measured the uptake of water in a tree. Brittanica.com explains “In what is perhaps his best-known experiment, van Helmont placed a 5-pound (about 2.2-kg) willow in an earthen pot containing 200 pounds of dried soil, and over a five-year period he added nothing to the pot but

rainwater or distilled water. After five years, he found that the tree weighed 169 pounds while the soil had lost only 02 grams. He concluded that “164 pounds of wood, barks, and roots arose out of water only,” and he had not even included the weight of the leaves that fell off every autumn.”

Robert Hooke invented the microscope in 1665 because of this; Robert Hooke had the chance to take a close look of a cell looks like. His description of these cells was published in *Micrographia*. However, the cells seen by Hooke showed no signs of the nucleus and other organelles found in most living cells. Anton van Leeuwenhoek saw a live cell under a microscope. Before his discovery, the existence of single-celled organisms was unknown and initially was met with scepticism in 1674. John Ray published his book, in 1686 *Historia Plantarum*. This became an important step towards modern taxonomy. In 1694 Rudolf Camerarius established plant sexuality in his book entitled *De Sexu Plantarum Epistola*. There, he stated that: “No ovules of plants could ever develop into seeds from the female style and ovary without first being prepared by the pollen from the stamens, the male sexual organs of the plant.

Development of plant science during the 18th Century-

Stephen Hales in 1727 successfully established plant physiology as a science. He published his experiments dealing with the nutrition and respiration of plants in his publication entitled *Vegetable Staticks*. He developed techniques to measure area, mass, volume, temperature, pressure, and even gravity in plants. In 1758 Carolus Linnaeus the “Father of Taxonomy“, introduced the science of taxonomy which deals with the identification, nomenclature, description and classification of organisms.

His classification is based on the fact that species was the smallest unit and each species (taxon) is under a higher category. Botany became even more widespread among educated women who painted plants, attended classes on plant classification, and collected herbarium specimens. However, the focus of their study was on the healing properties of plants rather than plant reproduction. Women began publishing on botanical topics and children’s books on botany appeared in 1760. The prize resulting from the period of exploration was accumulated in gardens and herbaria.

And the task of systematically cataloguing them was left to the taxonomists. Joseph Priestley laid the foundation for the chemical analysis of plant metabolism. Joseph Priestley published his works as *Experiments and Observations on Different Kinds of Air* in 1774. The published paper demonstrated that green plants absorb “fixed air” (carbon dioxide) from the atmosphere, give off “gas” or “dephlogisticated air”, which is now known as oxygen, and that this gas is essential to animal life.

Development of plant science during the 19th Century-

Early in 1818 Chlorophyll pigment was discovered in plant parts, in 1840 Advances were made in the study of plant diseases because of the potato blight that killed potato crops in Ireland. This led to the further study of plant diseases. The process of photosynthesis was first elucidated by Mayer. In 1847 however, the exact and detailed mechanism remained a mystery until the 1862. Charles Darwin proposed his theory of evolution and adaptation, or more commonly referred to as “survival of the fittest” Charles Darwin and Alfred Russel Wallace collaborated.

Darwin soon published his renowned and highly recognized book *On the Origin of Species by Means of Natural Selection*. Around the same time, Gregor Mendel, was performing experiments on the inheritance among pea plants. Gregor Mendel became the “Father of Genetics”. The exact mechanism of photosynthesis was discovered when it was observed that starch was formed in green cells only in the presence of light in 1862. The results of Mendel’s experiments in 1865 showed that both parents should pass distinct physical factors which code information to their offspring at conception. The offspring then inherits one unit for each trait from each of his parents in 1865.

Development of plant science during the 20th Century-

Early in 20th Century the process of nitrogen fixation, nitrification, and ammonification was discovered. The two types of chlorophyll a and b were discovered in 1903. In 1936 through his experiment, Alexander Oparin demonstrated the mechanism of the synthesis of organic matter from inorganic molecules. Refer to a controversial observation of his findings at later years. Ecology became a separate discipline.

Technology has helped specialists in botany to see and understand the three-dimensional nature of cells, and genetic engineering of plants. This had greatly improved agricultural crops and products in 1940. Up until the present, the study of plants continues as botanists try to both understand the structure, behaviour, and cellular activities of plants. This endeavor is in order to develop better crops, find new medicines, and explore ways of maintaining an ecological balance on Earth to continue to sustain both plant and animal life.

India's footprint in the biological sciences is relatively small, especially considering its population. Much of India's high-level biology research is pursued at 15 Institutes and a few Universities with good biology departments, each of which houses 10–80 faculties. The relatively small size of India's life science enterprise is hardly surprising given that the country began much of its own national scientific agenda after achieving independence in 1947. In addition, physics, math, and engineering in India have been considered as higher scientific endeavors than biology and have produced more internationally recognized scientists.

Thus, it is useful to look at how biology in India developed in the last century, to provide a historical backdrop for its current situation and a perspective for how it might develop in the future. In the middle of the 19th century, the British East India Company established Universities in the three Presidency towns of Calcutta, Madras, and Bombay (now known as Kolkata, Chennai, and Mumbai) with the objective of training native Indians in liberal arts and sciences, medicine, law, and engineering.

Just before Independence, India had 20 Central and State run Universities, in addition to the original Presidency Universities. These Universities provided a solid basic education, but did not conduct any significant amount of research. The first Institute with a mandate to pursue scientific research was the Indian Association for the Cultivation of Science (IACS), which was established in Calcutta in 1876 and focused on chemistry and physics. The IACS spawned a number of intellectual giants, including Sir CV Raman who conducted his Nobel Prize-winning research there. A second prominent research Institute was the Indian Institute of Science (IISc) in Bangalore, which was conceived of in 1896 and launched in 1909.

These two Institutes continued to dominate basic scientific research in the physical sciences for the first half of the 20th century. At the end of World War II, a committee was convened to establish higher technical institutes for the industrial development of an independent India. This committee envisioned these institutes as engaging in world-class engineering training and research, following Western examples such as the Massachusetts Institute of Technology.

The first Indian Institute of Technology (IIT), as these schools came to be known, was inaugurated near Kolkata in 1951. Jawaharlal Nehru, the first Prime Minister of India, was a key force in establishing four additional IITs in other regions of the country in the ensuing decade. Currently, India has seven highly regarded IITs that attract top students in a highly competitive admissions process.

The IITs and other research institutes such as the IISc and the Bose Institute were focused primarily on mathematics, physics, and engineering. The legacy of this early investment carries through to the present; India now trains over 400,000 engineers per year and has a strong international reputation in physics, math, and

engineering. In contrast, modern biological research came into being much later in India. Until the 1960s, biological research was largely directed toward pragmatic applications in agriculture, nutrition, and public health. For example, the IISc in Bangalore started laboratory groups involved in fermentation, pharmacology, and silkworm biology in 1941.

The first truly modern “molecular biology research unit” began in 1962 as a branch of the Tata Institute of Fundamental Research (TIFR) in Mumbai, an institute originally devoted solely to physics and mathematics. Similarly, new biological research units formed within traditional physical science institutes in other locations. G.N. Ramachandran founded the Molecular Biophysics Unit at the IISc in 1970.

The Center for Cellular and Molecular Biology (CCMB) in Hyderabad also began as a semi-autonomous branch of a regional Indian Institute of Chemical Technology in 1977 and became a National Laboratory in 1981. Other biology institutes started with very pragmatic goals and then broadened their scope.

The National Institute of Immunology (NII) began in 1986 with the focused goal of developing vaccines but broadened several years later and is now conducting a wide range of basic biological research. The Centre for Biochemical Technology began as a producer of biochemical reagents for India in 1977 but changed its name (Institute of Genomics and Integrative Biology) and mission (basic scientific research) in 2002. In a somewhat analogous path, the National Centre for Cell Science (NCCS) started in 1988 as a repository and distribution centre for tissue culture cell lines (then known as the National Facility for Animal Tissue and Cell Culture) but became a broad, basic biological science institute and was rechristened with its current name in 1995.

More recently, research Institutes have seeded new Institutes. Obaid Siddiqi, who started the molecular biology unit at TIFR, Mumbai, went on to found the National Centre for Biological Sciences (NCBS) in Bangalore in 1992, which has developed into India's premier biological institute. NCBS's current institute director K. Vijay Raghavan now has been instrumental in launching a nearby Stem Cell Institute .

In recent years, the government has invested heavily in the infrastructure of its research institutes, and some of their facilities are on par with those in the US and Europe. Plants play an essential role in our lives, serving as our primary food source, a key ingredient in life-saving drugs, and filtering the air we breathe, just to name a few examples. In order to best conserve and utilize plants, we have to be able to identify them and understand how they work - which is why the research of botanists is so important.

Conclusion-

Plant science is old science which is essential to maintaining the world around us, plants feed us and also make us full about our necessities. Plants respire oxygen which is our earth's life. It also provides beauty, and medicine for our good health, it also helps to control the earth's environment condition so it is important and fundamental for all life. In the current period we are facing climate change, food security and fossil fuel like issues, plants are the best solution for all problems. By 2050 we the world population reached up to 09 billion people it will represent a tripling of world population within the average lifetime of a single human being.

Applied science is important as they enable science to be more applicable in the real life. Without it great scientific discoveries may be limited as human knowledge will increase but underutilized. Every invention, medicine and even buildings are a result of Applied Science.

So with the help of different scientific discoveries with the help of plant science we make solution upon the different major problems of human.

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52

B CHITIN AND CHITOSAN – A MINI REVIEW.

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Abstract.

Chitin is known to exist in three isomorphs α , β and γ ; this review will focus on the β isomorph and its corresponding chitosan called β chitosan which is predominantly extracted from squid and cuttlefish, some of the bio applications of chitosan which are predominantly due to its property of absorbability and adsorbability are also highlighted which could be benefitted by the use of the β isomorph.

Keywords.

α chitin, β chitin, γ chitin, chitosan, squid, cephalopod.

INTRODUCTION.

Chitin is a natural polysaccharide linear chain consisting of poly β (1–4) N-acetyl-d-glucosamine derived predominantly from the exoskeleton of crustaceans, molluscs and fungi; chitosan is a polymer that can be derived from further deacetylation of chitin. Chitin is the most abundant polysaccharide found in nature after cellulose (Abdelmalek et al., 2017).

Chitin is usually isolated from the exoskeletons of crustaceans and more particularly from shrimps and crabs where α -chitin isomorph is produced. α -Chitin has a tightly compact structure due

to its crystalline structure in which antiparallel chain favour strong hydrogen bonding. Squid is another important source of chitin in which it exists in the β -isomorph which was found to show higher solubility, higher reactivity and higher affinity toward solvents and swelling than α -chitin. These characteristics are due to weaker intermolecular hydrogen bonding ascribable to the parallel arrangement of the main chains(Hajji et al., 2014),

A third isomorph γ -chitin was isolated, however it has not been completely identified, an arrangement of two parallel and one antiparallel sheet has been proposed (Rudall, 1963). Roberts (Roberts, 1992)has suggested that γ -chitin can be a combination of α and β structures rather than as a different polymorph. α -Chitin is usually isolated from the exoskeleton of crustaceans and more particularly from shrimps and crabs. β -Chitin can be obtained from squid pens, while γ -chitin exists in fungi and yeast(Sagheer et al., 2009).

Although most data confirm the higher reactivity of β – chitin than that of the α – form(Hajji et al., 2014), α – chitin is the most abundantly synthesised form due to the fact that the starting

material for it – shrimp shells contribute a high percentage of fishery industry waste and the yield of chitin from shrimp shells is found to be higher than from other sources (Younes & Rinaudo, 2015).

β -chitin is found in association with proteins in squid pens and in the tubes synthesized by pogonophoran and vestimetiferan worms. The crystallographic parameters of the two isomorphs allow us to conclude that there are two antiparallel molecules per unit cell in α -chitin but only one in β -chitin in a parallel arrangement. In these two structures, the chains are organized in sheets and held by intra-sheet hydrogen bonds. In addition, in α -chitin, inter-sheet hydrogen bonds prevent diffusion of small molecules into the crystalline phase.

No inter-sheet hydrogen bonds are found in the crystal structure of β -chitin. This may explain its swelling in the presence of polar guest molecules (ranging from water to alcohol and amines) which penetrate the crystal lattice without disturbing the sheet organization and the crystallinity of the sample. (Younes & Rinaudo, 2015)

FEW KNOWN APPLICATIONS.

- Fining of apple juice (Abdelmalek et al., 2017).

Chitosan possesses several intrinsic characteristics that make it an effective coagulant and/or flocculant for the removal of contaminants. It has characteristics of both coagulants and flocculants, i.e., high cationic charge density, long polymer chains, bridging of aggregates and precipitation (Kumar, 2000). The object of fining a beverage is to produce a product that is near perfect in terms of aroma, taste, color and clarity. Chitosan is used in the production of fruit juices for clarification and precipitation of substances causing turbidity, and also for reducing the concentration of polyphenols such as tannins and anthocyanogens (SOTO-PERALTA et al., 1989).

- As adhesive compositions (Niaounakis, 2015).

Chitin and chitosan are known to be non-toxic and biocompatible; an adhesive composition of this can be used as an adhesive or glue during surgical procedures. (Mati-Baouche et al., 2014).

- Bone repair and tissue engineering. (Keller et al., 2017)

Scaffolds have been prepared with chitosan for bone repair, these scaffolds need to be biocompatible, have some compressive strength

and provide suitable pore size, and all of these are present in chitosan Nano composite scaffolds

“Tissue engineering is a promising tool in bone regeneration as an alternative to bone transplantation. CS scaffolds may be considered as a potential approach because of their reduced immune response, high biocompatibility and bactericidal effects.”(Keller et al., 2017).

- Removal of synthetic dyes from wastewater.(Sakkayawong et al., 2005)

Under acidic and caustic conditions chitosan was found to be able to remove synthetic dyes from wastewater, this property is due to the adsorption of the dye by the chitosan at higher temperatures.

- Fat buster.(*The Health Professional’s Guide to Popular Dietary Supplements - Allison Sarubin-Fragakis, American Dietetic Association - Google Books, n.d.*)

Chitosan cannot be hydrolysed in the human system and when ingested it is known to bind to negatively charged molecules like fat and aid in its excretion from the body, due to this property it is being marketed in capsule format as fat busters even though it is not FDA approved

DISCUSSION.

β chitin is a known isomorph of α chitin which is predominantly extracted from cephalopod sources, for example the pen (Gladius) of squid (Sagheer et al., 2009) and the cuttlebone of cuttlefish (Hackman, 1960) (Arrouze et al., 2020) (Arrouze et al., 2017).

α chitosan is generally produced and utilised in higher amounts when compared to β chitosan, which may be due to the fact that the source for α chitosan - shrimp waste is present in larger quantities than cephalopod waste which is the source for β chitosan (Davies et al., 2009), and also the fact that percentage yield of chitin is on average higher from crustaceans (14-25% α chitin) (Acosta et al., 1993) than from cephalopods (11-40% β chitin) (Arrouze et al., 2017). However the superiority of β chitosan over commercially available chitosan which is predominantly α chitosan is established (Subhapradha et al., 2013) and this trend of productions warrants a turn around.

CONCLUSION.

In the review we have discussed in brief on the applications of chitosan particularly relating to its property of absorbability and

adsorbability. It is conclusively evident from a short and quick review of literature that β chitin and chitosan is superior to its isomorph in many aspects, specifically in the ability to absorb certain molecules and swell, the authors propose the use of β chitosan in the known applications of chitosan (all isomorphs) and a possible use of the β chitosan isomorph as a high grade additive in one or more steps in the procedure of one application.

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53

COVID-2019 OUTBREAK IN INDIA- AN OVERVIEW

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Abstract

Novel corona virus causes infection associated with lungs including pneumonia, cold, sneezing and diarrhoea. Novel corona virus transmitted human to human via airborne droplets while coughing, sneezing, touching the infected person. WHO and Government of India advised to avoid public place and quarantine infected person. Large Vaccination drive has been initiated by Government of India to control pandemic spread.

Keywords; *Corona, India, pneumonia, COVID-19, Quarantine, social distancing.*

INTRODUCTION

Corona viruses (CoVs) are large family of positive sense, single stranded RNA viruses that being to the Nisovirales order. The order includes that being to the Roriviridae, Arteriviridae, Coronaviridae families. The size of virus range from 60nm to 140 nm in diameter. Corona virus in turn further classified into subtypes alpha, Beta, Gamma, Del CoVs¹. They can be isolated from bats, Camels, mice, dogs, etc.,² Corona viruses were first identified during the year 1960s in the patients with common cold.

Corona viruses were given the name based on the crown like projections on their surfaces. The Latin word “Corona” means “halo” or “crown” like projections in its surface under the electron microscope³. These viruses are reported to undergo moderate to high rate of mutation because of this type of mutation if same person may have multiple time infection. antibodies raised against one time may last for 4 months only.

Antibodies produced for one strain may be useless for other strain⁴. Over the past two decades three novel zoonotic CoVs have emerged. They include SARS COV , MERS COV and 2019-nCoV. The disease caused by 2019-nCoV is called Coronavirus disease 2019 (COVID-19)⁵. Climatic change play a vital role to cause change in viruses to adapt to change in environment. This type of natural adoption leads to emergence of new adapted viral species. Most recent one 2019nCoV.

Incubation time for this virus is found to be 3 days. Common human virus cause mild to moderate upper respiratory tract illness. These illness last for a short time. As regards the symptoms, runny nose, head ache, cough, sore throat, fever.

If the person is with weakened immune system, old and infants pneumonia Or bronchitis will be seen⁶.

TRANSMISSION

2019-nCoV is identified as the cause of out break of respiratory illness first detected in Wuhan of China in the month of December 2019⁷. Then it has spread world wide to become a pandemic with a maximum death cases in America though initially the maximum mortality was reported in China and Italy

Till now 2420360deaths and 109728045 infected people throught the world⁸.Initial reports from China reportsthat virus exposure to human was from sea food market. later sea food market was closed. Even then thereis increase in patients.

nCoV 19 appears highly transmissible from human to human.COVID-19 attracted more attention by mass news and social media than any other disease. Various measures have been directed by the World Health Organization to overcome this crisis. COVID-19 spreads to entire world in exponential phase⁹.

COVID-19 most commonly spread from infected person to others throughone of following¹⁰

The air by coughing and sneezing

Close personnel contact like shaking , touching,

Touching droplets having virus on the surface then touching your mouth, nose, or eyes before washing your hands.

MECHNISM OF ENTRY INTO CELL

nCov-19 first replicates in epithelial cells of the respiratory and enteric cells, which leads to cytopathic changes. The spike glycoprotein(s- glycoprotein) attaches the virion to the host cell membrane is postulated to play a role in host range restriction¹¹. Genomic study of this spike has been studied. Indian ones found to be modified one. So this virus is less lethal to Indians¹².

Infected patients often shows three types of diseases¹³

MILD DISEASE

Patient with mild illness may present with symptoms of an upper respiratory tract viral infection. The include dry cough, mild fever, nasal congestion, sore throat, head ache, muscle pain and malaise. It is also characterised by the absence of serious symptoms such as dyspnoea.

MODERATE DISEASE

Shortness of breath, cough, tachypnea. However no signs and symptoms of severe disease are present.

SEVERE DISEASE

Patients with severe disease exhibit severe pneumonia, Acute respiratory distress syndrome, sepsis, or septic shock, lung infiltrate will be present within 48 hours. The patient will be more complicated if diabetes, cancer, hypertension, cardiovascular disease present¹⁴.

BIOCHEMICAL FINDINGS

COVID19 patients shows elevated level of prothrombin time, LDH, CRP, ALT, & CK. Decreased level of lymphocytes have also been reported. Elevated levels of immunologic factors like Interleukin and other components of immune system. Respiratory specimens, bronchial alveolar lavage fluid, sputum or

bronchial aspirates were tested. The biochemical findings are almost similar to SARS-CoV. number of deaths rising quickly. Further detailed studies has to be done because it is a global treat. Reliable quick pathogen detection methods and feasible differential diagnosis for confirmation to give better treatment¹⁵.

ISOLATION OF ILL & QUARANTINE OF ILL

Confirmed cases of COVID19 are medically isolated in hospitals and their close contacts are being Carefully traced and quarantined at home. Quarantine of asymptomatic person should also be done. Prevention is better than cure. Staying home while at risk is better.

Avoiding close contact with others is recommended. Social distancing is most recommended. Cover mouth nose with tissue when you cough or sneeze, then throw it in trash and wash your hands. Most important thing for health care persons must use N95 masks, FFP3 masks, gowns, eye protection, gloves.

வருமுன்னர்க்காவாதான்வாழ்க்கைஎரிமுன்னர்
வைத்தாறுபோலக்கெடும்.

Thirukkural 0435

The meaning of above thirukkural is the prosperity of him who does not timely guard against faults, will perish like straw before fire¹⁵. So we should take care of our health by protecting from virus. Combination of anti viral drugs and pain killers are recommended. Nutritional supplements can be given. In critically ill patients ECMO

is preferred¹⁶. The drug regulatory committee of India has granted emergency use authorisation to use covaxine in clinical trial mode.

The vaccine is killed virus and mounts an antibody response. This process leaves the viral proteins, including the spike protein of the coronavirus which it uses to enter the human cells, intact. Given as two doses, three weeks apart, the viral proteins in the vaccine activate the immune system and prepare people for future infections with the actual infectious virus, the drugmaker stated.

"BBV152 led to tolerable safety outcomes and enhanced immune responses. The vaccine was well tolerated in all dose groups with no vaccine-related serious adverse events," the authors of *the Lancet* study said.

During the phase II trial, Covaxin has been tested in 11 hospitals across the country. Volunteers between the ages of 18 and 55 with no co-morbidity conditions have participated in the trial. The vaccine trial took place in Hyderabad, Rohtak, Patna, Kancheepuram, Delhi, Goa, Bhubaneswar and Lucknow among other places. Two intramuscular doses of vaccines were administered

14 days apart. The most common adverse event was pain at the injection site, followed by headache, fatigue, and fever.

CONCLUSION

COVID-19 is spreading exponentially throughout the world with mutation. This has challenged medical, economic, public health infrastructure globally. WHO and Government of India is taking various measures to control the disease spread. Early detection and isolation, contact tracing, and use of personal protective equipment's can stop this disease. As per WHO guidelines avoid the contact with sick person and also avoid the market or public place as possible. There is no anti corona virus vaccine to prevent or treatment. But some supporting therapy work. Future research needed to fight with COVID-19. Till only "Distance is rescue". Public should follow the rules and regulations instructed by Government of India during quarantine period to combat disease.

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54

A REVIEW ON PRODUCTION OF ECO ENZYME AND ITS APPLICATIONS

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ABSTRACT

Food has always been the major source of energy for all living organisms in and around the world. In the fast growing era, there is an urge to produce huge tons of food commodities in order to quantify the needs of increasing population. Due to increased population and food production, waste generation has reached its peak. Wastes generated are classified into many categories into many types, among which municipal solid waste hold a larger proportion. Municipal solid waste comprises compostable organic matter, recyclables, toxic substances and soiled wastes. The organic municipal solid wastes emit huge amount of greenhouse gases when dumped in landfills. In order to reduce such emissions these wastes can be fermented to produce a multipurpose bio enzyme called garbage enzyme. Hence this review is an overview of production of garbage enzyme and its applications.

Keywords: Municipal solid waste, greenhouse gas, garbage enzyme.

1. INTRODUCTION

Vegetables and fruits are the most consumed merchandises among stall agricultural crops. They are used up uncooked, slightly

treated, as well as processed, because of the nutritional value and health-promoting composites. The waste generally comprises of kernel, peel, husk, and pomace, holding worthy sources ofcherishablebioactive complexes, for example polyphenols, carotenoids, vitamins, fibres etc. Inthe emerging world, vast volume of fruit along with vegetable solid waste are spawned mostly as a result of greater production, dearth of proper conservation and carriage (Mahmood*etal.*, 1998).

The food centered organic waste holds a major role in the increase of municipal solid waste. The food centered organic waste holds a major role in the increase of municipal solid waste. Municipal solid waste comprises compostable organic matter, recyclables, toxic substances and soiled wastes.

The organic municipal solid wastes emit an enormous amount of greenhouse gases when dumped in landfills. Organic Solid Waste possess an enormous amount of organic substance which eventually decomposes to release carbon dioxide and methane, and causes a serious environmental pollution and health issues to living beings (Khalid *et al.*, 2011).

Organic wastes dumped in landfill release harmful gases affecting the well-being of people residing nearby the landfill. As a result of dumping, organic waste undergo anaerobic degradation producing methane, a green house gas which has the ability to trace hotness 30 times more than carbon dioxide.

From an ecological perception, there is a critical want to improve suitable waste management technology for the consumption of organic wastes in addition to diminish problems (Antoet *al.*, 2006, Neves *etal.*, 2008,DhanalakshmiandAlwar,2012). In recent researches, a mixture of rudimentary hydrolytic enzymes are been developed by fermentation process which appears to be noble and efficient compared to commercially available products (Enu*etal.*,2006,Wei*etal*2015).

Researchers recommended that if the activity of the fermented bio-enzyme activity is better, it can be used straightly without undergoing retrieval procedure in a possible andcost-effectiveway(Parawira,2012,Leung2012,Kiran2014).

The value added products such as biofuels and biochemicals can produced from nutrient rich complex sources of organic wastes

by fermentation method due to its higher chemical convolution, degradability and moisture content. (Kiran *et al.*, 2014). In 2006, Dr. Rosukon from Thailand formulated a solution by simple low-cost method for many domestic and hospital cleaning purposes and termed as garbage enzyme or eco-enzyme. This review of literature pertains to the production of garbage enzyme and its applications.

2. SCENARIO OF LAND POLLUTION DUE TO ORGANIC WASTES

Environment pollution is a wide-affecting issue and it is possible to effect the well being of human race in vast. The perception about the adverse effects of air, water and land/soil pollution on living organisms in the form of various diseases is very low (Khan, M.A. and Ghouri, A.M., 2011). Municipal solid waste is a substantial benefactor to green house gas discharges over putrefaction and degradation processes.

The bulk of these emanations are a consequence of landfills, which remains as the principal unwanted dumping tactic globally. As a product, nations have been including substitute procedures of waste administration policies such as energy retrieval from landfills, aerolandfills, landfill covering and pre-fertilizing of

the biological parts of municipal solid waste. The altering weather has been one of the foremost ecological dares confronted by the world currently. There is a cumulative requirement to realize the influence of waste administration on green house gas releases. Green house gas productions from waste decay are significantly complex for landfill than fertilizing.

Though, varied fall outs were noticed for green house gas discharges from landfill and compost functioning activities. Nevertheless, in overall, remaining greenhouse gas emissions for landfills likely to be greater than that for composting amenities (Lou, X.F. and Nair, J., 2009).

The usage and its linked discarding of tenacious organic toxins (POPs) have been happening for above 50 years. Simultaneous with the phase-out of several of the most dangerous substances, the production of new POPs, such as fluorinated and brominated compounds has augmented then the 1990s. These mixtures are normally implied in an extensive variety of user possessions, and as customer yields influence the end of their worthwhile lives, eventually go in excess.

2. PRODUCTION OF ECO-ENZYME FROM ORGANIC WASTES

Ecoenzyme is an organic solution produced by the simple fermentation of fresh vegetable waste, brown sugar and water, in much the same process that wine is made Fig.1 This fermentation makes usual chains of proteins, mineral salts and enzymes. This solution has the capacity to breakdown, change, create and catalyze functions that make it a wonderful cleaning aid. Garbage enzyme solution was developed by Dr. Rosukon from Thailand. She has been vigorously involved in enzyme research for more than 30 years and inspires people to make garbage enzyme at home to ease global warming (Arun, C. and Sivashanmugam, P., 2015).

Eco-enzyme is a biological solution produced by the simple fermentation of fresh vegetable wastes, fruit wastes with accumulation of brown sugar and water. The fermentation makes natural chains of proteins, mineral salts, organic acids, alcohol and enzymes. The fermented solution has the capacity to breakdown, change, create and catalyze the functions that make it a great cleaning agent in domestic as well as in industrial and medical applications

Ecoenzyme serves as a suitable alternate to the artificial cleaning solution with concern to biodegradability, low harmfulness, non-corrosiveness, environment-sociability, improved cleaning possessions as well as increased competence and steadiness indifferent environmental conditions are obligatory to develop.

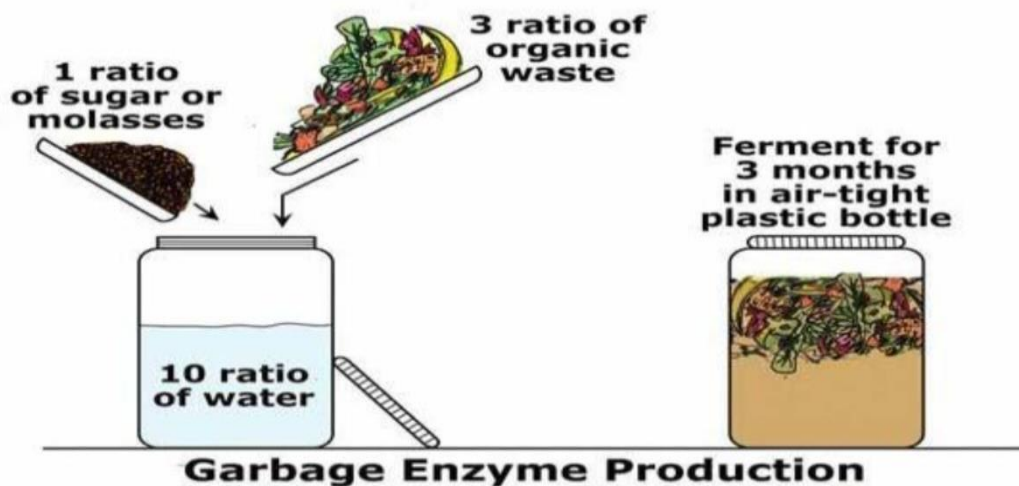


Fig 1. Preparation of eco enzyme

3. APPLICATIONS OF ECO-ENZYME

The advantages of using enzyme bio-cleaning solution are given below:

- ❖ It is harmless for the environment and safer for human health than chemical cleansers and fragrance control merchandises.

- ❖ It is an extremely specialized enzyme producing microbes to sanitize and regulatescents by eradicating the soils promptly.
- ❖ It is economically inexpensive and the cost of production is less.
- ❖ These Bio-cleaning solutions deliver remaining housework for longer period and gives stable application.
- ❖ This Enzyme Bio-cleaning solution help to transfer unknown, possibly pathogenic (disease causing) bacteria with known, healthy microbes and in this way it promotes better human health (Fig.2)



Fig. 2 Applications of eco-enzyme

3.1 ANTIMICROBIAL AGENT

The antimicrobial activity was carried out by agar well diffusion technique against five bacteria and three fungi. The citrus peel extracts exhibited maximum zone of inhibition against microbes, equated with the control Chloramphenicol and Griseofulvin. Citrus peel extract exposed decent antimicrobial activity indicating its strength as a hopeful basis of natural antimicrobials. As microorganism are becoming resilient to current day antibiotics (Arun and Sivashanmugam, 2015).

3.2. ECO ENZYME AS A CLEANING AGENT

Parkaret *al.* (2004) indicated that the cleaning approaches verified were based on biofilm biochemistry and composition, and fixated on the chemistry of the cleaners, the period and temperature of the cleaning course and a mixture of numerous cleaners. The success of the cleaning systems was strong grounded on the elimination of cells and biological remains and the elimination of feasible cells.

The results long-established that a corrosive and acid (75_C for 30 min) wash, depends upon deeply in most food dispensation

industries for cleaning-in-place schemes and were fruitful in eliminating these biofilms.

Jegannathan *et al.*, (2013) detailed that the enzymatic procedures have been applied in a comprehensive range of productions in recent periodssince they are exact, debauched in action and often some raw materials of energy, chemical slander water associated to conservative processes. A number of proportional ecological valuation studies have been led in the previous 15 years to examine whether these possessions of enzymatic procedures lead to environmental developments and measure whether they could show a role in moving toward domestic industrial invention.

Enzymes have efficiently aided the growth and enhancement of current household and industrial cleaners. The main categories of cleaning enzymes such as cellulases, lipases, proteases, amylases, and cellulases each provide exact assistances for application in laundry and instinctive dishwashing. Generally, proteases remained first to be used widely in washing cleaners.

In addition to raising the level of cleaning, they have also provided environmental benefits by reducing energy consumption

over shorter laundry times, lower washing temperatures, and abridged water ingestion. Now proteases are combined by lipases and amylases in refining cleaner ability principally for household washing at lesser temperatures and in industrial cleaning procedures, at lower pH levels..

3.3 TREATMENT OF WASTE WATER

Eco-enzyme can be employed as an efficient alternative in order to enhance wastewater treatment procedures by eliminating the filths and bacteria (Khairul and Shamila 2012, BhavaniPrakash 2013, Nazim and Meera 2013). This enzyme is a multi faceted biological material of protein chains, organic acids and mineral salts formed by fermentation of waste fruits, vegetables or its peels, brown sugar and water. The eco-enzyme purposes equally to enzymes in attaining a high grade of deprivation in a shorter time period. In garbage enzyme, brown sugar is used often as a substrate in fermentation methods (Baeet *al.*, 2004).

The invention of eco enzyme with advanced action of protease, lipase and amylase is desirable to provide for action of higher quantity of manufacturing waste triggered sludge produced.

This requires the enhancing of various limits to improve the action of rough enzyme combinations to decrease their cost and cost of use (Saravanan *et al.*, 2012).

The exponents of the eco-enzyme defines it as a compound organic matters of mineral salts, protein chains, hormones and also claim that it functions to fester, alter as well as induce reactions. It is also demanded that the eco enzyme functions contrarily in diverse concentrations (Arun *et al.*, 2015).

3.4 SYNERGISTIC ACTIVITY

The eco-enzyme exhibits solid synergistic action towards injurious microorganisms. The antiseptic possessions in eco-enzyme are due to the ethanolic content. Ethanol and acetic acid are formed by the breakdown procedure of bacteria that clearly exist on fruit or vegetable scrapings. Fermentation is endured by the bacteria to obtain energy from carbohydrate in an anaerobic condition and with ethanol or acetic acid as the derivative. Yeast and bacteria produce ethanol through fermentation, though most bacteria produce acetic acid. The fermentation method is a result of enzyme actions of the microbes and has an antiseptic stuff (Rahna *et al.*, 2011).

3.5 FEED FOR FISHES

Even with the rise in manufacture of fish nourishments, the absence of proficient, economical and obtainable feedstuff in the arcade rests as a severe issue in the husbandry of aquatic creatures. Furthermore, there are perils of contamination of these feedstuffs if they are not well conserved. The need for decent quality feed ingredients with better-quality, nourishing cost, commercial feasibility and rising mindfulness of the environment has led to an increase in the use of external enzymes in the regime of fish and shrimp in recent years.

Enzymes are produced during the development of microbes (trophophase), as a result of oxidative breakdown and fermentation. This enzyme has been derived to make cleaning solution at home easily which may help to minimize global warming by utilizing biodegradable kitchen wastes(Rengeet *al.*,2012).

Eco-enzymes are also used to sterilize water on farms, as food additions to animals and to decrease scents from farms. International aqua feed (2012) reports that eco enzymes have the capacity to steady the soil biological matter and can be efficiently used to safeguard the

class of soil and rural circumstances of aquatic species. The combination that covers the change of enzymes can be real worth for bioremediation in aquaculture.

3.6 MULTIPLE PURPOSES

The efficacy of eco-enzyme is significant to accomplish waste in composting also diminish pest trouble (Saravan *et al.*, 2013) Eco-enzyme is natural, safe, and decent for the surroundings and use the mystic of nature to yield strange elimination of grime, lubricant, tint etc. caused to purchaser satisfaction. (Chowdhury, 2014).

Eco-enzymes are used in many zones for their valuable stuffs with the air, rural, livestock, people and aquaculture. In the path of production of eco-enzymes, catalase process releases ozone (O_3), which approves the CO_2 reduction in the air and it can trap dense metals in the mist groups while plummeting the consequence of global warming. At one go, nitrate (NO_3) and carbonate (CO_3) are produced to advance soil lushness and natural florae. Also, they are used to cleanse the surroundings. Enzymes confined in the solution counter act pollutants and other impurities from rivers, muds and atmospheres (Triassi, *et al.*, 2015).

4. CONCLUSION

Thus the aim of the present review work is to explore the possibility of eco-enzyme in order to implement in all walks of life to achieve Go Green vision for waste disposal around the world and to provide a quality environment from pollution.

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Chapter-LV

55

CANCER THERAPY

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Abstract:

Cancer is a group of diseases that involve abnormal cell growth with the potential to invade or spread to other parts of the body. Cancer is the second leading cause of death in the world. The majority of cancers, some 90–95% of cases, are due to genetic mutations due to environmental and lifestyle factors. The remaining 5–10 per cent is due to genetics. Environmental refers to any cause which is not inherited, such as lifestyle, economic and behavioral factors. Symptoms include difficulty in swallowing, hoarseness, pain, etc. Effective diagnostic testing is used to confirm or eliminate the presence of disease, monitor the disease process, and plan and evaluate the efficacy of treatment. The cancer diagnosis and treatment plan is a key component of any overall cancer control plan. Its main goal is to cure or prolong cancer patients' lives considerably, ensuring a good quality of life.

Keywords: Cancer, Biopsy, Chemotherapy, Radiation therapy, Surgery.

Introduction:

Cancer is a group of diseases that involve abnormal cell growth

with the potential to invade or spread to other parts of the body. Cancer is the second leading cause of death in the world. Cancer cells differ in many ways from normal cells that allow them to grow out of control and become invasive. An important difference is that cancer cells are less specialized than normal cells. Cancer cells can induce nearby normal cells to form blood vessels that supply oxygen and nutrients to tumors that need to grow. These blood vessels also remove tumor waste products. Cancer cells are able to ignore signals that normally tell cells to stop dividing or initiate a process known as programmed cell death, or apoptosis that the body uses to get rid of unneeded cells. Cancer cells are also often able to evade the immune system, the network of organs, tissues, and specialized cells that protect the body from infections and other conditions.

Causes of cancer:

The majority of cancers, about 90–95% of cases, are due to genetic variations due to environmental and lifestyle causes. The remaining 5–10 per cent is due to genetics. Common environmental causes that lead to cancer death include smoking (25–30 per cent), diet and obesity (30–35 per cent), diseases (15–20 per cent), radiation

(both ionizing and non-ionizing), lack of physical exercise, and emissions.

Cancer Caused by environmental factors:

- ★ Asbestos fibers
- ★ Tar and pitch
- ★ Polynuclear hydrocarbons (e.g. benzopyrene)etc.,

Cancer caused by Lifestyle-related factors:

- ★ Tobacco
- ★ Alcohol
- ★ Some food-related factors, such as nitrites and poly aromatic hydrocarbons generated by barbecuing food. etc.,

Cancer caused by Bacteria and viruses:

- ★ Helicobacter pylori (H. pylori, which causes gastritis)
- ★ HBV, HCV (hepatitis viruses that cause hepatitis)
- ★ HPV (human papilloma virus, papilloma virus, which causes changes eg. Cervical cells) etc.,

Cancer caused by Radiation:

- ★ Ionising radiation (e.g. X-ray radiation, soil radon)

- ★ Non-ionised radiation (the sun's ultraviolet radiation)

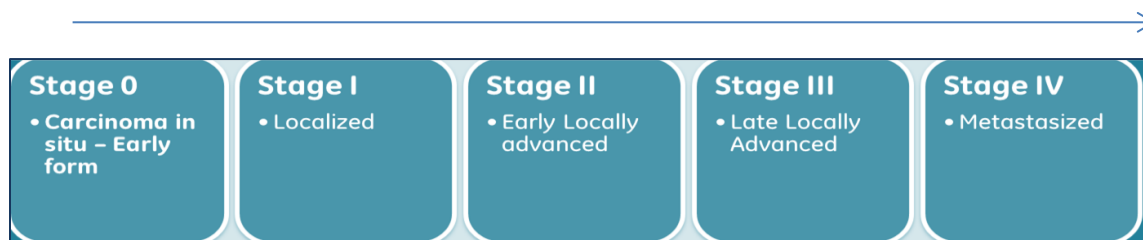
Drugs that may increase the risk of cancer:

- ★ certain antineoplastic agents
- ★ certain hormones etc.,

Roman numeral Staging of Cancer:

This system uses numerals I, II, III, and IV (plus the 0) to describe the progression of cancer.

- ★ **Stage 0**- [Carcinoma in situ](#), abnormal cells growing in their normal place ("in situ" from Latin for "in its place").
- ★ **Stage I** - Cancers are localized to one part of the body. Stage I cancer can be surgically removed if small enough.



- ★ **Stage II** - cancers are locally advanced. Stage II cancer can be treated by chemotherapy, radiation, or surgery.
- ★ **Stage III** - Cancers are also locally advanced. Whether a cancer is designated as Stage II or Stage III can depend on the specific type of

cancer. Stage III can be treated by chemotherapy, radiation, or surgery.

- ★ **Stage IV**- Cancers have often metastasized, or spread to other organs or throughout the body. Stage IV cancer can be treated by chemotherapy, radiation, or surgery. Despite treatment, a patient's mortality rate can be significantly higher with Stage IV cancer, e.g., the cancer can progress to become terminal.

Symptoms of Cancer:

Signs and signs caused by cancer can differ based on which portion of the body is affected. Many of the general signs and symptoms associated with, but not unique to, cancer include:

- ★ Fatigue
- ★ Lump or area of thickening that can be felt under the skin
- ★ Weight changes, including unintended loss or gain
- ★ Skin changes, such as yellowing, darkening or redness of the skin, sores that won't heal, or changes to existing moles
- ★ Changes in bowel or bladder habits
- ★ Persistent cough or trouble breathing
- ★ Difficulty swallowing

- ★ Hoarseness
- ★ Pain
- ★ Anemia etc.,

Diagnosis of Cancer:

Efficient diagnostic testing is used to confirm or exclude the occurrence of disease, control the disease process, and schedule and assess the feasibility of treatment. Cancer screening techniques can include imaging, laboratory tests (including tumor marker tests), tumor biopsy, endoscopic examination, surgery, or genetic testing.

- ★ **Medical test**-During a physical exam, he or she may check for irregularities, such as changes in the Colour of the skin or enlargement of the organ, which may signify the presence of cancer.
- ★ **Laboratory tests**-Labor tests, such as urine and blood tests, can help your doctor detect anomalies that may be caused by cancer. For example, in people with leukemia, a normal blood test called a Complete blood count can show an unusual number or form of white blood cells.
- ★ **Imaging Tests**-The imaging tests used to detect cancer can include computerized tomography (CT) scan, bone scan, magnetic resonance

imaging (MRI), positron emission tomography (PET) scan, ultrasound and x-ray scan.

- ★ **Biopsy**-Cancer is confirmed by the acquisition of a portion of the tumor by needle biopsy or surgery and the identification of cancer cells by microscopic analysis of samples from the suspected region. Typically, the sample must be a slice of tissue, but often the blood test is sufficient (such as in leukemia). Having a tissue sample is referred to as a biopsy. In most cases, biopsy is the best way to detect cancer definitively.
- ★ **Tumor markers**-When screening or imaging findings indicate cancer, testing the blood levels of tumor markers (substances secreted into the bloodstream by some tumors) may provide further evidence for or against the diagnosis of cancer. Some tumor markers cannot be determined in the blood, so they can be detected in tumor cells instead. These markers are identified by a biopsy sample analysis of the tissue. HER2 and EGFR are examples of tumor markers present in tumor cells.

Some Tumor Markers*

Tumor Marker	Description	Comment About Testing
Alpha-fetoprotein (AFP)	Elevated AFP levels often are found in the blood of people with liver cancer (hepatocellular carcinoma). In addition, elevated AFP is often found in people with certain cancers of the ovary or testis.	Testing can be useful in monitoring treatment and perhaps for diagnosis of cancer in a person with cirrhosis (liver damage due to alcohol or viral hepatitis).
Beta-human chorionic gonadotropin (β -HCG)	This hormone is produced during pregnancy but also occurs in women who have a cancer originating in the placenta and in men with testicular cancer.	Testing can be useful in diagnosing such cancers and in monitoring treatment.
Beta ₂ (β_2)-microglobulin	Levels may be elevated in people with multiple myeloma and some lymphomas.	This test is not recommended for cancer screening.
Calcitonin	Calcitonin is produced by certain cells in the thyroid gland (C cells). Blood levels are elevated in medullary thyroid cancer.	This test may be used to detect the presence of cancer and monitor response to treatment of medullary thyroid cancer.

Treatment of Cancer:

There are many types of cancer treatment in place. The kinds of treatment you undergo will depend on the type of cancer you have and how severe it is. It includes,

- ★ Surgery
- ★ Radiation Therapy
- ★ Chemotherapy
- ★ Immunotherapy to Treat Cancer

- ★ Targeted Therapy
- ★ Hormone Therapy
- ★ Stem Cell Transplant
- ★ Precision Medicine.

Surgery:

Surgery, when used to treat cancer, is a procedure in which a surgeon removes cancer from the body. Surgery removes cancer that is present in one area. Surgery removes some, but not all, cancer tumors. Debulking is used to remove the entire tumor that could damage the organ or body. Removing part of the tumor may help other treatments to work better.

Depending on your type of cancer and how advanced the surgery is, you can use it to:

- ★ **Remove the entire tumor**-Surgery removes cancer in one area.
- ★ **Debulk a tumor**-Surgery removes some, but not all, cancer tumors. Debulking is used to remove the entire tumor that could damage the organ or body. Removing part of the tumor may help other treatments to work better.

- ★ **Ease Cancer Symptoms**-Surgery is used to remove tumors that cause pain or pressure.

Risks of Surgery:

Surgeons are highly trained and will do their utmost to prevent problems during surgery. Even so, there are problems sometimes. Common problems are,

- ★ **Pain:**After surgery, most people will have pain in the part of the body that has been operated on.
- ★ **Infection:**Infection is another problem that may occur after surgery. Other risks of surgery include bleeding, tissue damage and anesthesia reactions.

Radiation therapy:

Radiation therapy (also called radiotherapy) is a cancer treatment that uses high doses of radiation to kill cancer cells and reduce tumors. Radiation therapy is a type of cancer treatment that uses intense energy beams to kill cancer cells. Radiation therapy most often uses X-rays, but protons or other types of energy can also be used. Radiation therapy kills cancer cells at high doses or slows their growth by damaging their DNA. Cancer cells whose DNA is damaged

beyond repair stop dividing or dying.

Types of Cancer that Are Treated with Radiation Therapy:

External beam radiation therapy-is used to treat many types of cancers. **Brachytherapy**-is most commonly used to treat head and neck, breast, cervix, prostate, and eye cancers.

Systemic radiation therapy, called radioactive iodine, or I-131, is most commonly used to treat certain types of thyroid cancer. Another type of systemic radiation therapy, called targeted radionuclide therapy, is used to treat some patients with advanced prostate cancer or gastroenteropancreatic neuroendocrine tumors (GEP-NET). This type of therapy may also be referred to as molecular radiotherapy.

Side Effects:

Radiation not only kills or slows the growth of cancer cells, it can also affect healthy cells in the vicinity. Damage to healthy cells can cause side effects as indicated below.

- ★ Fatigue
- ★ Hair loss&Skin changes
- ★ Nausea and vomiting

- ★ Headache etc.,

Chemotherapy:

Chemotherapy is a drug treatment that uses powerful chemicals to kill rapidly growing cells in your body. Chemotherapy is most often used to treat cancer, as cancer cells grow and multiply much faster than most cells in the body. There are a number of settings in which chemotherapy may be used in people with cancer:

- ★ To cure Cancer without any other treatments. Chemotherapy may be used as the primary or sole treatment for cancer.
- ★ After other treatments, to kill hidden cancer cells. Chemotherapy may be used after other treatments, such as surgery, to kill any cancer cells that may remain in the body. Doctors are calling this adjuvant therapy.
- ★ To prepare for other treatments. Chemotherapy may be used to reduce the tumor so that other treatments, such as radiation and surgery, are possible. Doctors are calling this neoadjuvant therapy.
- ★ To relieve signs and symptoms. Chemotherapy may help to relieve signs and symptoms of cancer by killing some of the cancer cells. Doctors call it palliative chemotherapy.

Administration of Chemotherapeutic drugs into the body:

Chemotherapy drugs can be administered in a variety of ways, including:

- ★ **Chemotherapy infusions**-Chemotherapy is most often given as an infusion into a vein (intravenously). The drugs can be given by inserting a tube with a needle into a vein in your arm or into a device in a vein in your chest.
- ★ **Chemotherapy pills** - Some chemotherapy drugs can be taken in pill or capsule form.
- ★ **Chemotherapy shots** - Chemotherapy drugs can be injected with a needle, just as you would receive a shot.
- ★ **Chemotherapy creams** - Creams or gels containing chemotherapy drugs can be applied to the skin to treat certain types of skin cancer.
- ★ Chemotherapy drugs used to treat one area of the body. Chemotherapy drugs, for example, can be given directly in the abdomen (intraperitoneal chemotherapy), the chest cavity (intrapleural chemotherapy) or the central nervous system (intrathecal chemotherapy). Chemotherapy may also be given to the bladder through the urethra (intravesical chemotherapy).

★ Appropriate Chemotherapy given directly to cancer. Chemotherapy may be given directly to the cancer or, after surgery, to the cancer. For example, thin disk-shaped wafers containing chemotherapy drugs may be placed near a tumor during surgery. Over time, the wafers break down, releasing chemotherapy drugs. Chemotherapy drugs may also be injected into a vein or artery that feeds the tumor directly.

Chemotherapy in combination with other therapies:

Sometimes it treats cancer on its own, but more often it is used in combination with cancer.

- ★ Surgery
- ★ Radiation therapy
- ★ Biological therapy.

Side effects:

- ★ Nausea
- ★ Vomiting
- ★ Diarrhea
- ★ Hair loss
- ★ Loss of appetite etc.

Many of these side effects may be prevented or treated. Most of the side effects go down after the end of treatment.

Immunotherapy to cancer:

Immunotherapy is a type of cancer therapy that helps your immune system fight cancer. The immune system helps your body fight infection and other diseases. It is made up of white blood cells and lymph system organs and tissues.

Immunotherapy is a type of biotherapy. Biological therapy is a type of therapy that uses substances made from living organisms to treat cancer.

Immunotherapy working against cancer:

Immunotherapy can be performed in a few ways:

- ★ Stimulate or enhance the natural defenses of your immune system so that it works harder or smarter to find and attack cancer cells.
- ★ Making substances in a lab that are just like components of the immune system and using them to help restore or improve how your immune system works to detect and attack cancer cells
- ★ As part of its normal function, the immune system detects and destroys abnormal cells and most likely prevents or inhibits the

growth of many cancers. For example, immune cells are sometimes found in and around tumors. These cells, called tumor-infiltration lymphocytes or TILs, are a sign that the immune system responds to the tumor. People whose tumors contain TILs often do better than people whose tumors do not contain TILs.

Side effects:

- ★ Anemia
- ★ Appetite Loss
- ★ Bleeding and Bruising (Thrombocytopenia)
- ★ Constipation
- ★ Diarrhea
- ★ Edema (Swelling)

Targeted therapy:

Targeted therapy is a cancer treatment that uses drugs to target specific genes and proteins that contribute to the growth and survival of cancer cells. Targeted therapy can affect the tissue environment that helps cancer grow and survive, or can target cancer-related cells, such as blood cells.

Types of targeted therapy:

Most targeted therapies are either small-molecule drugs or monoclonal antibodies.

Small molecular drugs are small enough to easily enter cells, so they are used for targets inside cells.

Monoclonal antibodies, also known as therapeutic antibodies, are proteins produced in the laboratory. These proteins are designed to be attached to specific targets for cancer cells. Some monoclonal antibodies mark cancer cells so that they are better seen and destroyed by the immune system. Other monoclonal antibodies directly stop the growth or self-destruction of cancer cells.

Targeted therapy work against cancer:

Most types of targeted therapy help treat cancer by affecting specific proteins that help tumors grow and spread throughout the body. They're treating cancer in many ways. They could;

- ★ **Help the immune system to destroy cancer cells.** One reason cancer cells thrive is because they can hide from your immune system. Certain targeted therapies can mark cancer cells, making it easier for the immune system to detect and destroy them. Other

targeted therapies will help boost your immune system to work better against cancer.

★ **Stop cancer cells from growing.** Healthy cells in the body usually divide to form new cells only when they receive strong signals to do so. These signals bind to proteins on the surface of the cells, telling the cells to divide. This process helps the new cells to form just as your body needs them. But some cancer cells have protein changes on their surface that tell them to divide whether or not signals are present. Some of the targeted therapies interfere with these proteins, preventing them from telling the cells to divide. This process helps to slow the uncontrolled growth of cancer.

★ **Stop signals that help form** blood vessels. Tumors need to form new blood vessels in order to grow beyond a certain size. In a process called angiogenesis, these new blood vessels are formed in response to tumor signals. Some targeted therapies called angiogenesis inhibitors are designed to interfere with these signals in order to prevent the formation of a blood supply. Without a blood supply, the tumors remain small. Or, if the tumor already has a blood supply,

these treatments may cause the blood vessels to die, which causes the tumor to shrink.

Side effects:

- ★ Diarrhea and liver problems.
- ★ High blood pressure,
- ★ Fatigue,
- ★ Mouth sores,
- ★ Nail changes,etc.,

Hormone Therapy:

Hormone therapy is a cancer therapy that slows or stops the growth of cancer that uses hormones to grow. Hormone therapy is also called hormonal therapy, hormonal therapy, or endocrine therapy.

Hormone therapy is used to:

- ★ **To treat of cancer.** Hormone therapy may reduce the chance that cancer will return or stop or slow its growth.

★ **Ease the symptoms of cancer.** Hormone therapy may be used to reduce or prevent symptoms in men with prostate cancer who are unable to perform surgery or undergo radiation therapy.

Side effects:

Because hormone therapy blocks the ability of the body to produce hormones, it can cause unwanted side effects. The side effects will depend on the type of hormone therapy and how the body responds to it. Some side effects are also different if you're a man or a woman.

Some common side effects for men who receive hormone therapy for prostate cancer include:

- ★ Hot flashes
- ★ Weakened bones
- ★ Diarrhea
- ★ Nausea

Some common side effects for women who receive hormone therapy for breast cancer include:

- ★ Hot flashes
- ★ Vaginal dryness

- ★ Changes in your periods if you have not yet reached menopause

Stem Cell Transplant:

Stem cell transplant is a procedure for restoring blood-forming stem cells in people who have been destroyed by very high doses of chemotherapy or radiation therapy used to treat certain cancers. Blood-forming stem cells are important because they become different types of blood cells. The main types of blood cells are the following:

- ★ White blood cells that are part of your immune system and help your body fight infection
- ★ Red blood cells that carry oxygen throughout your body
- ★ Platelets, which help the blood clot.

Stem Cell Transplants Work against Cancer:

Stem cell transplants do not usually work directly against cancer. Instead, they help you restore your ability to produce stem cells after treatment with very high doses of radiation therapy, chemotherapy, or both.

However, in the case of multiple myeloma and some types of leukemia, a stem cell transplant may work directly against cancer.

This happens because of an effect called graft-versus-tumor that can occur after allogeneic transplantation. Graft-versus-tumor occurs when white blood cells from your donor (the graft) attack any cancer cells that remain in your body (the tumor) after high-dose treatment.

Side effects:

- ★ Infection and Neutropenia
- ★ Lymphedema
- ★ Memory or Concentration Problems
- ★ Mouth and Throat Problems etc.,

Precision Medicine:

Precision medicine is a patient care approach that allows physicians to choose treatments that are most likely to help patients with a genetic understanding of their disease. This may also be referred to as personalized medicine that helps your doctor find unique disease risks and treatments that will work best.

Side effects:

Side effects depend on the targeted therapy drug a patient is taking.

Common side effects include

- ★ Skin problems, including hives and intense itching.

- ★ Allergic-like reactions, including trouble breathing, tightness in the chest or throat, dizziness and swelling in the lips or tongue.

Conclusion:

The goal of cancer therapy is to develop safe and effective methods for preventing, detecting, diagnosing, treating and ultimately curing the collection of diseases we call cancer. Research has helped us learn extensively about the biological processes involved in the onset, growth and spread of cancer in the body. These findings have led to more effective and targeted treatment and prevention strategies. Breakthroughs in prevention, early detection, screening, diagnosis and treatment are often the result of research and discovery by scientists across a wide range of disciplines over decades and generations.

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56

MACHINE LEARNING AND THE BUSINESS OF CYBER SECURITY

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ABSTRACT

Considering that the volume of emails worldwide is 269 billion messages per day and that 49.7% of it is spam which includes emails from fraudsters. These cyber criminals have the intention to “phish” for personal sensitive information from their victims or infect their computers with viruses or malicious contents for illegal financial gains. This article therefore explains the different ways these online scams are perpetuated and presents several investigations and counter attack strategy proposals by machine learning experts to tackle the issue of spam filtering. This paper reports different research designs and solutions proposed with the use of machine learning algorithms, ranging from techniques that are based on text categorization to strategies that examines email content with attached images. The effectiveness and efficiency of these machine learning tools were discovered and discussed. In conclusion, further research on spam filtering tools based on machine learning algorithms was encouraged as cyber criminals are continuously innovating new methods that threaten and abuse these systems in their bid to avoid spam filters.

Keywords: Spam filtering, machine learning, algorithms, cyber criminals

1. INTRODUCTION

The internet started in the 1960s as a way for government researchers to share information. This eventually led to the formation of the APRANET (Advanced Research Project Agency Network). The APRANET network evolved into what we know as the internet. As computers have become more popular and universal, their security has become a major concern. Fraudsters and online criminals are finding ways to exploit the digital trend by perpetuating scams that has continued to break through security systems. The more people use their computers and the internet for online transactions, they become more attractive to these fraudsters who use emails, websites, chatrooms and social networks to get to their personal information. Attacks have been more ubiquitous and diverse and Africans are in the center of it all.

These attacks include unsolicited emails that deceive internet users into providing personal information or infect their computers with virus that can erase data and shut down the computer system.

Africa has had the highest online fraud rate in recent years compared to other continents. According to research by Iovation Inc., a United States based company, Africa generated 7% of online fraud activities with most coming from Nigeria and Ghana in 2012. It analyzed billions of online transactions processed through its

Reputation Manager 360 device and fraud prevention service and their results showed that Africa had the highest fraudulent activities as opposed to 5% generated from Asia, 4% from South America, 2% from Europe and 1% from North America. This paper focuses on fraud that is perpetuated via spam email services, the different methods these fraudulent acts are committed with emphasis on the African continent and the solution proffered by artificial intelligence through machine learning.

2. INTERNET FRAUD

Any application fraud committed with the help of the internet is called internet fraud. Online services are used to conduct fraudulent solicitations and transactions with the proceeds transmitted to financial institutions. With the help of online services, a perpetrator of fraud can commit debit card fraud without even having the

possession of a debit card. The report from Iovation Inc's 2012 research stated that majority of fraudulent transaction from Africa targeted online dating and retail websites. The continents top offence includes credit card fraud, identity theft and online scam and solicitations.

As stated on the Federal Bureau of Statistics (FBI) website, there are several high profile methods in which fraud is committed via emails and they include: email account compromise (EAC), business email compromise (BEC), phishing/spoofing malware and ransom ware. In the first method email account compromise, fraudsters use compromised emails to request payment to fraudulent locations. This scam targets the general public and professionals associated with but not limited to financial institutions, real estate companies, etc., but focus more on individuals.

The fraudster uses computer intrusion techniques to compromise the email account of its victim. Most times, they gain access to the victim's legitimate email address, and then create an account similar to it by slightly altering a character. The fraudsters then initiate unauthorized wire transfers using the spoofed email or

the victims' legitimate email. EAC scams are responsible for hundreds of thousands in consumer losses annually from their inboxes being hijacked by cyber thieves.

A typical case of this method of internet fraud was reported by the Agency France-Press (AFP) in 2018. The paper reported the case of a 48-year old Nigerian man who defrauded people around the world of \$20.5 million by pretending to be Nigeria's first lady and sending emails to individuals in her name. The second type business email compromise (BEC) sees email scam targets businesses working with foreign suppliers and companies that regularly perform wire transfer payments. In this case, the fraudster compromises legitimate business emails account through social engineering and computer intrusion techniques and then conducts unauthorized transfer of funds.

The FBI says BEC scams netted thieves more than \$12 billion between 2013 and 2018. Goodchild (2018) stated that these fraudsters do a lot of homework when targeting a company. They obtain information about the location of the company and its client, names and titles of company officers, management organizational

structure, information about new rounds of funding, new products, services and patent, geographic or product expansion plans and travel plans. New FBI data shows that business email compromise (BEC) and email account compromise (EAC) scam losses worldwide spiked 136% from December 2016 to May 2018.

There were 78,617 BEC/EAC incidence reported between October 2013 and May 2018 resulting in \$12 billion in losses. Phishing as the third type is the act of sending an email falsely claiming to be an established legitimate business in an attempt to deceive the unsuspected recipient into divulging personal, sensitive information such as password, credit card numbers and bank account information after directing the user to a fake website.

While spoofing refers to the dissemination of emails forged to appear as though it was sent by someone other than the actual source. Phishing and spoofing are clearly different beneath the surface. Cholewa (2016) state that one downloads malware to your computer and the other tricks you into giving up sensitive financial information to a cybercrook. Phishing is a method of retrieval, while spoofing is a means of delivery.

Malware as the last type is the malicious software that is intended to damage and disable computers and computer systems so as to scare victims and then tactically solicit for funds. While Ransomware is a form of malware targeting both human and technical weakness in organizations and individual network in an effort to deny the availability of critical data or systems.

Ransomware is frequently delivered through spear phishing emails to end users resulting in the rapid encryption of sensitive files on a corporate network. When the victim organization determines they are no longer able to access their data, the fraudster demands the payment of a ransom, typically in virtual currency such as Bitcoins. (FBI, 2018).

3. SPAM MAILS AND CYBER SECURITY

The shortest definition of spam is an unwanted electronic mail. According to Jorgensen et al (2008), it has been over thirty years since the first email spam appeared on APRANET. Over the years, spammers have grown in sophistication with cutting-edge technologies and have become more evasive.

The best evidence of their growing effectiveness is a recent estimate of over US \$10 billion worldwide spam-related cost (Jennings 2005). In recent years, spam has evolved from a serious security threat and is now a prime medium for phishing of sensitive information as well the spread of malicious software. The Melissa virus appeared on thousands of emails systems on the 26th of March 1999. The virus was designed to send an infected mail to the first 50 email addresses on the user Microsoft outlook address book. Each infected computer would infect 50 additional computers, which in turn would infect another 50 computers.

Many systems administrators had to disconnect their systems from the internet. Some companies were forced to shut down their email gateways due to the vast numbers of emails the virus generated (Weinstein, 2003). In the last decade, the continuous growth of the spam phenomenon, namely the bulk delivery of unsolicited emails with offensive contents or with fraudulent aims, has become a main problem to the email service for the internet service providers, corporate and private users.

Phishing spams emails are a serious threat for the security end users, since they try to convince them to surrender personal information like password and account numbers, through the use of spoof messages which are masqueraded as coming from reputable online businesses such as financial institution (Weinstein, 2003; Geer, 2004). The good word attack (Lewd and Meek, 2005b) is one of the techniques most frequently employed by spammers. This technique involves appending sets of so called “good words” to spam messages. Good words are word that are common to legitimate emails but rare in spam.

Spam messages injected with such words are more likely to appear legitimate and by pass spam filters. Goodman et al (2005) discussed different approaches for fighting spam, ranging from various sender authentication protocols to charging senders indiscriminately in money or computation resources. This paper focuses on technological techniques presented by machine learning solutions.

These solutions consist of software filters installed at internet service providers email servers or on the client side, whose aim is to

detect and automatically delete or to appropriately handle spam emails. At first, anti-spam filters were simply based on keyword detection in emails subject and body but spammers systematically introduce changes to their emails to circumvent filters.

They exploit vulnerabilities of mail servers (like open relay) to avoid sender identification and add fake information or errors in headers. They use content obscuring techniques to avoid automatic detection of typical spam keywords by misspelling words and inserting HTML tags inside words (Giorgio Funera et al, 2006).

4. MACHINE LEARNING SOLUTIONS

Domingos (2016) states that machine learning algorithms can figure out how to perform important tasks by generalizing from examples, while Stanford (2016), and define machine learning as the science of getting computers to act without being explicitly programmed. Bengio (2016) who is one of the world foremost machine learning experts insists that machine learning is part of research on artificial intelligence, seeking to provide knowledge to computers through data observations and interacting with the world.

That acquired knowledge allows computers to correctly generalize to new settings. Conventional security software requires a lot of human effort to identify threats extract characteristics from the threats and encode it into software to detect the threats.

This labor-intensive process can be more efficient by applying machine learning algorithms. Wang and Stolfo (2004) and Rieck and Laskov (2006) assert that machine learning methods offer a powerful tool to counter a rapid evolution of security threats. For example, anomaly detection solution can identify unusual/events that potentially contain novel, previously unseen exploits. Bratco et al (2006) explain that machine learning methods are perfect for this task since they are capable of adapting to the evolving characteristics of spam.

Spam filtering poses a special problem for automated text categorization of which the defining characteristic is that filters face an active adversary, which constantly attempts to evade filtering. Since spam evolves continuously and most practical applications are based on online user feedback, the task calls for fast incremental and robust learning algorithms.

Computer security is the most important application field in which robustness of learning algorithms against adversarial input is crucial. Modern computer security infrastructures are facing an increasing professionalization of attacks. A widespread deployment of evasion techniques such as an encryption, obfuscation and polymorphism is manifested in a rapidly increasing diversity of malicious software observed by experts. Machine learning methods can also help researchers better understand the design of malicious software by using classification or clustering\ techniques together with special malware acquisition and monitoring tools (Bailey et al 2007; Rieck et al, 2008).

5. APPROACHES TO MANAGING SPAM

Using the journal of machine learning research (JMLR) which contains submissions from machine learning expert on this topic from January 2000 till date, this paper aims to theorise these sophisticated packages and counter strategies. The journal was chosen because it has the highest citation index in the Scopus matrix in the field of machine learning.

If therefore follows that every cutting age research on machine learning since the year 2000 would have somehow appear in this journal. This paper is part of an ongoing research on machine learning as a whole and the data used in this paper comes from the over 100 articles published on this topic in the journal.

Most developed models for detecting and minimizing spam mails have been machine learning algorithms. Almost all spam filtering methods use text techniques; therefore, most of the problems are related to classification. This study investigates the different machine learning classified methods for detection and filtering spam mails, most of which are designed and dispatched to defraud unsuspecting internet users.

Ali et al (2016) posits that various systems have been introduced for automatic classification of emails and some sample-based methods which includes Bayesian classification algorithms, key word matching, header information processing, investigation of spam- sending factors and investigation if received emails. Using a multilayer perception model they describe three machine-learning algorithms to filters spam from valid emails efficiently with low error

rates. They presented a model with experimental dataset of 750 valid emails and 750 spams mails entered into a personal system during a six-month period.

The model has labels S (spam) and L (legitimate) for each email, the results were discussed and findings showed that the multilayers perception (MLP) neural network demonstrated higher efficiency in detecting and minimizing spam mails than the naïve Bayes classifier algorithms and the C4.5 decision tree classifier. Bratko et al (2006) introduced a new research on the use of data compression algorithm for text categorization to filter spam mails. Their study built two compression models, classifying one as spam and the other as a legitimate mail.

They evaluated two variants with one estimating the probability of a document using compression models derived from training data and assigning the class label based on the model that deems the targets documents most probable. The second variant picks the class for which the addition of the target document results in a minimal increase in the description length of the data set.

This study performed cross validation experiments of specified data sets and result showed that spam filtering methods based on sub-word symbol sequence are more suitable for spam filtering in general. It is a fact that most spam filters are based on manually coded rules derived from the analysis of spam emails, and are sometimes ineffective. This is because fraudsters now embed the emails message into images sent as attachments are automatically displayed by most email clients.

This means that all spam filter techniques based on the analysis of plain text in the subject and body of the emails will be ineffective. This prompted Giorgio et al (2006) to proffer another solution, an anti-spam filter based in visual content analysis. They presented an approach which involved two phases, first, plain text from images are extracted in the tokenization phase and then emails are indexed either by the text in the subject and body fields of the email and the text extracted from the images.

This phase is called the classification phase. They conducted an experiment on two large data sets of spam emails, the publicly available spam Archive Corpus containing 10% of email with

attached emails and a personal Corpus containing 4% of emails with attached images. Their experiment was mainly limited by the fact that their experimental emails included no legitimate email with attached images.

The result of their research showed that using text categorization techniques and OCR tools to exploit text information embedded into images attached to spam emails can improve the categorization accuracy of server-side spam filter effectively. Jorgensen et al (2008) investigated the attack on spam filters by spammers who inject good words that are common to legitimate emails in an attempt to bypass them.

This research was motivated by other research on adversarial learning where the adversary aims to identify difficult spam instances through membership queries. Spam filtering was formulated as a multiple instance binary classification problem in the context of adversarial attacks. Their approach to creating multiple instance bags from emails were divided into four, split-half (Split-H), split-term (Split-T), split-projection (Split-P) and split-subtraction (split-S) and they tested a new compression-based spam filter against the good

word attack.

Their experimental data consisted of 36,674 spam and legitimate email message from the 2006 TREC Spam Corpus. These emails were sorted out chronologically by receiving data and evenly dividing them into 11 subsets with each subset containing 3300 messages approximately. For their experiments, the following were used; SVM and multinomial naïve Bayes, Multiple Instance Learning tool kit (MILK) (XU, 2003), implementation of MILR and the Weka 3.47 (Witten and Frank, 2000). The experiment results showed that the splitting methods presented in the research works fairly and can be used as a counter attack strategy on spam mails injected with good words to attack spam filters and pass off as legitimate mails.

6. THEORISING THE WAY FORWARD

In the world we live today, computers and the internet has enhanced the quality of life for a lot of people but cyber criminals have devised ways to undermine these systems by fraudulently tricking unsuspecting internet users into providing personal information's that are used to perpetrate fraud in alarming dimensions.

The findings of this study indicates that the application of machine learning algorithms is more efficient in detecting and categorization of spam mails from internet fraudsters as opposed to conventional security software that require a lot of human effort. The different research investigations presented in this paper developed new approaches to tackle the menace of spam mails sent by cyber criminals to perpetuate fraud.

Improvements on machine learning methods that tackle spam emails from fraudsters were made. Due to the vulnerability of statistical spam filters to adversarial attacks, Jorgense et al (2008) proposed a Multiple Instance Learning (MIL) counter attack strategy that recognizes the spam party of an email even if the mail has been injected with good words so as to attack and bypass spam filters.

Their research presented a defence strategy in the use of multiple instant learning (MLP) to classify emails in unlabelled bags but each email is made up of instances that could be labelled positive or negative.

This classification technique assumes that a bag is positive if at least one instance in the bag is positive, and negative if all instances

are negative. This means that an email is classified spam if at least one instance in the corresponding bag is spam and as legitimate if all the instance in it are legitimate. Therefore, even if a spam mail has been injected with good words by a fraudster, the splitting of this email by a Multiple Instance Learner (MLP) will recognize the spam part of the email and then filter it.

This strategy was tested on various good words attacks from spam mails and proved effective. The experiment results showed that the splitting methods presented in the research works fairly and can be used as a counter attack strategy on spam mails injected with good words to attack spam filters and pass off as legitimate mails. They retained the top 500 features from these emails after classification and their result showed that their counter attack strategy was effective but also subject to future investigations.

Bratko (2006) on the other hand proposed an approach to spam filtering based on adaptive statistical data compression models. Since machine learning methods are capable of adapting to the evolving characteristics of spam and data is available for training such models, they employed the dynamics of Markov compression and

prediction by partial matching algorithms. This research proposed a simple modified method which showed that compression models are robust to the type of noise introduced in text by obfuscation tactics which are commonly used by spammers against tokenization based filters. They classified text using compression model in two different ways, the Minimum Cross-Entropy (MCE) approach. These classification criteria were evaluated using an online spam filters and the result from all experimental comparison of compression models showed the effectiveness of this method.

7. CONCLUSION

Despite the rising popularity of instant messaging technologies and different digital communication medium, emails have been a dominant means of exchanging information by individuals and businesses. Fraudsters have caught in on this and are becoming daunting with different methods of committing online fraud. Daily growths of spam mails have been recorded and machine learning algorithms have provided effective mechanisms and efficient models and packages to filter these fraudulent spam mails.

This article attempts to encourage the use of machine learning methods to tackle this menace. There are known traditional methods of filtering spam mails in general which includes list-based filters, such as the blacklist, real-time black hole list, white list, grey list, content-based filters, word-based filters, Bayesian filters, etc. But machine learning algorithms techniques are a step further for more efficient methods of filtering spam mails.

Ranging from classification techniques that are text based to strategies that filter spam mails with attached images, machine learning strategies have been proven to be efficient with excellent results. Further research is being carried out to propose more systematic approaches to stop fraudulent spam mails that have found new ways to bypass these spam protection tools.

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57

INTERNET OF THINGS TO USE ARTIFICIAL INTELLIGENCE (AI) AND MACHINE LEARNING (ML)

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ABSTRACT

The innovation through interconnection of various gadgets via web is named as Internet of things (IoT). Creates of IoT has a vast measure of information regarding different attributes and characteristics of information. AI combination with IoT guarantees the inescapable advancement to expand the insight of the IoT gadgets and presentations. The introduction of distinctive brilliant IoT presentations through AI assist in perception, methodical investigation, handling and brilliant utilizations of the huge volume of information in various fields. Numerous enterprises are utilizing the AI and all the more explicitly, Machine learning (ML) as a Services to abuse IoT's latent capacity. This current article comprises of AI essential presentation, AI calculations, surveys of various specialist's investigation, different sensor gadgets and the different utilizations of AI calculations through IoT. Also, the end area of the article comprises of dialog and end

Key words: Algorithms, Internet of things (IoT), Machine learning (ML).

1. INTRODUCTION

After the most recent eras, as globe is observer for constant progression of various types of organized and unarranged information got from web based life, transport, specialized, gadgets and detectors. According to data, International Information Corp. gauges that close by 180 Zeta Bytes of information would be created until 2025. Such colossal blast of information has offered ascend to the knowledge economy throughout a modern economy on the planet. In the current state of the worldwide of computerization knowledge can be called a new fuel that is absolutely important but worthy when washed and prepared beforehand.

This gradual development in information economy has provided the climb throughout the utilization of idea of IoT and furthermore impels the presence of information sciences[1].

IoT is a half and half blend between the physical world protests and installed gadgets that are associated through the web to set up the correspondence. According to step by step contribution of IoT in day by day life just as within business with industry, the increasingly more measure of information is created through the assistance of

detectors[2]. As opposed to the entire produced recently information it's smarter to separate the savvy information of IoT information that could be by way of its great delegate.

Information Science is additionally persistently pushing forward in course to accomplish another worldview which is AI that creates conceivable to show the ML via the information and move near the assorted variety of its compelling bits of knowledge. For the most part, the gigantic ascent in measure of information to trade makes it difficult to break down utilizing conventional procedures.

In this way, machine learning exceptional towards the calculation and requirements a huge measure of information for preparing that incorporates tedious preparing so as to refine the capacity of learning just as choice taking with respect to the implied calculations. AI assists the IoT gadgets and presentations in settling on the additional astute choices as for the brilliant information[3].

2. MACHINE LEARNING

The order of ML remains as a subsection of AI that is worried about the ability to the PC frameworks or equipment's so as to enhance the execution naturally all through its experience.

Alongside the expansion of over the top information, ML improves the car learning procedure via preparing and led near adjustment of its calculation. ML algorithms are utilized to actualize the various replicas. Essentially AI may be sorted as: Directed, Undirected, Semi-Directed and support learning[4].

2.1 Directed Learning

When learning remains implied on marked information or the ideal results is referred to name as directed learning. For instance, Amazon's Reference Framework, voice right hand, climate Apps, Gmail Junk Filtration and so forth. It likewise assists in expectation of future outcomes for inconspicuous information.

2.2 Undirected Learning

On the off chance that learning remains implied on unlabelled information's or data isn't known ahead of time at that point this kind of learning remains recognized as undirected knowledge. For instance, NASA utilizes learning way to deal with make the various bunches of radiant forms every of that comprises of comparative environment objects.

2.3 Semi- Directed or Semi-Managed learning

Method is a mix method as a mix of directed including undirected learning through not many named and unlabelled information. For model, naturally discovery of facebook photographs for the numerous photographs of an equivalent individual of family work photograph group (bunching undirected learning) through naming that individual once (directed learning) and a while later it'll naturally joined the unofficial ID to which individual throughout all photographs[5].

2.4 Reinforcement Learning

Reinforcement Learning is an AI which permits the proficient perception of environment and predictable learning conduct to a learning framework all together to upgrade the recurrence of combined motivating forces or rewards. It is otherwise called prize founded learning framework. For instance, Robots in an assembling unit.

3. RECENT IOT DEVICES AND TECHNOLOGIES

3.1 Arduino Device

Arduino Software is indeed the microcontroller kits utilized to run the computerized devices which may detect objects and also to monitor them to make these physical objects accessible and relate. Arduino is actually one of the well-known IoT boards that may be used in a demonstration with sophisticated and easy I/O pins that often communicate with multiple circuits and could be attached to USB ports interfaces to computers[6].

3.2 Intel Galileo

The second era leading body from Intel Galileo comprise from Intel Quark Excellent PC processor, 256 Megabits RAM with various sorts all together to offer help toward Arudino equipment[7].

3.3 Raspberry – Pi

Furthermost well-known IoT boards named Pi 3, which gives the additional minimized and independent PC frameworks by including Bluetooth, manufactured - in Wi-Fi office and furthermore ready to incorporate extraordinary software design bundles such as python, LAMP Stacks and so on[8].

4. IOT PLATFORM

IoT Platform remains a built-in assist used to reach space or even as an intermediary among the IoT (detectors) but IoT (network) apps and provides a fast lines of physical objects on world stage.

4.1 AWS IoT Platform

Amazon network Services IoT stage plays out the information assortment since the associated gadgets furthermore; imply it to this present reality situation by keeping up the security criteria.

4.2 Microsoft Azure IoT Stage

Sky blue IoT Stage gives the bi-directional correspondence among associated gadgets and stages with solid safety instrument, versatility and simple mix with frameworks. It likewise included sky blue spilling examination which can process the tremendous data, which is produced by detectors in genuine world

4.3 Google Cloud Platform

This stage gives a few extra highlights such as cloud IoT Central, Speed-Up IoT devices, Cloud Publishers besides Subscribers including Cloud AI Engines. IBM Watson's IoT stage also, Artik Cloud's IoT stage (SAMSUNG).

5. LITERATURE STUDY

IoT is rising as the difficult region of data including IT and advanced globe that edify the look at additional studies open doors throughout the earth of web associated gadgets and presentations. Various analysts has been as of now shown their examination in this field with a few AI calculations so as to make legitimate use of gigantic measure of created information and to give some particular purpose of perspectives.

Lei Zhang and et al. (2012) presented a methodology focused on a presentation for following the area for example SensTrack that is utilized with advanced mobile mobiles installed through Wi-Fi office in request to lessen the utilization with GPS because of its accessibility at High costs in exceptionally limited time and detrimental impacts on the battery. SensTrack has been using the GPS-test with data excluded and can adjust the field and replicate the pattern trace from the reported area[9].

Mohammed S. Alam including Son T. Vuong (2013) had has been utilized arbitrary backwoods calculation of directed AI method to characterize the Android highlights and concentrate Inconsistency

in implementation as putrid or type of data collection so that it can preserve precision in order. The key approach in this article is to measure the unusual parameters of timberland again for specified datasets.

The presence of the Weka check while the continuous discharge 3.6.9 was used since recently discharged variant of WEKA gave the multithreading support so as to limit the time-multifaceted nature stage. It additionally has impediment that WEKA not really does execute the calculation with respect to Feature significance if there should be an occurrence of irregular woods arrangement because of which that is not figured in the paper[10].

Vishwajeet Hari Bhide with dr Sanjeev Wagh (2015) suggested a fresh procedure so as to give the good absorption of encompassing circumstances in homes with lower impedance of humans and furthermore ready to naturally recognize the shortcoming or issue in any gadget. Despite the fact that, expansion of Naïve Bayes calculation expanded the degree of insight. Additional use instance of this framework can likewise ready to oversee and give lower value factor, proficient measure of vitality with adaptability to the savvy

houses. This article additionally incorporated the upcoming extent of their effort to incorporate the s.m.s cautions, email notices or voicemails cautions through the all-inclusive component to improve the safety at house entry entryway via movement discovery[11].

Alberto M. C. Soza including Jose' R. Amazonas (2015) had has been executed as Principals Module Analysis (PMA) founded bunching calculation for issue location which utilized Hadoop System with Mahout Usage. This calculation coordinated through IoT engineering executed via LinkSmart middleware. Suggested usage and engineering expanded the possible as well as usefulness with IoT LinkSmart's middleware[12].

Arijit Ukil and et al. (2016) delineated a universal wellbeing observing framework dependent on (unguided adapting) peculiarity location of illnesses at beginning period so as to give the substance of life. The exactness of peculiarity location fluctuated through the SNR degree (increasingly exact with lower SNR). Present article moreover depicted an utilization instance of peculiarity location for cardiovascular through the assist of moderate android advanced

mobiles via the viewpoint of initial identification of heart associated ailments that abstain from driving the extreme circumstance[13].

Hardi Desai with et al. (2017) has suggested a dream to actualize a moderate and good IoT founded remote detector organize so as to checking and breaking down the staple stages at stores just as at households. This framework additionally gives a huge to utilization as future degree in the kitchenettes also, to screen the distinctive stockpiling spots to deal with the products in easy way.

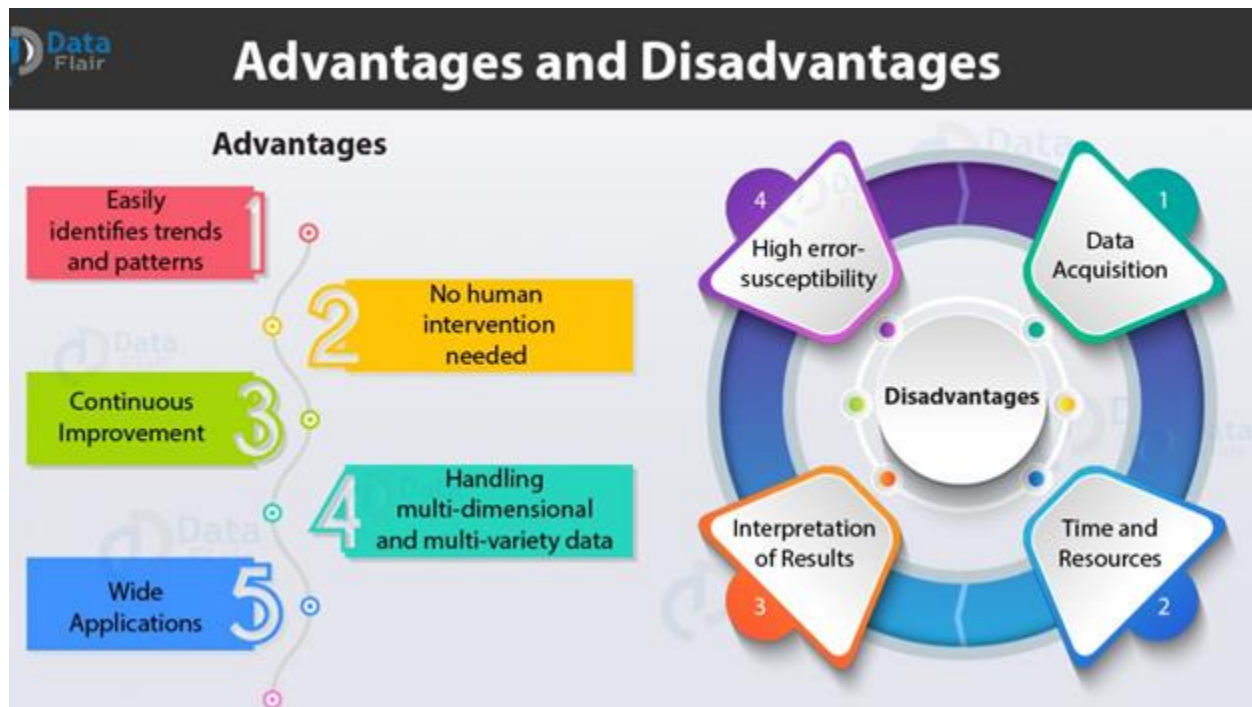
Guangie Han and et al. (2018) concentrated on basic matters as to protection throughout WSNs to keep up area protection furthermore, presented the novel assurance conspire dependent on means that is bunch-based area protection (KCLP). This specific plan upgraded the safety and limits the deferral in cost of vitality utilization at slight stage which could be decreased additional in future tasks.

K. Gai, M. Qiu (2018) suggested a fresh strategy for ideal allotment of assets in artificial intelligence physical condition (IoT) in light of the fortification learning worldview. Fortification strategy is utilized to acquire the high agreeable stage which remains QOK

(Quality-of Knowledge), additional exactness and lower expense in asset designation. Fortification learning measured QOE stage as remuneration factor with come about an incentive as ideal arrangement[14].

SrijaneeMookherji as well as Suresh Sankaranarayanan (2019) had has been presented the IoT Automatic Traffic Flagging Systems so as to progressively direct the jam in clogged zones. For information safety examination reason tended to Mans-In – Middle Attack (MITM) as well a Support Vector Machines (SVM) in light of administered (directed) learning strategy is utilized to send at verge to arrange the circulation information as crude database. This framework is actualized within IoT Boards Raspberry-Pi3 utilizing Scikit. Different type of IoT base machine learning algorithm analysis is shown in the Table 1.

Examination of Various Sorts of ML Algorithms via IoT



6. CONCLUSION

AI has a hazardous possible to be main innovation for the unavoidable condition from IoT. The ongoing pollutions of accomplishment of ML alongside IoT demonstrate their combination as the awesome resources throughout the area of information sciences. This article examined the various uses of AI calculations aimed at IoT besides spreads the ongoing cutting-edge innovations utilized in IoT condition. This paper additionally accentuated the intensive examination on late investigates with respect to uses of AI calculations for IoT.

In this front line of antiques-based knowledge of up and coming innovations, the new creations are coming to at the zenith with the viewpoint of setting up between associations in the middle of the physical world articles that gives progressed, keen and dependable lifespan to humans.

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58

COMPUTER NETWORK AND ITS TYPES

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Definition of Network:

A computer network is a group of computers that use a set of common communication protocols over digital interconnections for the purpose of sharing resources located on or provided by the network nodes

1. Personal Area Network (PAN)
2. Local Area Network (LAN)
3. Wireless Local Area Network (WLAN)
4. Campus Area Network (CAN)
5. Metropolitan Area Network (MAN)
6. Wide Area Network (WAN)
7. Storage-Area Network (SAN)
8. System-Area Network (also known as SAN)

Personal Area Network

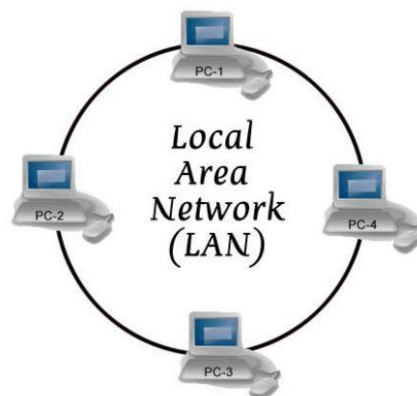
A Personal Area Network (PAN) is smallest network which is very personal to a user. This may include Bluetooth enabled devices or infra-red enabled devices. PAN has connectivity range up to 10 meters. PAN may include wireless computer keyboard and mouse, Bluetooth enabled headphones, wireless printers and TV remotes.



Local Area Network

A computer network spanned inside a building and operated under single administrative system is generally termed as Local Area Network (LAN). Usually, LAN covers an organization's offices, schools, colleges or universities. Number of systems connected in LAN may vary from as least as two to as much as 16 million.

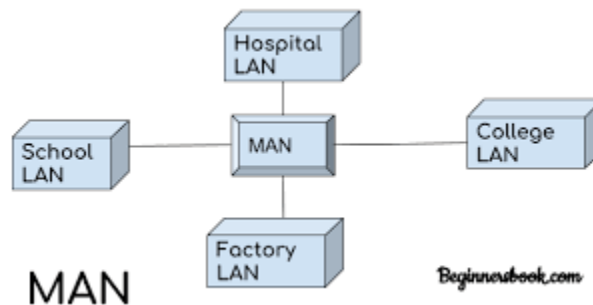
LAN provides a useful way of sharing the resources between end users. The resources such as printers, file servers, scanners, and internet are easily sharable among computers.



Metropolitan Area Network

The Metropolitan Area Network (MAN) generally expands throughout a city such as cable TV network. It can be in the form of Ethernet, Token-ring, ATM, or Fiber Distributed Data Interface (FDDI).

Metro Ethernet is a service which is provided by ISPs. This service enables its users to expand their Local Area Networks. For example, MAN can help an organization to connect all of its offices in a city.



Wide Area Network

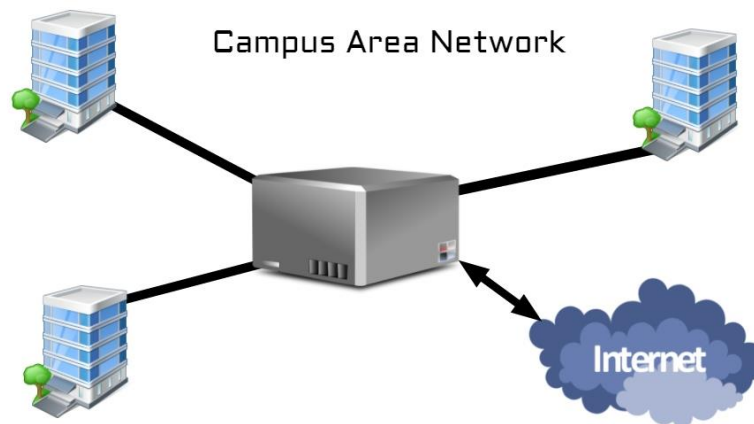
Wide Area Network (WAN) covers a wide area which may span across provinces and even a whole country. Generally, telecommunication networks are Wide Area Network. These networks provide connectivity to MANs and LANs. Since they are equipped with

very high speed backbone, WANs use very expensive network equipment.



Campus Area Network

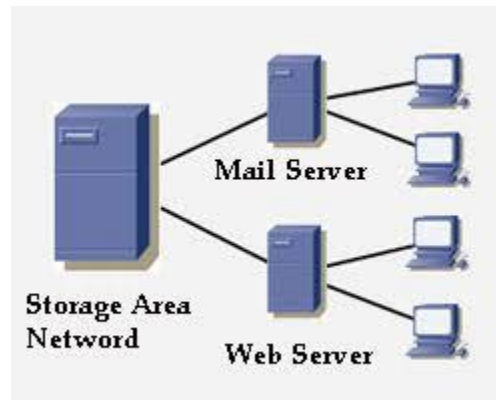
A campus network, campus area network, corporate area network or CAN is a computer network made up of an interconnection of local area networks within a limited geographical area



A storage area network (SAN)

It is a dedicated high-speed network or subnetwork that interconnects and presents shared pools of storage devices to

multiple servers. A SAN moves storage resources off the common user network and reorganizes them into an independent, high-performance network.



A wireless local area network (WLAN)

It is a wireless distribution method for two or more devices that use high-frequency radio waves and often include an access point to the Internet. A WLAN allows users to move around the coverage area, often a home or small office, while maintaining a network connection

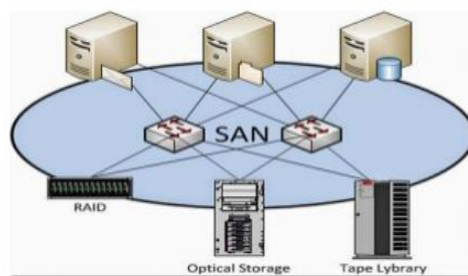


system area network (SAN)

It is a high-performance, connection-oriented network that can link a cluster of computers. A SAN delivers high bandwidth (1 Gbps or greater) with low latency. A SAN is typically switched by hubs that support eight or more nodes.

SYSTEM AREA NETWORK

❖ System Area Network (also known as Cluster Area Network) - Links high-performance computers with high-speed connections in a cluster configuration.



TOPOLOGY

The arrangements of nodes or systems called Topology.

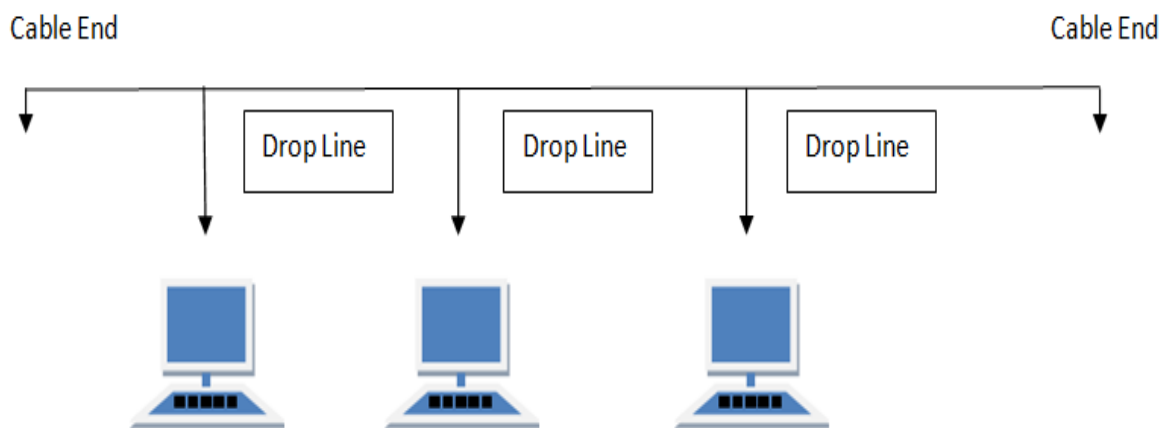
Topology can be classified in to five categories

- Bus Topology
- Star Topology
- Ring Topology
- Mesh Topology

- Tree Topology

BUS Topology

Bus topology is a network type in which every computer and network device is connected to single cable. When it has exactly two endpoints, then it is called Linear Bus topology.



Features of Bus Topology

- It transmits data only in one direction.
- Every device is connected to a single cable

Advantages of Bus Topology

- It is cost effective.
- Cable required is least compared to other network topology.
- Used in small networks.
- It is easy to understand.

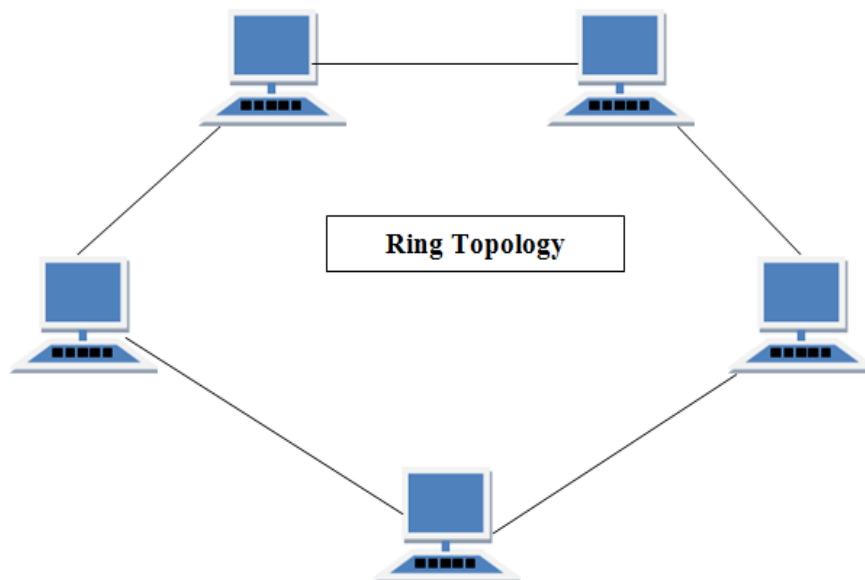
- Easy to expand joining two cables together.

Disadvantages of Bus Topology

- Cables fails then whole network fails.
- If network traffic is heavy or nodes are more the performance of the network decreases.
- Cable has a limited length.
- It is slower than the ring topology.

RING Topology

It is called ring topology because it forms a ring as each computer is connected to another computer, with the last one connected to the first. Exactly two neighbours for each device.



Features of Ring Topology

- A number of repeaters are used for Ring topology with large number of nodes, because if someone wants to send some data to the last node in the ring topology with 100 nodes, then the data will have to pass through 99 nodes to reach the 100th node. Hence to prevent data loss repeaters are used in the network.
- The transmission is unidirectional, but it can be made bidirectional by having 2 connections between each Network Node, it is called Dual Ring Topology.
- In Dual Ring Topology, two ring networks are formed, and data flow is in opposite direction in them. Also, if one ring fails, the second ring can act as a backup, to keep the network up.
- Data is transferred in a sequential manner that is bit by bit. Data transmitted, has to pass through each node of the network, till the destination node.

Advantages of Ring Topology

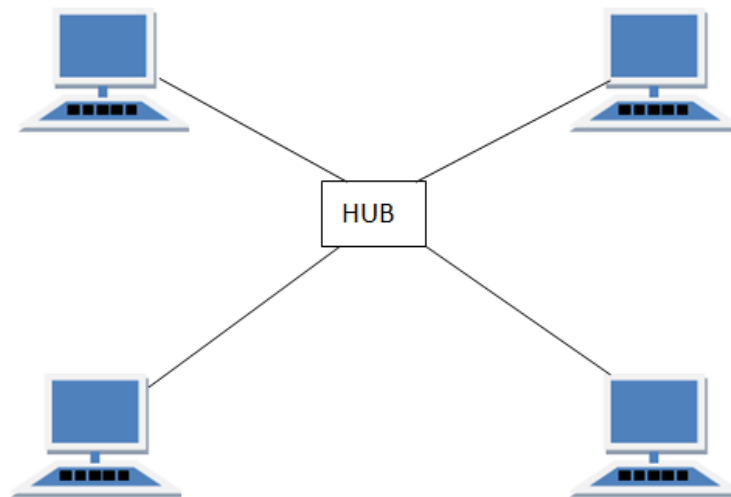
- Transmitting network is not affected by high traffic or by adding more nodes, as only the nodes having tokens can transmit data.
- Cheap to install and expand

Disadvantages of Ring Topology

- Troubleshooting is difficult in ring topology.
- Adding or deleting the computers disturbs the network activity.
- Failure of one computer disturbs the whole network.

STAR Topology

In this type of topology all the computers are connected to a single hub through a cable. This hub is the central node and all other nodes are connected to the central node.



Features of Star Topology

Every node has its own dedicated connection to the hub.

- Hub acts as a repeater for data flow.
- Can be used with twisted pair, Optical Fibre or coaxial cable.

Advantages of Star Topology

- Fast performance with few nodes and low network traffic.
- Hub can be upgraded easily.
- Easy to troubleshoot.
- Easy to setup and modify.
- Only that node is affected which has failed, rest of the nodes can work smoothly.

Disadvantages of Star Topology

- Cost of installation is high.
- Expensive to use.
- If the hub fails then the whole network is stopped because all the nodes depend on the hub.
- Performance is based on the hub that is it depends on its capacity

MESH Topology

It is a point-to-point connection to other nodes or devices. All the network nodes are connected to each other. Mesh has $n(n-1)/2$ physical channels to link n devices.

There are two techniques to transmit data over the Mesh topology, they are :

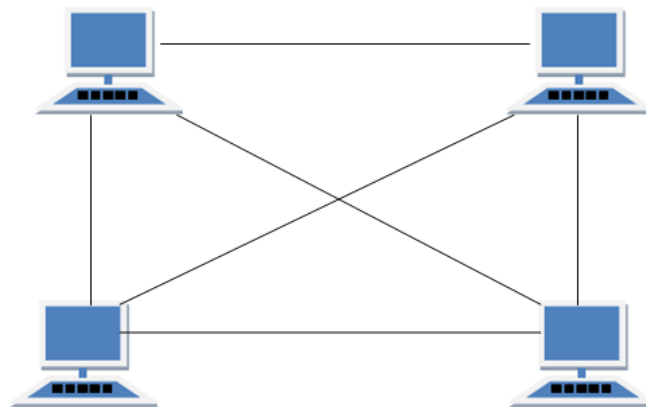
- Routing
- Flooding

MESH Topology: Routing

In routing, the nodes have a routing logic, as per the network requirements. Like routing logic to direct the data to reach the destination using the shortest distance. Or, routing logic which has information about the broken links, and it avoids those node etc. We can even have routing logic, to re-configure the failed nodes.

MESH Topology: Flooding

In flooding, the same data is transmitted to all the network nodes, hence no routing logic is required. The network is robust, and the its very unlikely to lose the data. But it leads to unwanted load over the network.



Types of Mesh Topology

Partial Mesh Topology :

In this topology some of the systems are connected in the same fashion as mesh topology but some devices are only connected to two or three devices.

Full Mesh Topology :

Each and every nodes or devices are connected to each other.

Features of Mesh Topology

- Fully connected.
- Robust.
- Not flexible.

Advantages of Mesh Topology

- Each connection can carry its own data load.
- It is robust.
- Fault is diagnosed easily.
- Provides security and privacy.

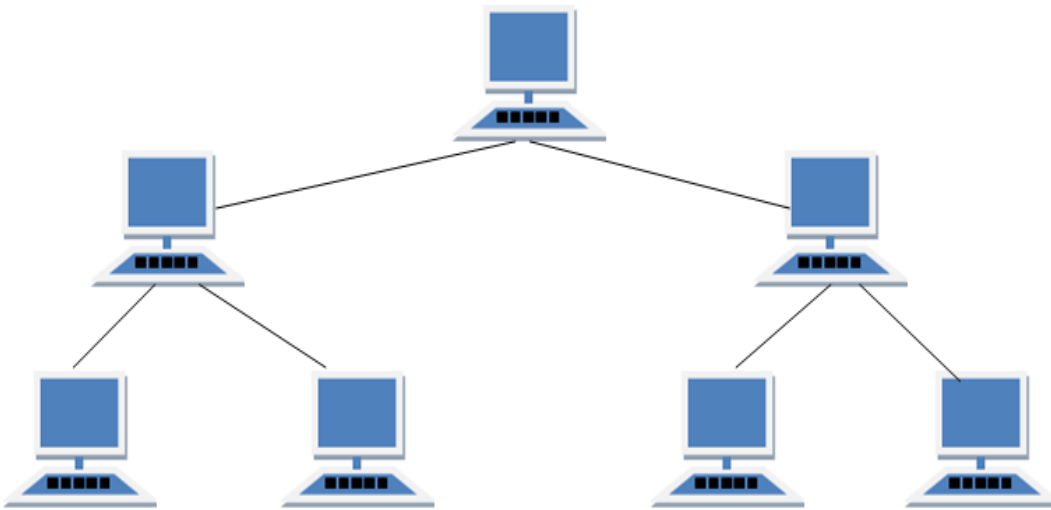
Disadvantages of Mesh Topology

- Installation and configuration is difficult.

- Cabling cost is more.
- Bulk wiring is required.

TREE Topology

It has a root node and all other nodes are connected to it forming a hierarchy. It is also called hierarchical topology. It should at least have three levels to the hierarchy.



Features of Tree Topology

- Ideal if workstations are located in groups.
- Used in Wide Area Network.

Advantages of Tree Topology

- Extension of bus and star topologies.
- Expansion of nodes is possible and easy.

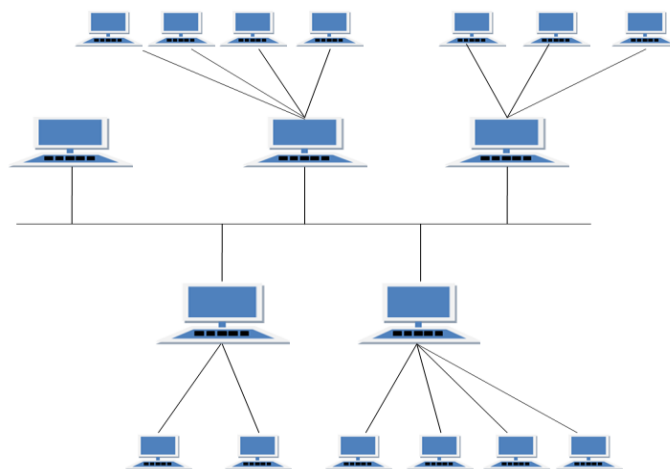
- Easily managed and maintained.
- Error detection is easily done.

Disadvantages of Tree Topology

- Heavily cabled.
- Costly.
- If more nodes are added maintenance is difficult.
- Central hub fails, network fails.

HYBRID Topology

It is two different types of topologies which is a mixture of two or more topologies. For example if in an office in one department ring topology is used and in another star topology is used, connecting these topologies will result in Hybrid Topology (ring topology and star topology).



Features of Hybrid Topology

- It is a combination of two or topologies
- Inherits the advantages and disadvantages of the topologies included

Advantages of Hybrid Topology

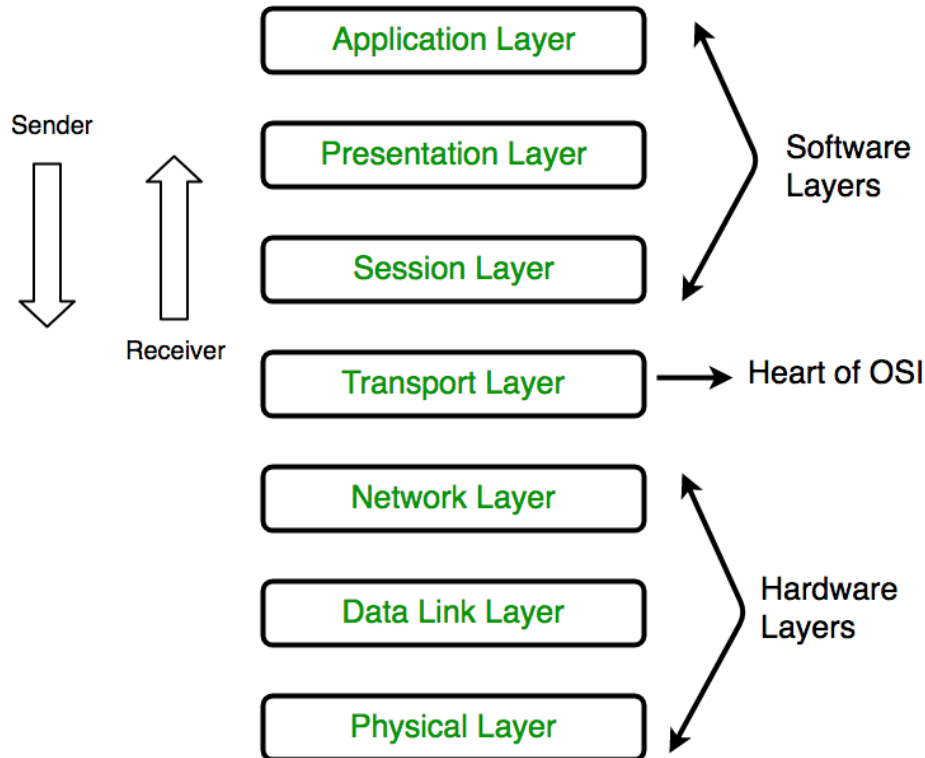
- Reliable as Error detecting and trouble shooting is easy.
- Effective.
- Scalable as size can be increased easily.
- Flexible.

Disadvantages of Hybrid Topology

- Complex in design.
- Costly.

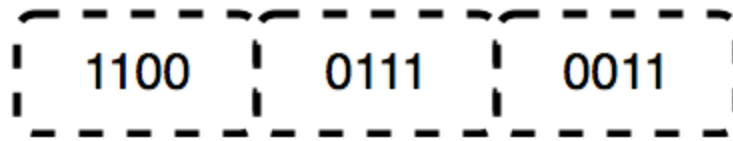
Layers of OSI Model

OSI stands for Open Systems Interconnection. It has been developed by ISO – ‘International Organization of Standardization’, in the year 1984. It is a 7layer architecture with each layer having specific functionality to perform. All these 7 layers work collaboratively to transmit the data from one person to another across the globe.



1. Physical Layer (Layer 1) :

The lowest layer of the OSI reference model is the physical layer. It is responsible for the actual physical connection between the devices. The physical layer contains information in the form of bits. It is responsible for transmitting individual bits from one node to the next. When receiving data, this layer will get the signal received and convert it into 0s and 1s and send them to the Data Link layer, which will put the frame back together.



The functions of the physical layer are :

Bit synchronization: The physical layer provides the synchronization of the bits by providing a clock. This clock controls both sender and receiver thus providing synchronization at bit level.

Bit rate control: The Physical layer also defines the transmission rate i.e. the number of bits sent per second.

Physical topologies: Physical layer specifies the way in which the different, devices/nodes are arranged in a network i.e. bus, star or mesh topology.

Transmission mode: Physical layer also defines the way in which the data flows between the two connected devices. The various transmission modes possible are: Simplex, half-duplex and full-duplex.

* Hub, Repeater, Modem, Cables are Physical Layer devices.

** Network Layer, Data Link Layer and Physical Layer are also known as Lower Layers or Hardware Layers.

Functions of Physical Layer

Following are the various functions performed by the Physical layer of the OSI model.

Representation of Bits: Data in this layer consists of stream of bits. The bits must be encoded into signals for transmission. It defines the type of encoding i.e. how 0's and 1's are changed to signal.

Data Rate: This layer defines the rate of transmission which is the number of bits per second.

Synchronization: It deals with the synchronization of the transmitter and receiver. The sender and receiver are synchronized at bit level.

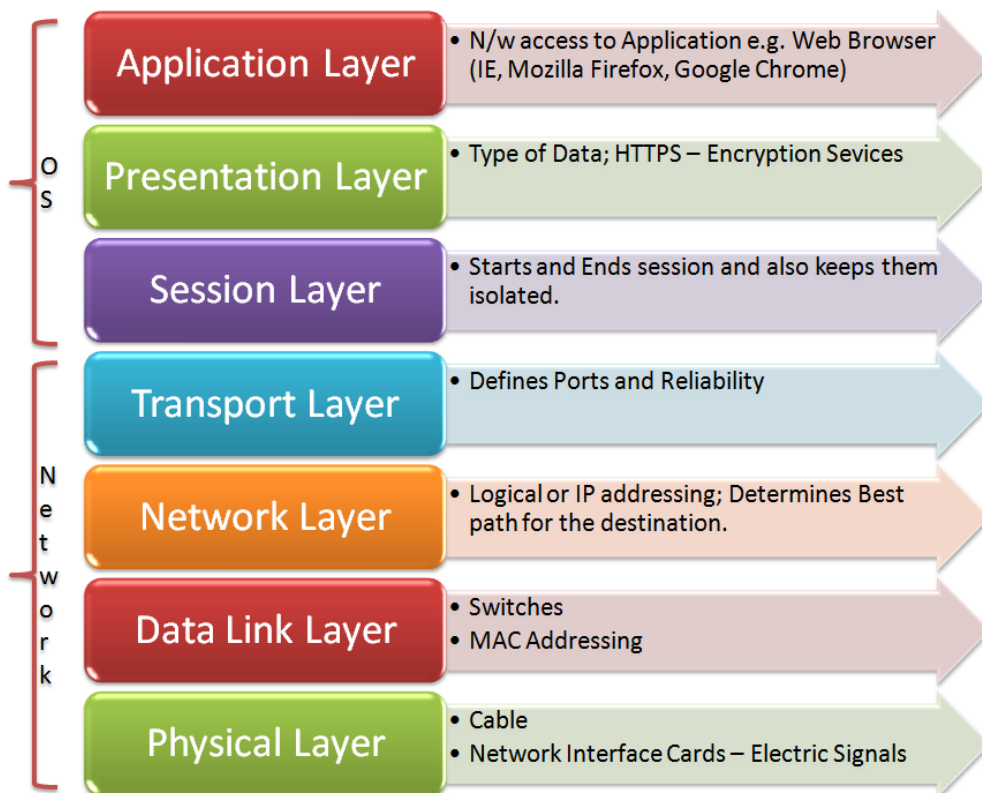
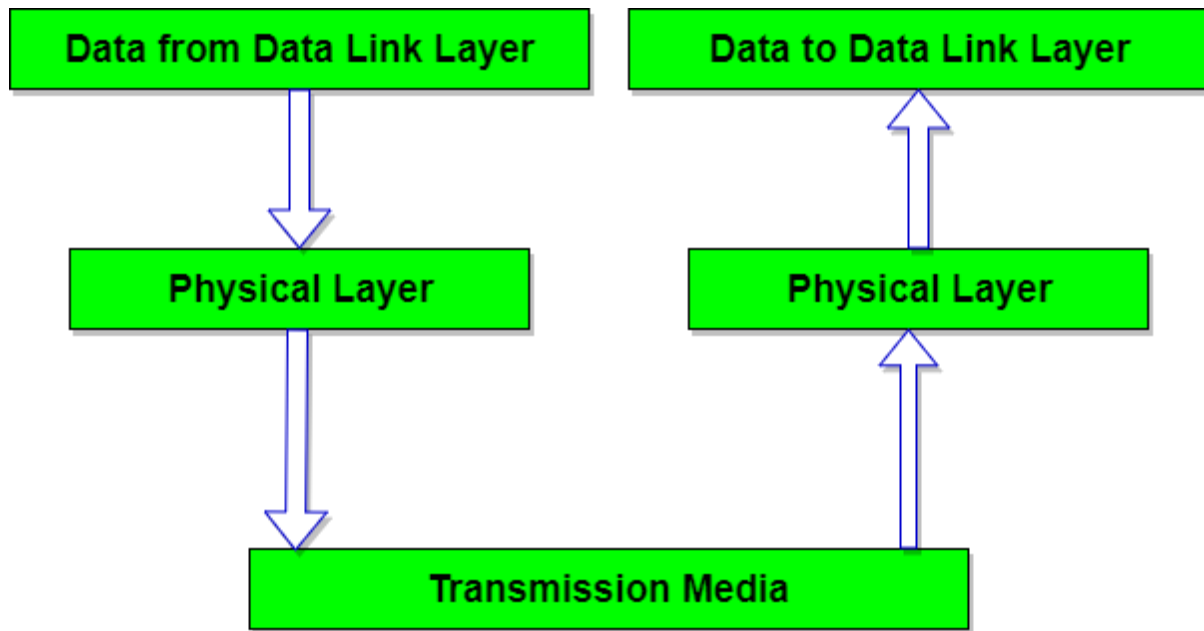
Interface: The physical layer defines the transmission interface between devices and transmission medium.

Line Configuration: This layer connects devices with the medium: Point to Point configuration and Multipoint configuration.

Topologies: Devices must be connected using the following topologies: Mesh, Star, Ring and Bus.

Transmission Modes: Physical Layer defines the direction of transmission between two devices: Simplex, Half Duplex, Full

Duplex. Deals with baseband and broadband transmission.

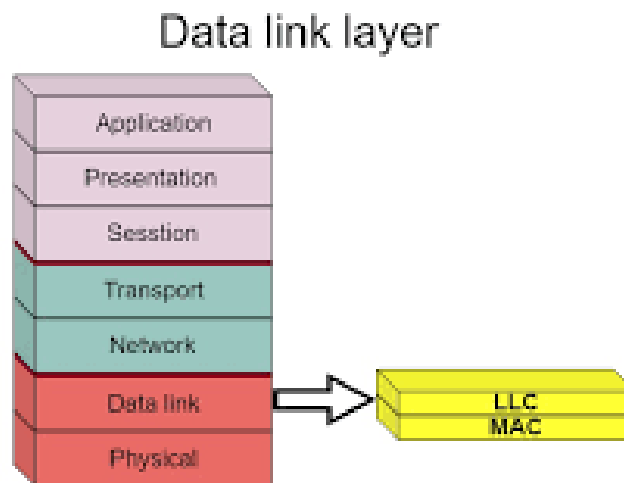


2. Data Link Layer (DLL) (Layer 2) :

The data link layer is responsible for the node to node delivery of the message. The main function of this layer is to make sure data transfer is error-free from one node to another, over the physical layer. When a packet arrives in a network, it is the responsibility of DLL to transmit it to the Host using its MAC address.

Data Link Layer is divided into two sub layers :

- Logical Link Control (LLC)
- Media Access Control (MAC)



The packet received from Network layer is further divided into frames depending on the frame size of NIC(Network Interface Card). DLL also encapsulates Sender and Receiver's MAC address in the header.

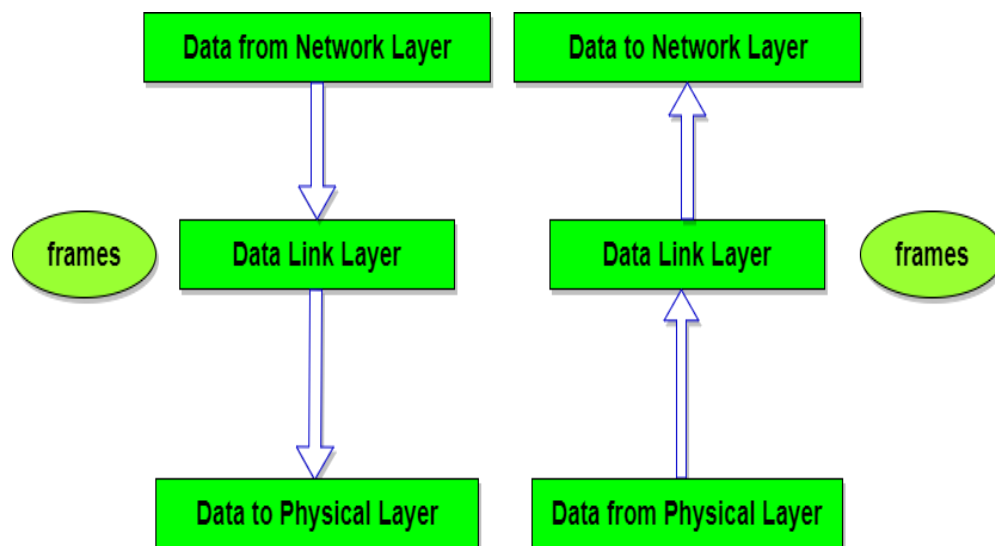
The Receiver's MAC address is obtained by placing an ARP(Address Resolution Protocol) request onto the wire asking "Who has that IP address?" and the destination host will reply with its MAC address.

The functions of the data Link layer are :

Framing: Framing is a function of the data link layer. It provides a way for a sender to transmit a set of bits that are meaningful to the receiver. This can be accomplished by attaching special bit patterns to the beginning and end of the frame.

Physical addressing: After creating frames, Data link layer adds physical addresses (MAC address) of sender and/or receiver in the header of each frame.

Error control: Data link layer provides the mechanism of error control in which it detects and retransmits damaged or lost frames.



Flow Control: The data rate must be constant on both sides else the data may get corrupted thus , flow control coordinates that amount of data that can be sent before receiving acknowledgement.

Access control: When a single communication channel is shared by multiple devices, MAC sub-layer of data link layer helps to determine which device has control over the channel at a given time.

Types of framing – There are two types of framing:

1. Fixed size – The frame is of fixed size and there is no need to provide boundaries to the frame, length of the frame itself acts as delimiter.

Drawback: It suffers from internal fragmentation if data size is less than frame size

Solution: Padding

2. Variable size – In this there is need to define end of frame as well as beginning of next frame to distinguish. This can be done in two ways:

Length field –introduce a length field in the frame to indicate the length of the frame. Used in Ethernet(802.3). The problem with this is that sometimes the length field might get corrupted.

End Delimiter (ED) –introduce an ED(pattern) to indicate the end of the frame. Used in Token Ring. The problem with this is that ED can occur in the data. This can be solved by:

3. Network Layer (Layer 3) :

Network layer works for the transmission of data from one host to the other located in different networks. It also takes care of packet routing i.e. selection of the shortest path to transmit the packet, from the number of routes available. The sender & receiver's IP address are placed in the header by the network layer.

The functions of the Network layer are :

Routing: The network layer protocols determine which route is suitable from source to destination. This function of network layer is known as routing.

Logical Addressing: In order to identify each device on internet network uniquely, network layer defines an addressing scheme. The sender & receiver's IP address are placed in the header by network layer. Such an address distinguishes each device uniquely and universally.

* Segment in Network layer is referred as Packet.

Network Layer Features

With its standard functionalities, Layer 3 can provide various features as:

- Quality of service management
- Load balancing and link management
- Security
- Interrelation of different protocols and subnets with different schema.
- Different logical network design over the physical network design.

4. Transport Layer (Layer 4) :

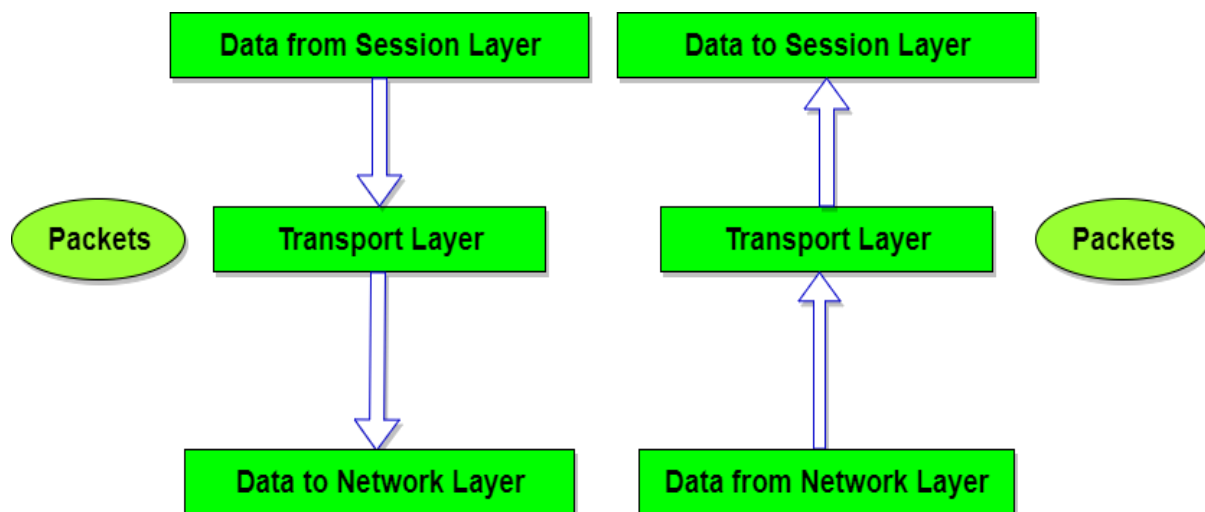
Transport layer provides services to application layer and takes services from network layer. The data in the transport layer is referred to as Segments. It is responsible for the End to End Delivery of the complete message. The transport layer also provides the acknowledgement of the successful data transmission and re-transmits the data if an error is found.

- **At sender's side:**

- Transport layer receives the formatted data from the upper layers, performs Segmentation and also implements Flow & Error control to ensure proper data transmission.
- It also adds Source and Destination port number in its header and forwards the segmented data to the Network Layer.

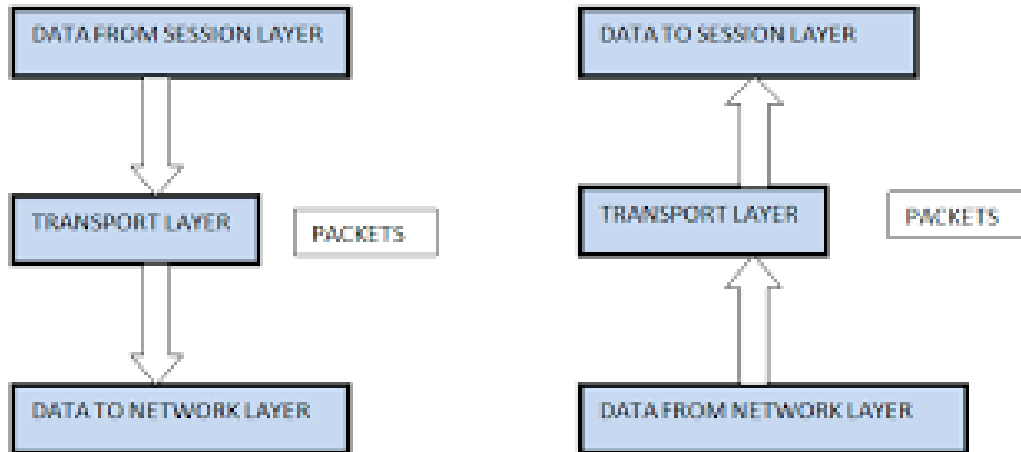
Note: The sender need to know the port number associated with the receiver's application.

- Generally, this destination port number is configured, either by default or manually. For example, when a web application makes a request to a web server, it typically uses port number 80, because this is the default port assigned to web applications. Many applications have default port assigned.



- **At receiver's side:**

- Transport Layer reads the port number from its header and forwards the Data which it has received to the respective application. It also performs sequencing and reassembling of the segmented data.



The functions of the transport layer are :

Segmentation and Reassembly: This layer accepts the message from the (session) layer , breaks the message into smaller units . Each of the segment produced has a header associated with it. The transport layer at the destination station reassembles the message.

Service Point Addressing: In order to deliver the message to correct process, transport layer header includes a type of address called service point address or port address. Thus by specifying this address, transport layer makes sure that the message is delivered to

the correct process.

The services provided by the transport layer :

Connection Oriented Service: It is a three-phase process which include

- Connection Establishment
- Data Transfer
- Termination / disconnection

In this type of transmission, the receiving device sends an acknowledgement, back to the source after a packet or group of packet is received. This type of transmission is reliable and secure.

Connection less service: It is a one-phase process and includes Data Transfer. In this type of transmission, the receiver does not acknowledge receipt of a packet. This approach allows for much faster communication between devices. Connection-oriented service is more reliable than connectionless Service.

* Data in the Transport Layer

Transport layer is operated by the Operating System. It is a part of the OS and communicates with the Application Layer by making system calls.

*Transport Layer is called as **Heart of OSI** model.is called as Segments.*

5. Session Layer (Layer 5) :

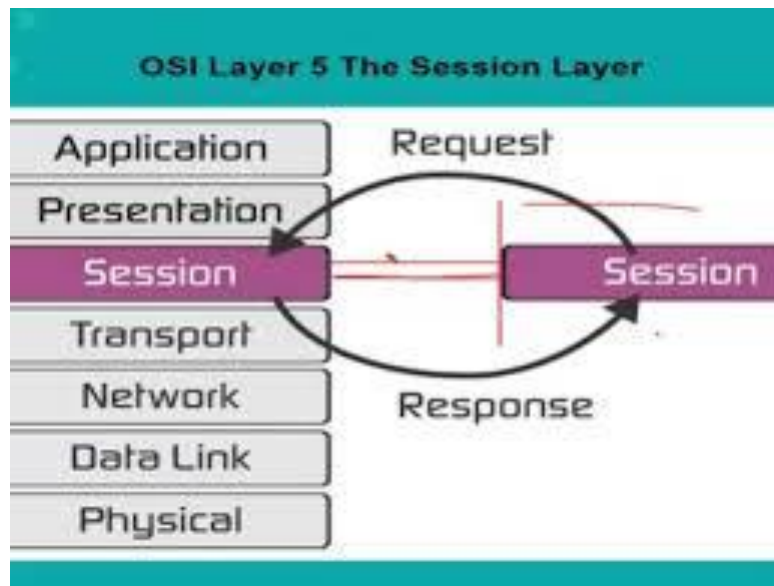
This layer is responsible for establishment of connection, maintenance of sessions, authentication and also ensures security.

The functions of the session layer are :

Session establishment, maintenance and termination: The layer allows the two processes to establish, use and terminate a connection.

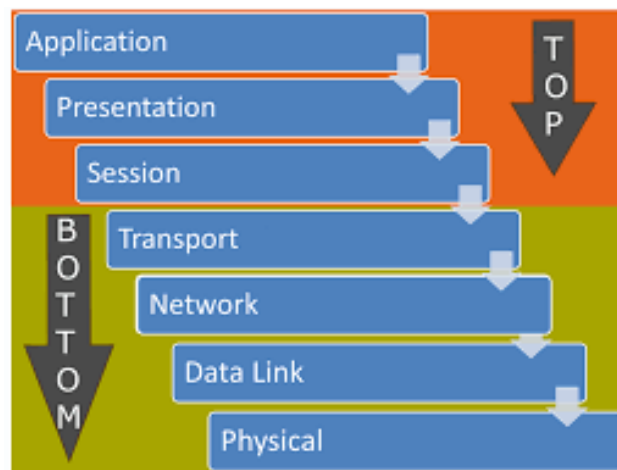
Synchronization : This layer allows a process to add checkpoints which are considered as synchronization points into the data. These synchronization point help to identify the error so that the data is re-synchronized properly, and ends of the messages are not cut prematurely and data loss is avoided.

Dialog Controller : The session layer allows two systems to start communication with each other in half-duplex or full-duplex.



**All the below 3 layers(including Session Layer) are integrated as a single layer in the TCP/IP model as “Application Layer”.

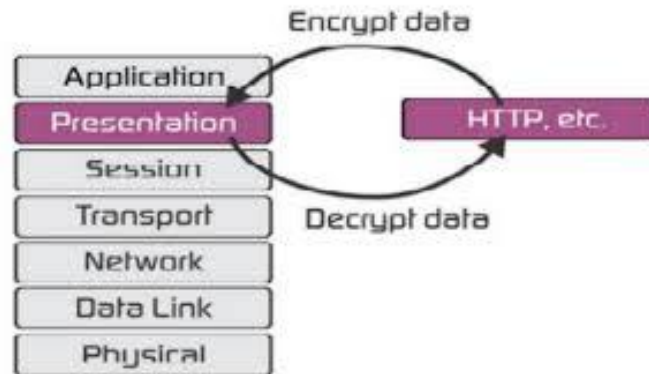
**Implementation of these 3 layers is done by the network application itself. These are also known as Upper Layers or Software Layers.



6. Presentation Layer (Layer 6) :

Presentation layer is also called the Translation layer. The data from

the application layer is extracted here and manipulated as per the required format to transmit over the network.

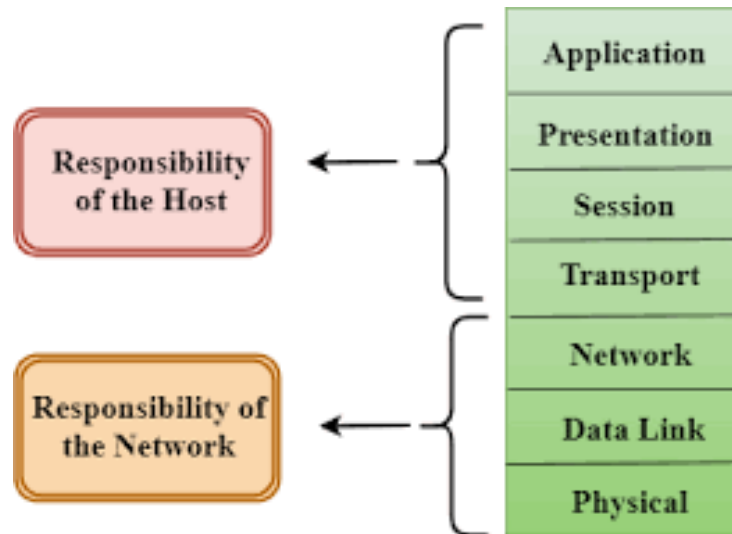


The functions of the presentation layer are :

Translation : For example, ASCII to EBCDIC.

Encryption/ Decryption : Data encryption translates the data into another form or code. The encrypted data is known as the cipher text and the decrypted data is known as plain text. A key value is used for encrypting as well as decrypting data.

Compression: Reduces the number of bits that need to be transmitted on the network.



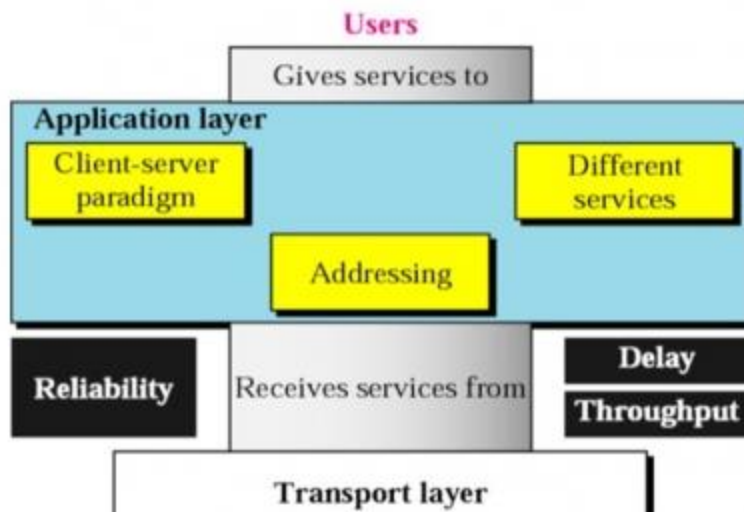
7. Application Layer (Layer 7) :

At the very top of the OSI Reference Model stack of layers, we find Application layer which is implemented by the network applications. These applications produce the data, which has to be transferred over the network. This layer also serves as a window for the application services to access the network and for displaying the received information to the user.

Ex: Application – Browsers, Skype Messenger etc.

**Application Layer is also called as Desktop Layer.

Application Layer



The functions of the Application layer are :

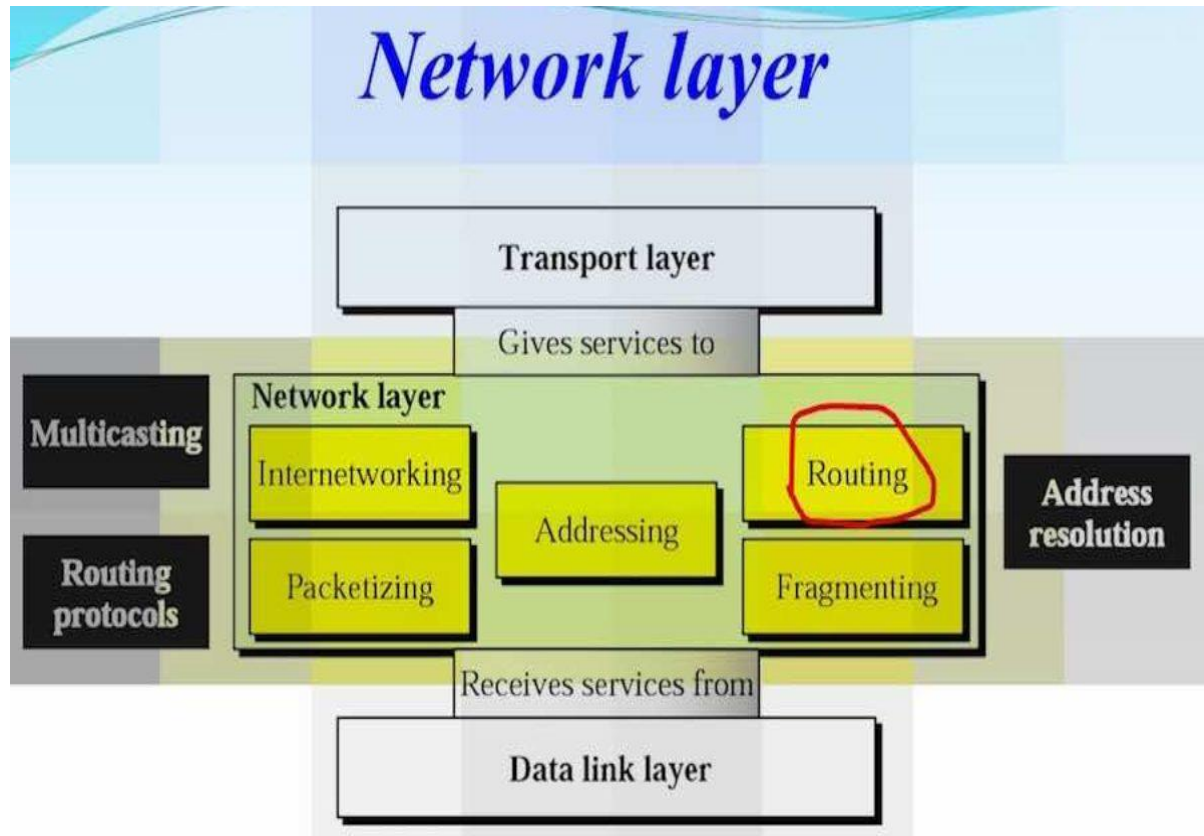
- Network Virtual Terminal
- FTAM-File transfer access and management
- Mail Services
- Directory Services

OSI model acts as a reference model and is not implemented in the Internet because of its late invention. Current model being used is the TCP/IP model.

I NETWORK LAYER

The Network Layer is the third layer of the OSI model. It handles the service requests from the transport layer and further forwards the

service request to the data link layer. The network layer translates the logical addresses into physical addresses.



Functions of Network Layer

Devices which work on Network Layer mainly focus on routing. Routing may include various tasks aimed to achieve a single goal.

These can be:

- Addressing devices and networks.
- Populating routing tables or static routes.

- Queuing incoming and outgoing data and then forwarding them according to quality of service constraints set for those packets.
- Internetworking between two different subnets.
- Delivering packets to destination with best efforts.
- Provides connection oriented and connection less mechanism.

Network Layer Features

With its standard functionalities, Layer 3 can provide various features as:

- Quality of service management
- Load balancing and link management
- Security
- Interrelation of different protocols and subnets with different schema.
- Different logical network design over the physical network design.
- L3 VPN and tunnels can be used to provide end to end dedicated connectivity.

59

BIOGENIC SYNTHESIS OF CuO NANOPARTICLES AND THEIR BIOMEDICAL APPLICATIONS

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Abstract

Synthesis of nanoparticles has drawn significant attention since the last few years. Metal oxides are important technological materials used in the chemical and electronic and photonic equipment as antibacterial, antioxidant, antihydrogen and catalysts. Due to advanced technology applications, researchers have concentrated more on CuO synthesizing nanoparticles, with enhanced and cost-efficient synthetic strategies for the setting. Nanoparticles of copper oxide appear as brownish-black powder. They can be reduced to metallic copper if exposed to high temperatures of hydrogen or carbon monoxide. The use of copper-oxide nanoparticles in a broad range of applications, including biological applications, catalysis, gas sensors, magnetic storage media, batteries, solar power transformers, semiconductor and field emissions. CuO, as a P-type semiconductor with a narrow band gap, received great attention because of its possible use in Nano applications, such as electronics, optoelectronics.

Keywords: - CuO, Nanoparticles, Green Synthesis Leaf Extract, Antioxidant, Antibacterial Photocatalytic Degradation

Introduction: -

In the past few decades, the interests of scientists in the field of science and technology at the nanometer scale continue to increase daily. Nano science and nanotechnology can cover all areas of science and technology, as every particle of material consists of atoms and molecules [1]. In science and technology, the last few years have been considered an advanced interdisciplinary area of study. Especially metal oxides nanoparticles, for their physical and chemical properties, are well known in their application in many fields of research, including chemistry, electronics, biomedical science, biosensors, molecular catalysts, magnet materials and drug-gene delivery [2].

Synthesis of new nanoparticles of different sizes and new morphology is the primary goal of nanoscience and nanotechnology. Due to changes in morphology, the effects on their vastly different properties are strong. Nanoparticles have gained great interest because of their peculiar properties and energy use that are strongly affected by their scale, morphology and structure.

Because of their distinctive properties between other metal oxides nanomaterials, cupric oxide nanomaterials have received a great deal of attention [3]. Cupric oxide nanoparticles are very important as they form the simplest member of the copper salt family and show a variety of potentially useful physical properties such as electron correlation effects, spin dynamics and superconductivity in high temperature.

Cupric oxide has demonstrated wide applications in the areas of energy conversion and storage, environmental science, and sensor. Cupric oxide is a semi-conductor p-type material with a small 1.2 eV band gap. In recent years, their particular characteristics and possible applications as heterogeneous catalysts, lithium-ion batteries, gas sensors, anti-bacterial products and solar cells have been taken into consideration. CuO NAPs are also robust, durable and have a longer shelf life in comparison with organic antimicrobials [4]. Silver, Gold and cupric oxides colloidal metal and metal oxide nanoparticles were widely used in opto-electronic, industrial and biomedical applications.

CuO nanoparticles have nonclinical crystallite structures that are used in various technological and scientific applications, thanks to their flexible physical and chemical properties. They were used as antibacterial agents, antioxidants, medication administrators and biomedical imaging agents. In the industrial sector, they are commonly used in the construction of batteries, gas sensors and field emitters as p-type half-conductors, transistors and transistors. Nanoparticles may modify their applications in accordance with form and size that directly affect the physical and chemical properties of cupric oxide nanoparticles.

In terms of energy saving, the viscosity of a fluid enhances and thus increases thermal conductivity by using copper oxide nanoparticles in energy-transferring fluids [5]. There are many methods to synthesize CuO NAPs in practice, but the use of plant extracts is progressively developing research fields known as green nanoparticle synthesis (NAPs). The plant-extract-mediated synthesis method showed direct impact on the morphology of copper oxide nanoparticles in some experimental parameters, i.e. mass ratio between copper salt and extract, nature of the plant extract,

temperature and reaction time [6,7].

Green synthesis of CuO nanoparticles: -

Since then, human beings have relied on plants for survival [8]. In the nature, aerobic organisms have been endowed with an internal defense mechanism resisting oxidative damage by reactive oxygen species [9]. Plants are well known to be the richest resorts of antioxidants. Plants have a large cradle in energetic natural products, which vary widely in building relations, biological characteristics and acting mechanism [10]. They function as antibacterial, anti-oxidants, anti-Hungarians, analgesics and anti-carcinogenic.

Compound antioxidants include tocopherols, alkaloids, flavonoids, carotenoids of glycosides, compounds of phenolics and agents [11]. Plants have been castoff as medicines for humanoid conditions for centuries [12]. Apart from this, various plants such as (*Abutilon indicium*) are currently also used for the green synthesis of nanoparticles [13].

Green synthesis can be beneficial compared to chemical or microbial approaches as it simplifies processes and leads to larger

production [14]. It was a lot of work to find suitable, non-toxic and natural products to prepare metal nanoparticles in an aqueous setting. Several natural materials have been used in the construction of nanoparticles, but plants seem to overrun the other competitors. Nanoparticles of plant origin are long-lasting, give different sizes and shapes and, moreover, can be produced much quicker [15].

Green chemistry is the biosynthesis by environmentally-friendly methods of metal or metal oxide nanoparticles. It means avoiding the use of harsh and harmful reduction agents (for example hydrazine hydrate, sodium borohydride, dimethyl formamide, ethylene glycol, etc.) and costly chemicals. Many of these reduction agents are regarded as major culprits of biological hazards and contribute to ecological toxicity.

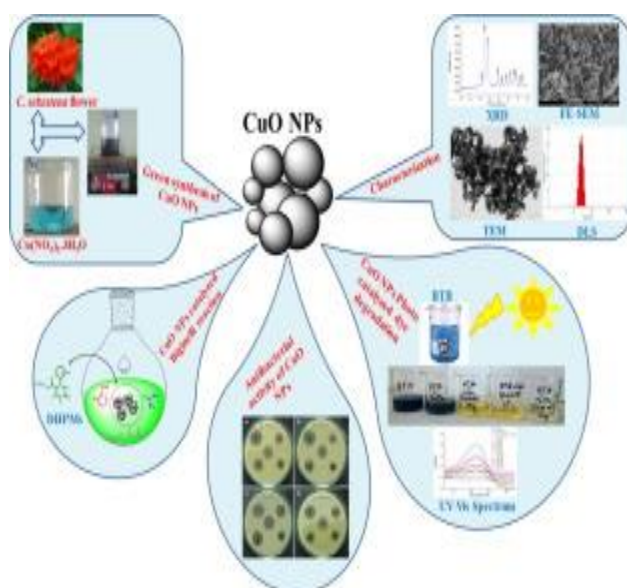
For the synthesis of nanomaterials with increasing interest, waste is reduced or completely removed and proper procedures and processes are implemented. We used the key genuine principles of green chemistry in these processes to develop natural and biomimetic procedures [16]. When we use chemical synthesis techniques, we then adsorb the chemical on the surface of the material, which has

great implications for our lives. Different factors in nanomaterial synthesis still remain the responsibility of the material chemists for the development of high-quality nanomaterials with regard to chemical purity, crystallinity, phase selectivity and homogeneity in dot-size and shape, with regulated accumulation in an inexpensive way.

As the understanding of green chemistry and other biological processes has increased, the demand for a green approach to nanoparticle preparation has grown. Nanoparticles from plant extract have been synthesized that provide an environmentally friendly atmosphere that benefits from environmental protection and compatible pharmaceutical materials and other biomedical applications. They do not use toxic substances in the manufacturing process [17]. Recently, materials scientists and researchers focused on green routes to create new routes for synthesizing nanoparticles. Greener processes are environmentally friendly, cheap, very cheap and free of harsh chemicals (Sankar, 2013).

The plant extract is combined with a certain mass ratio of metal salts on the basis of applied synthesis protocols facilitated by

distinctive plant extract nanoparticles synthesis. Nanoparticles are formed and various temperature ranges from a hundred degree centigrade room temperature. At different times than minutes to hours, nanoparticles are formed. Usually, large numbers of metabolites, such as terpenoids, tannins, flavonoids and proteins are present in plant extract, that reduce and stabilize agents [6,19].



Copper metal ion solution and a reduction in biological agent are the primary prerequisite for green synthesis of CuO NAPs. In most cases, capping agents or other constituents present in cells serve as stabilizing agents and capping agents, so capping and stabilizing agents from outside are not required.

Metal Ion Solution: -

The Cu^{++} ions and O^{2-} ions are a primary necessity for the composition of CuO NPs obtainable from different water-soluble copper salts. The majority of scientists, however, have used the aqueous solution $\text{Cu}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ with Cu^{++} ion concentration range from 0.1 to 10 mM (most usually 1 mM).

Biological reducing Agents:-

In biological systems, the reduction agents are widely distributed[6]. CuO NPs is synthesized under various conditions using different plants [13]. Data on the use of animal materials for CuO NP synthesis are not available until now, to the best of our knowledge. This restriction has led to the discussion of green synthesis of CuO NPs under headings plants and bio polymers. Using plant extracts, microbial cell biomass or cell-free growing medium and biopolymers[3], green CuO NP syntheses were performed. The plants for CuO NPs range from algae to angiosperms; however, minimal reporting is available on lower plants and angiosperm plants are the best choice [4].

Plant leaf, bark, root and stem were used for the synthesis of CuO NAP[6,7]. Medically important plants such as *Carica papaya* [6], *Gloriosa superba* [22], *Albizialebeck* [24], *Aloe green* [25], *Rauwolfia serpentine* [26], *Cissus quadrangularis* [27], *Tinosporacordifolia* [28], *Malva sylvestris* [29], *Rupusglaucus* [30], *Phyllanthus Amarus* [31], *Bifurcaria bifurcate* [31], *Talbernemus* [32], *Malva sylvestris* [23], *Rupusglaucus* [13], *Rupusglaucus* [23]. Some exotic weeds such as *Tridaxprocumbens* [34] have been utilized for CuO NAPs synthesis because of the lack of natural enemies and health problems.

The other category includes plant-producing alkaloids (*Carica papaya*) and essential oils (*Mentha piperita*) [35]. In certain cases except where external chemical agents, such as sodium-dodecyl sulphate, were used to stabilize CuO NAPs, all plant extracts played a dual role as a possible reduction and stabilizing agent[36]. The metabolites, proteins, and chlorophyll found to serve as capping agents for synthesized CuO NAPs in plant extracts [37]. In most cases the preferred solvent used for the extraction of reduction agents from the plant is water, while organic solvents like methanol [35], ethanol[36], and ethyl acetate are rarely reported[37].

Some scientists have pretreated plant materials in saline atmospheres [32] or acetone[33] before extracting. While the extracting solvents varied in total, the suspension of Nanoparticles only took place in aqueous medium. Synthesis with extracts from plants produces nanoparticles with a well-defined form, structure and morphology compared to those produced through the use of bark, tissue and plant-wide[38].

No special capsizing agent has been used to stabilize the synthesized CuO NAPs by many researchers, Among the many biopolymers that have been used for the synthesis of CuO NAPs, nearly all played the dual role of reducing and stabilizing agents, except for the use of starch as capping agents[39].

Separation of CuO NAPs:-

The centrifugation technique is primarily employed by researchers to obtain synthesized silver nanoparticles in the form of pellets or powders[31]. The CuO NAP suspensions have also been oven-dried for powder forming of the product[32]. UV-Vis Spectra, SEM, TEM, FTIR, XRD and EDAX or EDX/EDS are some of the typical features of CuO NAPs.

In addition to plant extracts and microorganisms, the DLS analysis is used primarily for CuO NPs synthesized from organic polymers. The possible zeta values show the stability of the synthesized CuO NPs. The effect of Cu (NO) $3.3H_2O$ and L-cystine on the organic composition of the CuO NPs is used for the purpose of thermogravimetric (TGA) analysis [58] to detect the amount of organic material in the synthesized CuO NPs [33] and to forecast the thermal stability of the CuO NPs [34]. A study of the concentration and conversion of CuO NPs was carried out inductively coupled plasma (ICP) [13].

Monitoring of CuO NPs:-

The presence of a faint brownish to dark brownish color in the colorless solution indicates that almost all researchers synthesize CuO NPs [20]. The SPR peak of synthesized CuO NPs was seen in the 400-450 nm range, a large CuO NP range [21]. The spectral UV-Vis analyzes have been used to evaluate the pH dependence, metal ion concentration, extract content for CuO NP formation, and to show the size-stability of the synthesized CuO NPs by showing red shifts in the SPR peaks with an increase in nanoparticle size and

blue shifts to decrease in size[23]. In most of the studies, the morphological SEM study found spherical structure for CuO NAPs[24]. Some studies have also revealed the CuO NAPs' floral and cube structure. Using XRD studies by almost all researchers, hexagonal crystalline, CuO NAPs were formed [13, 25].

The characteristic optical absorption range peak of approximately 2-3 KeV with a percentage of Cu and O weight of 45 percent to 80 percent was shown by EDS or EDAX for the analysis of elementary composition in nanomaterials[13]. The stability of synthesized CuO NAPs recorded varied between 1 day and 1 year, depending on the reducing agent and other operating conditions[29].

Factors affecting CuO NAPs synthesis:-

The principal physical and chemical parameters affecting CuO NAP synthesis are reaction temperature, ion content of the metal, extract content, reaction pH mixing, length of reaction and turmoil[40]. [40]. The size, shape and morphology of CuO NAPs are largely affected by parameters such as concentration of ions in metal, composition of extracts and reaction periods[41].

Most authors have stated that the basic medium for CuO NAP synthesis is appropriate, since the synthesized nanoparticles are better stable in the fundamental medium [13,31,35,40]. Fast growth (21,25,27,33,41), high yield and mono dispersity are other advantages recorded under the basic pH[42]. Increasing pH of the reaction mixture[43] has been used to synthesize small and uniform nanoparticles. Altering pH [44] transformed the almost spherical CuO NAPs to spherical CuO NAPs. However, very high pH ($\text{pH} > 11$) was linked to the disadvantage of the production of agglomerated and unstable CuO NAPs[41].

Reaction conditions such as stirring time and reaction temperature are significant parameters. Many researchers have been using plant extracts for CuO NAP synthesis at temperatures of up to 37-400 – C. The rise in temperature (37 to 400 livres per cent) resulted in an increased synthesis of CuO NAP [45] and also a synthesis of smaller CuO NAPs [46]. In total, most employees have synthesized CuO NAPs at room temperature (25 per cent to 37 per cent). CuO NAPs synthesized from algae, bryophytes, gymnosperms and bio-polymer sources were found to be below 50.0 nm and that

CuO NAPs synthesized from angiosperm sources were below 100 nm. The reaction mix synthesizing CuO NAPs with biopolymers was constantly agitated to protect agglomerations in comparison with plant extracts without the appropriate author's reason.

Reaction mixture agitation achieved through the application of external mechanical force will speed up nanoparticle formation. Sphere nanoparticles have become a flower like structure by aging of the synthesized CuO NAPs solution [47,48,49].

Applications of CuO NAPs:-

The recent research has shown that CuO NAPs have huge potential for applications, such as antimicrobial, anti-parasite and anti-fouling agents as site-specific drug agents, water purification systems etc, thanks to their unique characteristics. In the following sections the main features of each of these applications are discussed.

Anti-microbial Activity:-

In comparison to chemical synthesized CuO NAPs, the CuO NAPs show promising anti-microbial activity. Researchers have used various new techniques to validate and measure CuO NAPs' anti-

microbial activity. Different microbe strains have been used by scientists for this purpose, from positive grams, e.g. E. coli, etc. to negative grams, e.g. subtilis, Staphylococcus aureus, Klebsiella, etc.

Disc/Well Diffusion Methods:-

Many researchers use the disk diffusion process, a most frequently used technique to access the antimicrobial activity of a liquid, to confirm the antimicrobial effect of the green synthesized CuO NAP solution. This process dips into the ever greater concentrations of green synthesized CuO NAPs and places the intended microbe on the surface inoculated on the medium-sized nutrient disks.

The creation of an inhibition area around the disk represents the nanomaterials' antimicrobial action. Literature has found that the superior antimicrobial activity of verdant CuO NAPs was based on the permeation of the cell membrane by the copper ions freed from CuO nanoparticles and the destruction of its structure by fastening the negatively charged cell wall[6,13]. Copper ions released from CuO nanoparticles interlink nucleic acid strands via the binding of the strands with bacteria's DNA molecule.

This results in a disordered helical structure of the DNA molecule, resulting in protein denaturation and other biochemical processes of the cell that completely destroy the bacterial cell[13]. Factors which affect the sensitivity of the bacteria to the copper-oxide nanoparticle are particle size, nanoparticle synthesis temperature, bacterial cell wall structure and bacteria contact level of the nanoparticles [6,13].

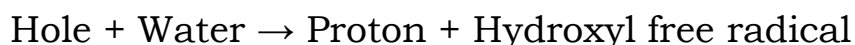
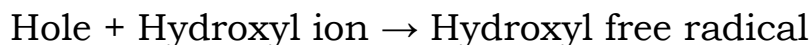
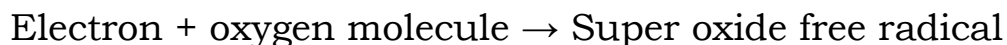
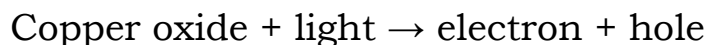
Antioxidant Activity:-

The green synthesized CuO NAPs show promising antioxidant activity. Researchers have been using many new techniques to validate and quantify green synthesized CuO NAP antioxidant activity[13]. Various methods, such as the radical DPPH scavenging assay, the ferric antioxidant reduction (FRAP) assay, total antioxidant tests, the ferric thiocyanate (FTCs) and the total phenolic content (TPCs) tests, were used to assess the green synthesized CuO NAP antioxidant activity by researchers.

In comparison to chemical synthesized CuO NAPs, all antioxidant test results demonstrated remarkable antioxidant potential of green CuO NAPs.

Photocatalytic degradation Activity:-

The degradation of different commercial grade organic dyes used as effluents was estimated in the photocatalytic degrade behavior of green synthesized CuO nanoparticles [13,28,35,37,41]. Various organic dyes i.e. Green synthesized CUO NAPs have disintegrated Acid Black 210, Methylene Blue, Methylene Red etc. Its behavior was regulated by adjusting the pH and changing the light medium from UV to sunlight. The UV-Visible spectrophotometer instrument was used by all the researchers in this activity. The organic dye disintegration takes place as follows,



Hydroxyl free radical + Dye → Product of Degradation Oxygen molecule



In the first step, light comes into contact with green copper oxide nanoparticles. It produces an electron and a hole for

photogeneration. This photogenerated electron reacts to superoxide free radical form by the oxygen molecule in the second step. In the third stage, the hole reacts to strongly mercurial hydroxyl radicals with water and hydroxyl ions.

Superoxide free radicals and hydroxyl free radicals react violently with the organic color and decolorize the organic color in the next step. The rate of degradation/decomposition of the organic dye totally depends on the photochemical catalyst's morphological and crystal structure. The activity of photocatalyst sites can be improved by increased surface and crystallinity, which increases the efficiency of photocatalytic reactions through the separation of electron-hole pairs. Literature has shown that the CuO nanoparticles disintegrated the organic dye fully into their respective products, i.e. NH₃, SO₂, H₂O and CO₂.

The CuO nanoparticles' high disintegrating power is due to their crystalline nature, as studies have shown that the higher the crystalline nature, the higher the disintegrative potential and the rate of disintegration [[13,28,35].

Summary for the Green synthesis of CuO Nanoparticles:-

Ijaz et al., [13] identified the syntheses of the use of eco-friendly techniques for copper oxide (CuO) nanoparticles and assessed their antimicrobial, antioxidant and photo-catalytic degradation capacity. For the synthesis of copper oxide nanoparticles from an aqueous extract of *Abutilon indicum*, a superficial (solution combustion method) was used. The nanoparticles of CuO have been characterized using x-ray diffraction (XRD), x-ray energy scatter (EDX), microscope scanning electron (SEM) and spectroscopic ultraviolet (UV-Vis) techniques.

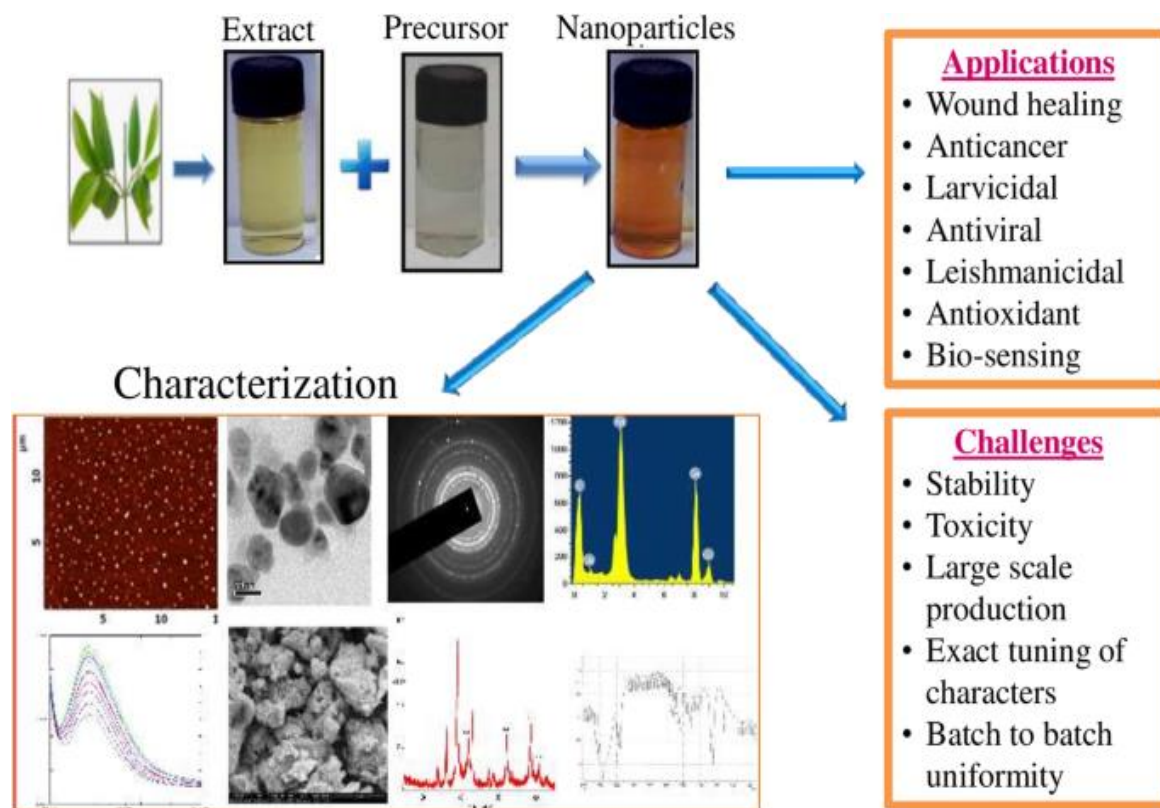
Antimicrobial activities of CuO nanoparticles have been calculated by an agar well diffusion method and DPPH radical scavenging, ferric reduction in the antioxidants strength (FRAP), total antioxidant, ferric thiocyanate (FTC) and total phenolic content (TPC) tests have been evaluated for their anti-oxidants properties. The degradation of Acid Black 210 (AB) dye under the radiation of the sun was assessed in photocatalytic degradation of synthesized CuO nanoparticles. The result XRD, EDX and SEM verified that CuO nanoparticles of 16.78 nm were successfully synthesized using

hexagonal, rooted and sponge crystal structures. Photocatalytic data show that nanoparticles are a strong catalyst of successful Acid Black 210 degradation.

There has also been impressive antioxidant activity of nanoparticles with IC₅₀ and FRAP values of 40 ± 0.23 to 84 ± 0.32 $\mu\text{g/mL}$ and 0.65 ± 0.01 to 9.10 ± 0.21 trolox equivalent/mL. The CuO nanoparticles against *Klebsiella* and *Bacillus subtilis* with an inhibition zone of 14 ± 0.05 and 15 ± 0.11 mm demonstrated significant bactericidal activity. The synthesized CuO nanoparticles have antibacterial and antioxidant potential and are good candidates for future therapeutic applications. They are good.

Fatih et al. [22] investigated the use of copper oxide nanoparticles as a reducer and as a capsulator in extract of medicinal plant (*Matricaria chamomilla*). The antioxidant properties of nanoparticles and their interface with DNA plasmid were also examined. Different techniques have been used to determine the chemical characterisation and morphology of nanoparticles, including UV-Vis spectroscopy, FTIR, DLS, XRD, EDX, SEM etc. The CuO NPs were 140 nm in diameter.

The form of such particles is spherical or more mono-distributed.



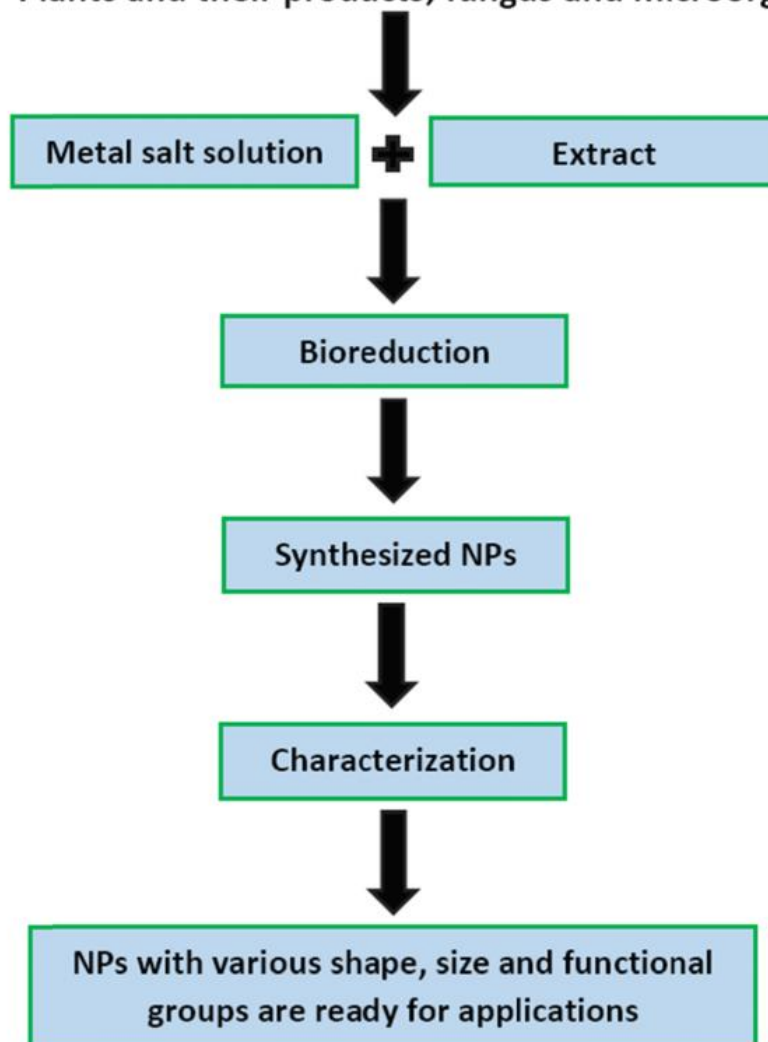
Gowdhami et al., [27] studied greenly synthesized CuO nanoparticles' antibacterial activity with the stem extract plant *Cissusquadrangularis*. The nanoparticles have been synthesized through UV-Vis spectroscopy, SEM, XRD, FTIR, as well as antibacterial activity of pathogens *S. aureus*, *E.coli*, *K. pneumoniae*, *P. aeruginosa*, *S. typhi*, *S. dysentery* and *V. cholera*. The hexagonal and cubic shapes of the synthesized particles. According to their SEM picture, the diameter of these particles was around 58 nm.

The substance obtained existed in pure phase, as the XRD results confirm. When the spectrum was observed by means of FTIR, intensive peaks were seen with a blue change, indicating a crystalline structure and shorter the lattice distance. They concluded that these NAPs demonstrated a great resistance to all the pathogen tested The nanoparticles used in the pharmaceutical industry as bactericides, disinfectants and germ killers are reliable for large-scale synthesis of inorganic materials as a method of green synthesis.

The solution combustion method was demonstrated by Naika et al. [23]. This is a greener method since extract *Gloriosa superba* L. used for synthesizing cupric oxide nanoparticles as a fuel. XRD studied the monoclinic nature of copper oxide nanoparticles. Blue shift cupric oxide value UV visible absorption spectrum nanoparticles were measured. The use of SEM images proved CuO nanoparticles are spherical in nature. Transmission electron microscope defined the size of the 5-10 nm range of copper oxide nanoparticles. Antimicrobial application against pathogenic microbial strains *K. aerogenes*, *P. desmolyticus* and *E. coli* is effectively shown to be Gram negative and *S. aureus* are Gram positive bacteria.



Plants and their products, fungus and microorganism



Jayakumarai et al.,[24] used the leaf extract *Albizialebbeck* for a very quick, efficient and rapid research green synthesis of copper oxide nanoparticles. Synthesized CuO NPs have been characterized by spectroscopy of SEM, EDS, TEM, XRD and UV-Vis. The size of nanoparticles of copper oxide is less than 100 nm and are all spherical in shape. The extract from *A. lebbeck* leaves has been proved to be an economical and efficient reduction agent for the bulk production of CuO NPs.

Kumar et al., [25] documented green approach to cupric oxide nanoparticles synthesis. This is a biological and environmentally friendly system. They were manufactured with the use of harmless *Aloe vera* leaf extract (PXRD) and TEM. These manufactured particles were contained in monoclinic phases with an average size of 20 nm. The increased antibacterial activities of such nanoparticles have also been demonstrated to combat those bacteria that cause severe infections in fish such as *A. hydrophila*, *P. fluorescens* and *F. branchiophilum* at even lower concentrations.

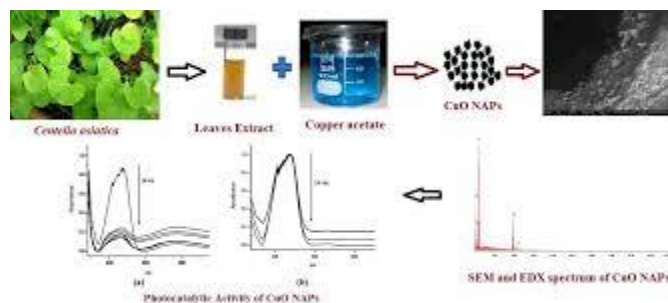
The method of combustion of copper oxide nanoparticles was studied by Lingaraju et al.[26]. The extract of *Rauwolfia serpentina*'s

aqueous leaf was used as combustion fuel. For characterization and morphology of nanoparticles, PXRD, SEM, UV-visible and TEM were used. The monoclinic crystals were developed as demonstrated by PXRD patterns. SEM showed a large surface area of a sponge-like picture. For the antibacterial properties of CuO nanoparticles, the Agar well diffusion method was used with Gram negatives *E. coli* (NCIM-5051) and *P. desmolyticum* (NCIM-2028) and Gram positive bacteria *S. aureus* (NCIM- 5022).

Udayabhanu et al., [28] also mentioned combustion solution. This green approach is very important for cupric oxide nanoparticles synthesis (CuO NAPs). In this process, *Tinosporacordifolia* water extract was used. For the morphology and characterisation of these nanoparticles they have used XRD, SEM, TEM and UV-visible.

As shown by XRD, the prepared nanoparticles were monoclinic crystallite structures. SEM photos determined sponge-like structure and large surface area. In TEM, the average crystalline dimensions were found to be 6–8 nm. CuO Nps revealed possible pathogens against *K. aerogenes*, *P. aeruginosa*, *E. coli* and *S. aureus*.

This was an environmentally safe and non-toxic approach used to prepare flexible cupric oxide nanoparticles for under-use remedial plants.



Awwad et al.,[29] recorded CuO synthesis with the use of *Malva sylvestris* leaf extract by an easy and green process. In order to characterize FT-IR, SEM, XRD and UV-vis spectroscopy, copper oxide nanoparticles were analyzed. The crystallite average size was 14 nm. The tunability of the structural characteristics of the cupric oxide nanoparticles was essential for this production by checking the ratio of the amount of *Malva sylvestris* leaf extract with copper ions. The synthesized CuO NPs showed significant antimicrobial activity in Grams-positive and Grams-negative microbes against pathogenic strain.

Brajesh et al., [30] stated the desired size biologically manufactured copper oxide nanoparticles (CuO-NPs).

The cupric oxide nanoparticles were made of 10 mM solution of copper nitrate with plant extract Andean Blackberry Fruit (ABF) and Leaf (ABL). They also evaluated their antioxidant activity. Using UV-visible, TEM, and XRD study, CuO-NPs were characterized. In their studies, antioxidant activities have also been identified.

The *Abutilon indicum* is largely grown in South Asia, according to Reyad-ul-ferdou et al., [39]. *A. indicum* plant contains a significant quantity of chemical components used in folk medicine. Golden yellow flowers and hairy *A. indum* stem found mainly in Pakistan and India. *Abutilon indicum* plant leaves have been used to treat various respiratory, erotic and sedative diseases. In several diseases such as astringent diuretic, expectorant, demulcent, anti-inflammatory and antihelmonic, plant bark, seeds, roots and oil have been used. Plant leaves were used for treatment in pile complaints. These plant flowers contained significant components that improve men's semen.

In plants measured in phytochemical analysis alkaloids, saponins, amino acids, flavonoids, glycosides and steroids were found. There are several possible pharmacological activities in this plant.

Acharyulu et al., [31] published the biological method for green manufacturing of CuO nanoparticles using a non-toxic and eco-friendly extract of *Phyllanthus amarus* leaf. Powder XRD study revealed CuO nanoparticles with an average size of 20 nm and a monoclinical form. These particles have also shown antibacterial properties for Gram+ve (*B. subtilis* and *S. aureus*) and Gram-ve (*E. coli* and *P. aeruginosa*). Antibacterial action against *B. subtilis* followed by *S. aureus*, *P. aeruginosa* and *E. coli* reportedly was much stronger.

Abboud et al., [32] also announced the manufacture of nanoparticles biologically focused. They said they had adapted a cheaper, safer and more powerful technology to manufacture these nanoparticles. They announced first use of brown algae (*Bifurcariabifurcata*) for the manufacture of 5-45 nm copper oxide nanoparticles. For the characterisation of these nanoparticles they used UV-visible and FT-IR spectrum analyses. X-ray diffraction has been used to describe copper oxide nanoparticles' crystallinity. The antibacterial effect of these nanoparticles on gram +ve and gram -ve bacteria has also been recorded.

Rajeshwari et al., [33] explained an environmentally friendly system. In this analysis, Indian plant *Tabernaemontana divaricate* extract was used in the preparation of biosynthesis cupric oxide nanoparticles. 50 percent leaf extract concentrations were used to synthesize cupric oxide nanoparticles that were extremely stable and spherical. These techniques were used to classify nanoparticles with UV-Vis, XRD, FT-IR, SEM, EDX and TEM. The average sizes were 48 ± 4 nm. In this study, cupric oxide nanoparticles had antimicrobial activity against urinary tract species.

Ali et al., [50] have published a new simple and cost-effective method of chemical reduction. The CuSO_4 , NaOH and NH_3 chemicals were used in situ to synthesize cotton cupro oxide nanoparticles. Copper sulphate decreases by the presence of cotton material that acts as a reductor and helps prepare Cu_2O as a stabiliser in the nanometer range. The synthesized cotton/nano cuprous oxide composite was characterized by these methods, such as XRD, SEM and EDX. In addition to cuprous oxide contact with cotton fiber, Fourier infrared spectroscopy was used to examine the altered functional group of cotton.

Manufactured nano-composites were used in antibacterial activities against pathogen such as *S. aureus* and *E. coli*. In addition, the handled fabric became strongly hydrophobic and sensed.

Prasanta et al. [38] published a green approach to cupric oxide nanoparticles synthesis. Coffee powder and tea leaves were used to synthesize CuO under microwave irradiations in this green approach. Cupric oxide nanoparticles were synthesized with a 540W microwave to irradiate metal salt and coffee and tea extracts in 3:1 ratios for around 7 to 8 minutes. To classify prepared particles, SEM, XRD, FT-IR and UV-Vis were used. To check the activity of these particles for six human pathogens. These particles demonstrated good activity against these pathogenic bacteria. These CuO nanoparticles have many advantages of ecological efficiency and usability for pharmaceutical and other biomedical applications.

The green process in the production of cupric oxide nanoparticles was studied by Renu et al. [35]. 5 mM CuSO₄ treated with extract of plant leaves (*Carica papaya*). To test the kinetics of the reaction, a UV-Vis spectrophotometer was used. Rod form cupric oxide nanoparticles with an average particle size of 140 nm were

shown by characterisation techniques such as SEM and DLS. Copper ions decreased when bioactive functional groups were analyzed by the FT-IR spectrometer. The crystallite nature of cupric oxide nanoparticles from the XRD spectrum has been confirmed. Nanoparticles of cupric oxide have catalytic behaviour. Coomassie bright blue R-250 coloration efficiently degraded under sunlight by cupric oxide nanoparticles.

Henam et al. [37] recorded use for the preparation of copper oxide nanoparticles at room temperature of *Centella asiatica* leaves extracts. This is an entirely green and environmentally friendly system. In this procedure, no poisonous and harmful solvent has been used. SEM, UV-Visible, IR and EDX were characterized for morphology and scale. CuO NAPs developed using this method were proposed for the catalytic photographic degradation of methyl orange. This catalytic effect of nanoparticles of copper oxide may lead to their tiny size. Due to its greater S/V ratio, nanoparticles have more active locations relative to bulk materials.

Ipsa et al. reviewed a new form of biology [20]. They were synthesized with clove by copper nanoparticles. Copper sulphate was

reduced to copper nanoparticles in the presence of clove extract. XRD verified the crystallite structure of copper nanoparticles. TEM revealed the size of copper nanoparticles in the 5-40 nm range. The spherical and granular nature of copper nanoparticles from SEM has been studied. Copper nanoparticles peak has been characterized to use UV spectrosopes for visible absorption.

Vinod et al., [21] stated that the catalytic, antibacterial, photonic, electronic, optical, and nanofluid activity of the copper oxide (CuO) nanoparticles, which are characteristic of all other nanomaterials, is determined by the aspect and shape of the particles. They demonstrated that these nanoparticles are manufactured using green technology using a natural non-toxic hydrocolloid, Gum karayas, and studied the antibacterial qualities of CuO nanoparticles.

The synthesis of cuprous oxide nanoparticles of the Fehling solution by *Tridaxprocumbens* leaf extract was stated by Gopalakrishnanaet al., [34]. They synthesized nanoparticles that are not harmful chemicals with the use of green technology.

Floor and flooring included water-soluble carbohydrates which played a major role in copper ion in cuprous oxide nano-size particles. Nanoparticles of cuprous oxide surface with polyaniline, using H₂O₂ as oxidizing agent, creating resistance to cupric oxide oxidation. Cuprous oxide nanoparticles and PANI coated cuprous oxide were synthesized in a range of different analytical techniques, including spectroscopy, XRD, SEM, UV-Vis and FT-IR. These particles have been tested using the disc diffusion method for a number of superplus infections and toxins in humans such as *E. coli*.

Soheyla et al., [40] have documented the biosynthesis of copper oxide nanoparticles using microorganisms, an emerging environmentally friendly manufacturing process. They synthesized copper oxide NPs with specified sizes and forms. They used the green method for nanoparticles processing. And there was stabilisation using *P. aurantiogriseum*, *P. citrinum* and *P. waksmanii*. These stabilizing organisms have been collected from the ground. This way, the NPs had uniform size and spherical shape. SEM was used to describe the form and the scale.

To assess the polydispersion of NPs, DLS was applied. The results were further verified by UV-VIS and the fluorescence spectrum by SEM and DLS.

Jiao et al., [36] documented process of metal hyper-accumulator. CuO/ZnO nanoparticles were synthesized from the metal hyper-accumulator plant process. This process is also used to purify radioactive and heavy metals contaminated soil. In this analysis, toxic metals were suggested from leaves and plant shoots. These poisonous metals have been passed from plants to animals and humans.

So it is easier to prepare nanoparticles by a hyper-accumulator plant. They obtained brassica juncea leaves close to the copper mine that are used as a raw chemical to synthesize Cu/ZnO nanoparticles. Ethanol was derived from plant leaves and extracted. Copper and zinc from Cu/Zn (NO₃)₂ reacted to HNO₃. Sodium hydroxide and ethanol were used for Cu/Zn chlorophyll precipitation. Around 97nm diameter of nanoparticles of synthesis.

Panneerselvam et al., [41] reporting the development by the wet impregnation technology of CuO/ZnO nano-photocatalyst light

assisted degradation of textiles dye. The samples CuO/ZnO were annealed at 550 °C for 5 hours from purple to grey, indicating that CuO clusters of the ZnO may not be metallic Cu, but it may be CuO-ZnO. TEM, DRS and XPS analysis were used to ensure that only the CuO phase is present as the prepared sample.

The effects of copper oxide nanoparticles and copper ions on the activity of antioxidant enzymes, lipid peroxidation rate and photosynthesis were studied by Nekrasova et al.[42]. They have indicated that the plants have accumulated NPs much more vigorously than the larger particles of the same material. They also demonstrated that both copper ions and NPs can oxidize the lipids. Catalase activity with NPs has increased by a factor of 1.5 to 2.0. The photosynthesis rate was reduced in the presence of concentrated copper ions and NPs, while the same depression was observed in the presence of NPs at 1.0 mg/l.

Rajendra et al. [43] The alcohol/nonionic polymer surfactant was used to prepare the nanostructured crystalline copper oxide. SEM, XRD, FTIR and UV-Vis were used for characterization TEM. The surface of metal nanoparticles was observed to depend on the

alcohol-to-anionic surfactant ratio. The largest surface area was obtained by synthesis using methanol. Catalytic activity for freshly prepared CuO nanoparticles has been tested.

Kooti et al., [44] proposed a simplistic way to prepare Cu₂O NPs with glucose as the reductive agent by reducing the Fehling solution. The method was very straightforward and simple. They also used copper sulfate for the processing of Fehling's solution and incorporated potassium sodium tartrate in alkaline mediums. Triton-X 100 has been used as surfactants for controlling the output of Fehling solution Cu₂O NPs. The results of the Cu₂O NPs were XRD, SEM, EDX, TEM and FTIR.

Abdul et al., [45] have set out a new approach to use Phormidium cyanobacterium for synthesizing cupric oxide nanoparticles. They have indicated that copper oxide nanoparticle synthesis occurs by extracellular copper ion hydrolysis, generated with certain anionic reductases, by bacteria under ambient and aerobic conditions.

Proteins reduce Cu (II) to nano-particles of copper oxide and help stabilize formed nanoparticles at room temperature.

These biologically synthesized NPs were characterized by analyzes of TEM, SEM, XRD and FTIR.

Guogang et al., [46] successfully tried to synthesize and characterize nanoparticles of copper oxide (CuO) with antimicrobial applications. They demonstrated the existence in nano-scale, thermal plasma technique of pure Cu and CuO nanoparticles. Particulate size was found with TEM in the range 20 to 95 nm. CuO nanoparticles have been screened for a number of bacterial pathogens, including *S. aureus* and *E. coli*, with minimal bactericidal levels from 100 µg/mL to 5000 µg/mL. The antibacterial activity of CuO NAPs in the presence of silver nanoparticles to decrease the population to zero.

Fei et al., [47] published hydrothermal system synthesis of CuO particles. The effect of hydrothermal temperature and time on NAP growth was investigated. For characterization, XRD, SEM, HRTEM, TEM and ED were used. The flower-like structures displayed high intensities of chemiluminescence and CO oxidation reactivation.

Dongyun et al., [48] analyzed the water-in-oil reverse micelles system based on TritonX-100. Cupric oxide nanoparticles were

synthesized with TritonX-100 in this study. Nanoparticles such as XRD and TEM have been characterized by different techniques. The water-to-surfactant ratio played an important role in grain size, morphology and distribution synthesis.

The control effect of dissolved water contents in reverse micelles was linked to an increase in the reactant exchange rate between micelles. This control effect also depends on the significant shift in reverse micelles' interfacial film flexibility with increasing quantity of water in the microemulsion.

Chun-Hong et al.,[49] recorded CuO NAP synthesis of approximately 40-420 nanometre. In aqueous solution, they adapted the seed-mediated process. Nanocubes are synthesized in the room after 2 hours. Cubes of Cu₂O have been synthesized to react to CuSO₄ with a mixture of sodium dodecyl sulfate reaction. Most likely, nanocubes produced by the regulated aggregation of Cu₂O particles. The surface reconstruction of nanocubes was influenced by SDS and sulfate ions.

The nanocubes showed optical characteristics are smaller than the absorbed 100 nm at ~490 nanometer. At 515–525 nm, the absorption band showed nanocubes to be bigger than 200 nm.

Conclusion:-

In the literature are available several cost-effective and environmentally safe methods for the synthesis of metal oxide nanoparticles such as copper oxide. A sufficient volume of published literature is available on the CuO NAP synthesis via green paths. Angiosperm varieties have been widely used for plants compared to other sources. Several methods and techniques of characterisation were used for the synthesis and validation of CuO NAPs. The CuO NAPs synthesized with biological capping and reducing agents showed a broad range of form and scale.

The anti-microbial activity of CuO NAPs has been widely studied among applications. Several methods have been developed for the performance of antibacterial studies and an elucidated mechanism of anti-microbial and antioxidants. However, the findings are contradictory and further work is needed to address this problem. The potential of CuO NAPs as drug carriers in cancer therapy, as

metabolite biosensors, as catalysts etc. is very high and demands extensive and integrated research to exploit them.

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Chapter - LVX

60

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING APPLICATIONS IN SMART PRODUCTION: PROGRESS, TRENDS, AND DIRECTIONS

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Abstract:

Adaptation and creativity for the manufacturing sector are extremely significant. This progress could contribute to sustainable production using new technologies. New technologies. Smart production needs global perspectives on smart production application technologies in order to encourage sustainability. In this regard, a range of AI-based techniques, such as machine learning, have already been established in the industry, thanks to the intense research efforts in the area of artificial intelligence (AI).

The objective of the current study therefore was to systematically review the scientific literature on the use of artificial intelligence and machine learning (ML) in industry. In reality, artificial intelligence and machine learning are considered to be the motor of the smart factory revolution in the implementation of Industry 4.0. The aim was to classify the literature, including year of publication, authors, scientific sector, region, institution and keywords. The research was carried out using the Science Web and the SCOPUS database. In addition, the software of UCINET and NVivo 12 was used to complete them.

A literature review on the empirical studies of ML and AI, published in the past century, highlighted developments in the field before and after the implementation of Industry 4.0 between 1999 and today. 82 papers have been reviewed and graded. A first important finding is the higher number of works published in the USA and the growing interest in Industry 4.0.

Keywords: artificial intelligence; machine learning; systematic literature review; applications; Industry 4.0; smart production; sustainability

1. Introduction

Intelligent production systems require creative solutions to enhance manufacturing activities' efficiency and sustainability while minimizing costs. In this sense, I4.0 Key Enabling Technologies (e.g. Internet of Thing, advanced embedded systems, cloud computing, big data, cognitive systems, virtual and enlarged reality) are willing to create new industrial paradigms [1].

In this respect, it is important to note that in the 1990s, John McCarthy, the father of artificial intelligence, called artificial intelligence "the science and engineering of making intelligent

machinery, and in particular intelligent computer programs." The word "AI" is generally used to simulate functions that human beings associate with other human minds, such as learning and problem solving [3].

Artificial intelligence areas are very broadly divided into 16 groups [4–8]. These include reasoning, programming, artificial life, revision of belief, data mining, distributed IA, expert systems, genetic algorithms, systems, representation of information, machine learning, comprehension of natural languages, neuronal networks, theorem proof, compliance, and computation theory [9-11].

The AI has become a major field of study in all fields in the twenty-first century: engineering, science, education, medicine, industry, accounting, finance, marketing, economy, stock exchange and law, for example [12–18]. The AI spectrum has expanded enormously since machine intelligence has produced deep impacts on companies, governments and society[19]. They also affect the broader trends in global sustainable development. Artificial intelligence can be useful for solving crucial problems in sustainable production (e.g., optimization of energy resources, logistics, supply

chain management, waste management, etc.). In this context, there is a trend to include AI in green manufacturing processes for more stringent environmental policy in smart production[20]. Indeed, as Hendrik Fink, Head of Sustainability Services at PricewaterhouseCoopers, said in March 2019, "if we integrate artificial intelligence correctly, we will achieve a sustainable revolution. The fourth industrial revolution will be driving force of AI"[21].

Subfields of AI, including machine learning, natural language processing, image processing and data mining, have therefore also become important topics in today's technological giants. The topic of AI is of great importance to the scientific community as technologies continue to evolve today.

ML's growth as an AI branch is very rapid now. Their use has spread to different areas, such as learning machines that are currently used in intelligent engineering, medical sciences, pharmacology, farming, archaeology, games, business etc.

According to the above considerations, a systematic literature review was conducted on AI and ML from 1999 to 2019. Therefore, a

classification system which refers to articles dealing with the two subjects jointly is considered essential to achieve greater variance and reflection. Moreover, the impact of other variables such as the thematic fields and the sectors in which technology is most prominent was studied to gain a deeper understanding.

The key contribution of this work is that it gives a summary of the current research.

For several years a variety of impressive documentations have been discussed on existing research methods and philosophy. Unfortunately, there is no comparison and integration between studies. A popular understanding of AI and ML research and their variations has been developed in this article.

This paper does not try to include an all-embracing framework on AI and ML research literature. It tries instead to provide a starting point for the integration of information into this field of study and proposes avenues for further research. It discusses studies in several new disciplines: pollution, medicine, maintenance, fabrication, etc.

Further research is necessary to expand the current AI system to include concepts and philosophies of some conventional

disciplines[22–24].

The aim of this document is not to cause a sudden spread of an already consolidated industry, but it is hoped that this report will serve as an important intellectual tool for reorienting work and for creating new intellectual opportunities. This paper provides useful insights and outlooks for AI and ML studies.

The ultimate goal was to predict the eventual transformation of discipline. This will be a journey which could change as new generations of scientists contribute to dialog and action. As previously pointed out, this study offers a critique, and thus provides the basis for future research. It not only provides a framework for possible comparisons, it also raises a range of new questions for research. Although the topics that could be used as the outcomes of this work are various, some of them are of particular interest or influence.

The document is arranged accordingly. Section 2 presents the framework suggested for the literature survey and details the research methodology adopted. The key findings of the bibliometric review are analyzed in Section 3. Finally, the key contribution of the

study is outlined in Section 4.

2. Methodology

The analytical approach combines bibliometric, content analysis, and techniques of the social network. This thesis performed state-of-the-art research on the SCOPUS and the Web of scientific databases. For the period of publication, the period from 1999 to 2019 was considered, with the aim of understanding how the level of attention to the subject shifted before and after industry 4.0. The methodology of analysis chosen for this thesis was a systematic examination of literature[25]. The key phases of the analysis were:

1. Phase 1: Research and Classification. The current phase was divided into three steps:

- Step 1: Identification;
- Step 2: Screening; and
- Step 3: Inclusion.

Bibliometric data were collected in Phase 1 (step 1). The total outcome was then screened to determine which documents can be considered, in line with the areas of study considered to be interesting and significant (step 2). The last move (Step 3) at the end

of that step was to pick the documents to be examined in detail.

2. Phase2: Analysis.

Once Step 1, the next phase, an analysis of the findings, was completed. Included was the method used for bibliometric analysis:

- the use of parameters for the studied indicators; and
- SNA (social network analysis) for keywords.

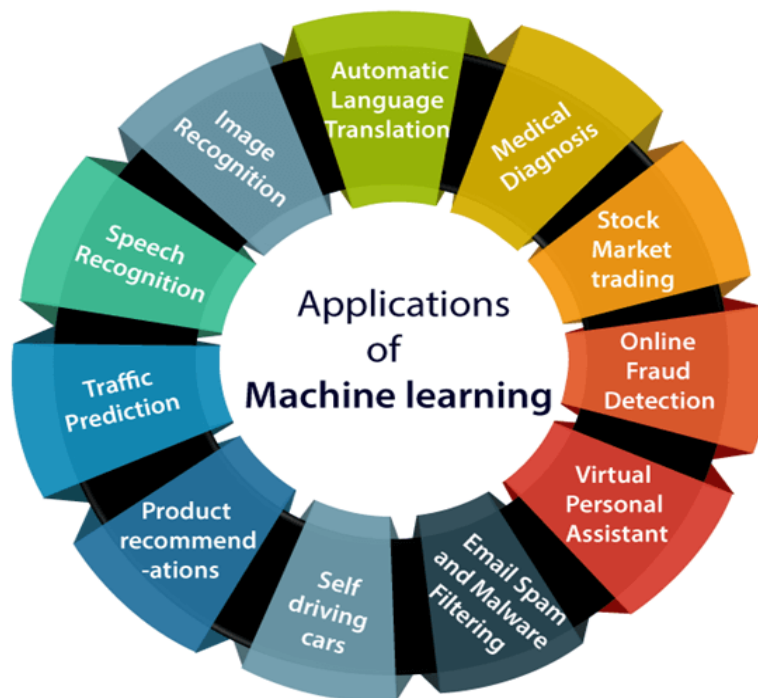
Total papers (TPs), which are the total number of articles and total quotes (TCs), were the metrics selected to conduct the study, which is the total number of citations.

SNA has been used in various social sciences and has recently been used in the analysis of various phenomena, such as foreign exchange, the distribution of knowledge, the study of institutions and the operation of organizations. In the use of this computable representation mode for complex and interdependent phenomena, the study of the use of the term SNA has grown exponentially in scientific literature. The UCINET program was used for the purpose of the study and was specifically designed for network construction and graphical processing, used for representing keywords in the network, and Excel for data input.

The UCINET, NetDraw program returned a sociometric network describing the class connections, i.e. data entered as input.

Furthermore, NVivo 12 software was used to evaluate the keywords in all documents, the leading qualitative research computer-assisted program (CAQDAS). In this particular case the potential connections between the keywords of the different documents analyzed were identified, creating conceptual schemes to render interpretive hypotheses.

3. Phase 3: The discussion. At the end of the second process, there was the third and final one, which addressed the findings and drawn conclusions.



3. Results of the Bibliometric Analysis

3.1. Phase 1: Classification and research The first stage consisted of the hunt for papers, which included the collection of materials from the academic universe. This first phase was split into the following three phases.

3.1.1. Identification (Step 1)

A study of Scopus (SCP) and Web of Science (WoS) databases was conducted using boolean operators for an extensive phenomenon survey. We started with the general keywords "artificial intelligence" AND "machine learning," AND "application," as presented for the Scopus and WoS databases.

To ensure the accuracy of the findings, the same keywords have been used in both databases and 20 years of time between 1999 and 2019 has been selected.

The selection of keywords for the survey was focused on the knowledge that AI and ML can be an effective tool to implement accountable business practices in the context of intelligent development. In this regard, it should be observed that it seemed fitting to concentrate our research on the theme of sustainability in

the increasingly urgent debates on climate change. The collection of papers therefore often considered sustainable applications.

A total of 13,512 documents were returned. Scopus findings are numerically higher than Web of Science (WOS): 12,445 for the first, and just 1081 for the second.

The result is not entirely unanticipated, and it can be found that Scopus as an Elsevier product collects data from all other databases, particularly Science Direct and Scirus search engines, while Web of Science (WoS) collects fewer records.

It was found from the documents extracted in Scopus that most of them are conference papers (57,28%) and publications thereafter (33.85 percent).

On the contrary, web science (WoS) research shows that the majority of documents are articles (46,12%) and, consequently, papers (42.86 percent).

AI started working in the 1940s and researchers demonstrated high aspirations until the 1970s, when severe difficulties were encountered and expenditure was significantly reduced.

Since then, the "AI winter" [26] has begun a long time: Despite

many achievements, including the Deep Blue method of IBM, which defeated world champion Garri Kasparov in the late 1990s, the AI solution research has only been going back for a couple of years. The I4.0, which considers AI as one of the primary main enabling technologies, has pushed for new technological growth (KETs).

From this time on, documents were added to the literature. After 2011, growth became evident as new innovations were introduced more regularly. Indeed, the fourth word of Industry appeared for the first time at the Hanover Messe in 2011 when the opening of the ceremony was discussed by Professor Wolfgang Wahlster, Director and CEO of the German Research Center for Artificial Intelligence.

In fact, the research shows that the number of published papers remained virtually constant until 2013 during the period considered (1999–2019), from which they experience an increase.

The increase in their adoption subsequently led researchers to keep pace with I4.0[27] development.

3.1.2. Screening (Step 2)

In the screening stage, an examination of documents defined by freedom of access was selected, except those with limitations, to

provide an overview of the topics and field interfaces and to limit the field to the thematic domains of scientific interest.

In this respect, the number of open access items has decreased dramatically (12,88 results for Scopus and 149 results for WoS) and a further reduction was also calculated by using the filter for thematic areas : 947 for Scopus and 60 for WoS.

Note how different are the number of filters applied. In reality, the databases provide the same search options, but the latter are more numerous and more organized in the Web of science (WoS) than Scopus in the particular case of the thematical sectors.

3.1.3. Inclusion (Step 3)

At the end of the screening procedure, the inclusion stage consisted of the collection of papers extracted from the last passage for inclusion in the sample of the bibliometric study. In this review stage, we reviewed the entire text of each document separately for eligibility purposes. We analyzed whether academic interests existed for each paper, whether case studies or actual implementations, ideas for new AI and ML algorithms or potential future scenarios included them. The final sample to be analyzed consisted of 60

Scopus documents and 22 WoS documents.

3.2. Phase 2: Analysis

The results of this analysis are presented and discussed in this section. First, a summary of the studies selected is given. Secondly, the review results are listed in the different sub-sections, one by one, according to the study criteria.

3.2.1. Top Highly Influential Analysis

This section lists the most frequently cited WoS and Scopus papers. The list is arranged according to research source, date, title, authors, source title and top quote (TP) in WoS or Scopus. The entire list is listed in Appendix A. If you look at Appendix A you will stress that the 2006 Larrañaga, Calvo, Santana et al. document[28] has the highest quote of 298. This article discusses and describes modelling approaches for machine learning in bioinformatics. In addition, the document year is 2006, before I4.0. Therefore, getting more years than today has a diffusion advantage. This means that it is one of the most important material in the university world, since it proposes some of the most useful modeling techniques, enabling the paper to become a leader in the field of computer science research.

Obviously, in general, all documents prior to I4.0 have more quotations than the most recent documents. It is important to remember, however, that even recent documents have a very large number of quotations relative to the year of publication. This reflects the interest of the scientific community in the subject.

The quote analysis showed that the first post, one of the most mentioned in the I4.0 period, is dated to 2016. The work, which was published by Krawczyk[29], proposes models of implementation for further development of the field of uneven learning, focusing on computer efficient, adaptive and real time methods, and provides discussion and suggested approaches to future studies in the subject-matter of the thesis. It has earned 119 quotes. In addition, the scientific community was devoted to an article written by Wuest, Weimer, Irgens et al.[30]. It offers an overview of the machine learning techniques available.

Finally, the quotation study showed that the total number of quotations from all documents is 16.58. This value is expected to rapidly increase in view of the interest in ML and AI issues.

3.2.2. Publications by Years

In accordance with the definition in section 3.1.1, the study shows the number of items included in the review is certainly low for the whole duration prior to I4.0. There are also two trout in the 2001–2008 and 2008–2011 periods shown. Thus, before it became a feasible I4.0 technology, technical applications were constrained in all respects only to have a technological peak as was foreseen.

As regards 2019, the statistic applies to the first months of the year, so it is possible that the literature will increase more in the course of the year. In addition, in the coming years an increase is expected in parallel with the I4.0 growth.

3.2.3. Most Collaborative Authors

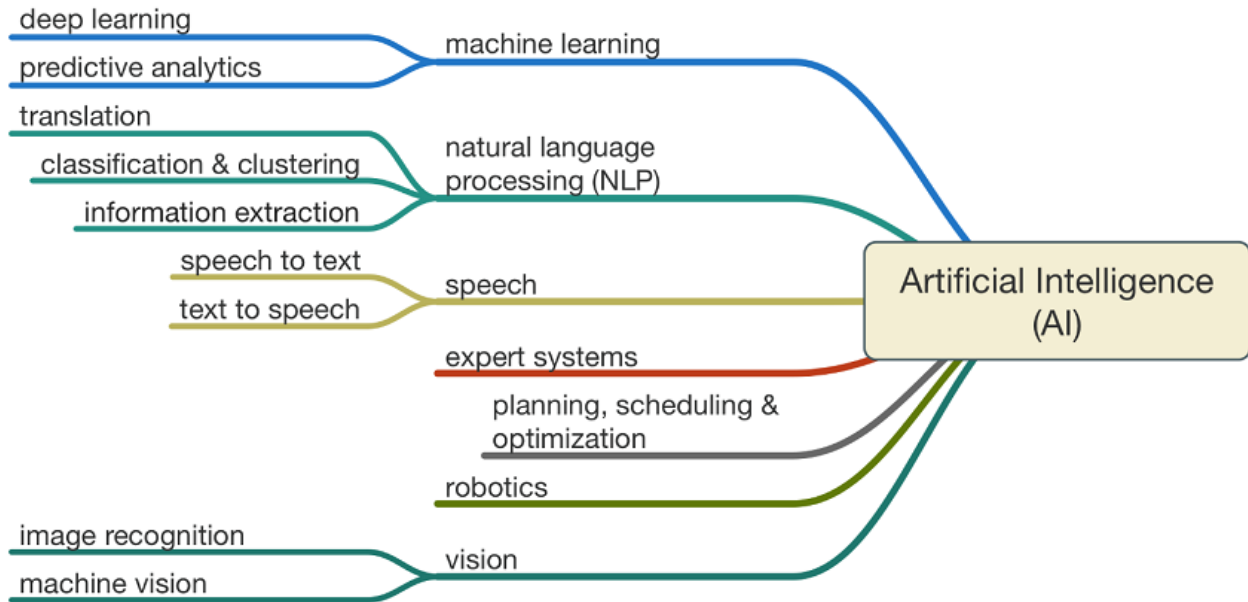
The research revealed that the majority of publications have more than one blogger. From this point of view, the number of writers for each text can be identified. Most manuscripts were manufactured by groups of two to five writers. Total papers (TPs), which is the total number of publications, were the metrics chosen for the study.

3.2.4. Research Areas Analysis

The total analysis of the research area from the 82 papers was 164, since each paper could be seen as more than one analysis of the research area. Given the limited number of documents listed before I4.0, the rating mainly applies to the current industrial revolution. The results also correspond in this case to the implementation of Paradigm 4.0, which accelerated study and technology adoption.

The first topics and disciplines in the ranking were computer science, engineering and biochemistry, genetics and molecular biology with 29%, 23% and 6% of publications, respectively. Moreover, the other disciplines for which applications are found are called transversal to the three first disciplines and this is the result of I4.0. The first three areas represent about 60 percent of the papers considered in terms of the percentage contribution.

In the top 20 fields of study, indicates a higher degree of concentration in the disciplines indicated above provided the frequency of distribution of the areas of research.



In reality, the first five areas cover around 70 percent of the papers examined in terms of the percentage contribution. Nevertheless, by counting only once study areas discovered, there are a total of 27.

This involves two things:

- The vast number of fields covered by this kind of study; and
- most papers include a cross-cutting approach: the subject-matter of each research is more than one field of application and thus includes more fields of research.

This confirms the broad interest in these topics from many areas.

3.2.5. Top Source Journals Analysis

In this section, the top 20 sources or journals that were published most frequently were extracted.

A journal is a time-bound publication with the objective of promoting and monitoring the progress of the discipline it represents.

In this specific case, the total source journals detected from the documents is 74, but, considering the top 20, given the frequency of the source journals' distribution, only the first 13 sources have more than one paper published, with a total percentage contribution of 43% of the total.

After analyzing the sources separately, the results obtained in the two databases were found to not be the same. In WoS, the top source journal was IEEE Access with two publications while in Scopus, the top source journals are Procedia Computer Science, Matec Web of Conferences, and Machine Learning with four publications, which contribute 5% of the total.

Aggregating the data collected from the two databases, the ranking moves to that obtained by Scopus, making sure that IEEE Access is no longer first in the standings, but only eighth, and that the former are precisely those of Scopus: Procedia Computer Science, Matec Web Of Conferences, and Machine Learning, with the same number of publications. Next, the 10 source journals have a 3%

publication contribution while the rest have a one-to-one relationship (1%) with the corresponding source journal.

The low level of concentration of the sources suggests that there is a great deal of interest in these topics from several scientific journals. As a matter of fact, it is foreseeable that specialized sector sources (AI Magazine and Machine Learning) are among the first 13; however, it is interesting to note that other sources are involved, such as Sustainability Switzerland or BMC Bioinformatics and Nuclear Engineering and Design.

3.2.6. Country Analysis

Results from studies on the two datasets are mutually compatible. In both cases, China and the United States are the countries that most contribute to science. This is apparent because more than 1.3 billion and 0.3 million people live in China and the United States and thus there are more researchers than in the single European countries. Germany published more papers than any other European country with a focus on Europe. This is not a random outcome: I4.0 was born in Germany and this was supposed to happen. However, from these data the following observation cannot

be ignored: The USA and China hold the first two positions on the list, although for European countries it is not the same. Europe has lost ground amid its skills and wealth. Presenting its artificial intelligence report, French deputy mathematician Cédric Villani said: "Europe must compete with China and the USA, protect its people and point the way to ethical issues." In Brussels, the rules of the twenty-first century will not be established, but in Shanghai. Intense geopolitical competition will redefine global relations of power is also a land of artificial intelligence.

Still, with regard to Europe, it is worth noting that France, Germany and Italy have stepped up tripartite cooperation since 2017 to facilitate the digitization of the manufacturing industry. We foresee a major development of intelligent production initiatives and therefore a rise in scientific research in this regard in the near future.

3.2.7. Affiliation Analysis

The total number of members of the 82 papers detected is 153. In this case, too, the magnitude of the affiliation distribution indicates that in most papers the corresponding affiliation is one-on-one. Only the first four affiliations have three papers (2%) and the

second four have two papers (1.3 percent of the contribution). This result informs us of the broad interest of several universities and research centers around the world in this field. The affiliate analysis then confirms the results of the country analysis. Indeed, if we try to add up the first eight affiliations by our own nation, the result is:

- Nine Chinese papers;
- Six German papers; and
- Five American papers.

The most significant event on artificial intelligence was held in Shanghai in September 2018. China is very committed to focusing on future technology.

For several months, China has become the world's leading scientific publishing force. At the end of the 20th century, China decided to do what the English-speaking people call a frog leap and concentrate on innovations from the 21st century.

China has more access to personal data than the United States and Europe, with its 800 million Internet users without any privacy policy.

3.2.8. Top Keywords Analysis

The top 20 keywords, which always appear in connection with each text, were extracted directly from NVivo 12.

The graphical representation, a word cloud type, of keywords has been extracted from this classification . It is noticed that the word used most often is precisely "computer," "learning" and "intelligence," which are more frequently used than all other words in the program.

The font size describes how indexed the keyword is. The tree words are another mode of representation . The most indexed terms in this case are also the ones seen in the larger boxes.

The most indexed terms with large numbers are obviously "learning," "machinery," and "intelligence." It is obvious that words that remember the technology itself were obtained from the first results, but it is worth noting that words referring to other AI applications are also indexed. The explanation is that AI and ML are technologies that cross all I4.0 sectors and thus do not stay circumscribed.

In particular, terms such as "information," "neural," "decision" and "management" are either very or average indexed, showing that

AI also covers many other sectors.

Another method to analyze keywords is the UCINET app, which analyzes social networks.

Social network analysis (SNA), also also known as the theory of social networks, is a new social relations technology.

SNA applies to various social sciences and has been recently used to study different phenomena, such as international commerce, distribution of knowledge, institutional research and organizational functioning. The study of the usage of the word SNA in scientific literature indicates that in the last five years the use of this computable representation mode of complex and interdependent phenomena has exponentially increased. The software gives a graph of a socio-metric network, that identifies the relationships within the class. Each relationship is represented by an arrow oriented.

The nodes are red-circular and match the most common keywords in which the terms computer, learning, artificial and intelligence are joined together to constitute the key words machine learning and artificial intelligence.

On the other hand, the leaves are depicted with blue squares

and match the objects. To make reading easier, the document titles have not been added but the ID count (Identification) for each document is shown in Appendix A.

First of all, the isolation of several leaves not attached to the nodes is noticeable. The corresponding documents are not identified by the keywords of the nodes. They are actually defined by keywords that have a unit order frequency.

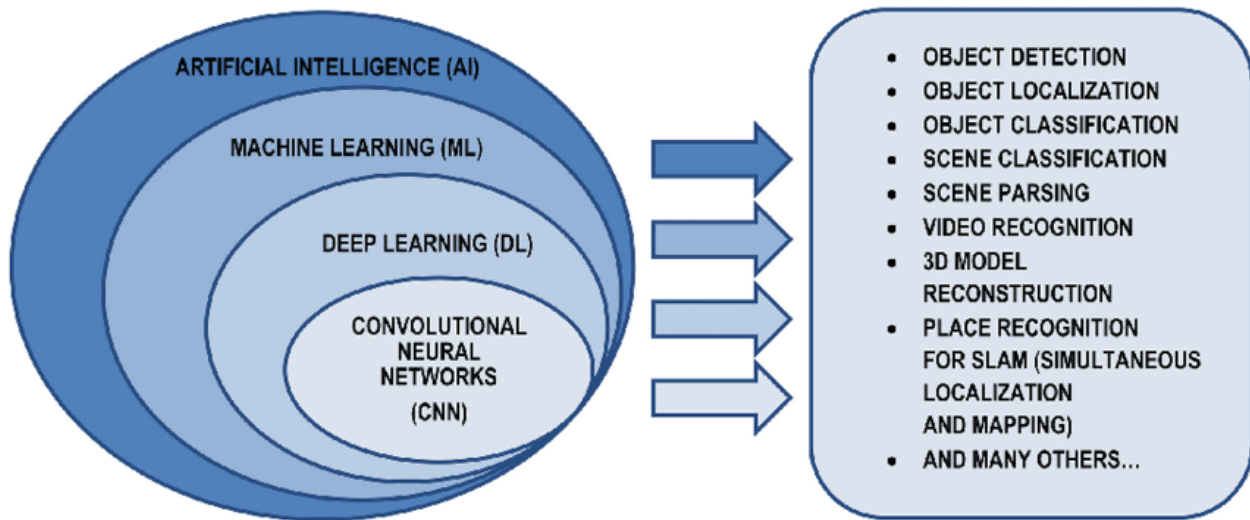
Another thing that can easily be seen is a greater density around the terms machine learning, decision, data, algorithm, framework, artificial intelligence, process and optimisation. This density is expressed in NVivo 12's cloud and box table. Therefore, these are the words most frequently used in the documents studied, stressing, again, that they include terminology that do not only concern the technical subject matter of research but also other fields of application.

3.3. Phase 3: Discussion

3.3.1. Benefits of Artificial Intelligence and Machine Learning in Industrial Contexts

The review of the research conducted revealed the first

knowledge that innovation and digitalization are becoming increasingly important in goods, services and processes. It also means that the introduction of advanced production technologies, such as AI and ML, is an evolving problem.



In other words, AI/ML algorithms are an opportunity for handling large-scale data and problems. The subject matter is of interest to all scientific sectors, but focuses on computer science and engineering.

In the industrial sectors, the most important advantages of AI and ML include: (1) improved creativity, (2) process optimisation, (3) capital optimisation and (4) improved efficiency.

AI with ML is, after all, one of today's most relevant inventions and transforms the economy and culture, as shown by the more than

340.000 patent applications filed since the 1950s.

The writers and affiliations are other knowledge which has emerged. Many of these are 1:1 compared to the chosen documents and this supports the fact that the technical applications have little interest in one direction, however, once again, the scientific community shows a wide interest.

Moreover, the countries most involved in scientific study are the United States, China and Europe.

This outcome is no surprise. As regards investment, the current efforts of the USA and China to gain dominance in the AI sector are far superior to those of other countries. More precisely, the ambition of China to become a world leader in AI by 2030 has been clearly expressed[31]. The "Made in China 2025" plan, dedicated to the manufacturing industry, includes China's utter plans; the "Internet+" plan is also dedicated to smart production and innovation.

New generations of researchers who lead to potential comparisons and new investigative issues may be a direct consequence of the above considerations.

3.3.2. Emerging Trends of Artificial Intelligence and Machine Learning in Sustainable Manufacturing

From a sustainability perspective, the analysis highlighted the potential of the latest paradigm of intelligent manufacturing to introduce profound changes in the sector, resolving scarce resources and enhancing productivity.

In reality, the survey indicated an increased interest in green production and sustainable development applications, showing that AI/ML play an important role in increasing sustainability by using smart materials and consuming electricity (i.e., reduction of energy consumption and pollutant emissions, environmental footprint monitoring and evaluation, etc.).

In addition, it has been noted that AI/ML algorithms offer a broad range of applications that provide a chance to grow sustainably, including inventory and supply chain management, predictive maintenance and production, involving many stakeholders from diverse countries and sectors.

In particular, Pérez-Ortiz, Jiménez-Fernández, Gutiérrez et al. [32] reviewed the most important renewable energy classification

algorithms. As a method for predictive analysis and consequently for preprocessing, interpretation of results or estimation of data, the key use of algorithms is to improve the management of energy and resources.

It has also been shown in this connection that AI/ML has been used successfully in various process optimization, manufacturing applications and predictive maintenance in different industries.

Lieber, Stolpe, Konrad et al. [33] publishes good research on the development of the steel industry. It proposes an approach to automatically preprocessing data from value series to increase process efficiency and product quality. This means that AI/ML techniques have been identified as promising prospects for improved quality control optimization in production systems.

Suitable implementation of IA/ML technologies will support sustainable production and the formation of the new smart manufacturing generation, including all aspects characterizing a sustainable operation, from supply chain management, quality control, predictive maintenance and energy consumption.

The main areas of sustainable production, their respective

primary targets and main AI/ML applications are summarized.

However, the relationship between I.4, AI/ML and sustainability calls for more conceptual and empirical research. The article recently published in Nature Sustainability is confirmed as one of the six transitions required to achieve sustainability goals, namely the Director of the Columbia University's Earth Institute, Jeffrey Sachs and other experts. And the so-called Fourth Industrial Revolution (made of artificial intelligence and other emerging technologies)[34].

4. Conclusions

This research centered on the research on the state-of-the-art applications for AI and ML, choosing literature for what has become an especially hot subject in science. The literature on any subject now available is extensive and it can be difficult or even impossible to cover all the documentation written on a certain subject. A systematic selection of the most important literature was then carried out. This paper offers a comprehensive analysis of applications using ML techniques in different scientific fields. Objective and straightforward methods of investigation were used for the collection of records, independently of the researchers' experience.

The goal of this report was not only to provide a thorough literature context on AI and ML research, but also to integrate information through research in this field and to propose potential research paths. It is necessary to note that this paper has only been created using two databases, namely WoS and Scopus, of which only open access documents have been used. As a consequence, several other papers, such as Google Scholar, with limited access and other indexing databases may be incorporated into future study.

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61

AN ANALYSIS OF DATA SECURITY AND PRIVACY IN CLOUD COMPUTING

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ABSTRACT

Cloud Computing is an important buzzword in today's computer world. Cloud is a global platform that allows digital information to be stored and distributed at very low cost and it is very fast to use. In present times since data storage requirements are huge many users are looking to store their invaluable data in more secure platforms such as Cloud. Cloud Computing is scalable, fast, flexible, and cost-effective technology platform for IT enabled services over the internet. Even though, there are various advantages of cloud computing, cloud service users have to still put their data under third party servers which are not directly controlled by the data owner.

The application software and databases in cloud computing are moved to large, centralized data centers, where the management of the data and services may not be trustworthy. Data security has consistently been a major issue in information technology. In cloud computing, mainly from government, industry and business users perspective, data security and privacy protection issues are relevant to both hardware and software parts of the cloud architecture.

Cloud security is becoming a key differentiator and adding competitive edge among different cloud providers. In spite of various benefits provided by the cloud computing services, cloud users are very much concerned about data security . This paper focuses on various issues regarding Cloud Computing, Data security, how cloud provides data integrity, confidentiality, availability over user's data and how data stored over cloud storage servers will be protected from attackers. Risk management of data present on the Cloud is another challenge. There is a requirement to identify the risks an organization would be taking while hosting data and services on the Cloud. In this paper, we present issues that are preventing people from adopting cloud and how to minimize these risks.

Keywords: Cloud Computing, Integrity, Confidentiality, Availability.

1. INTRODUCTION

There are several different definitions of cloud computing, but all of them agree on the way to provide services to users of the network. Cloud computing is an Internet-based development technology refers to the utilization of computing resources; hardware and software, available on demand as a service over the web. It offers

a variety of services for users of the network, like applications, storage, and various operations and remote printing. [1]. It typically involves over the web provision of dynamically scalable and sometimes virtualized resources [2]. Businesses are running all types of apps within the cloud. Cloud computing is often considered because the technology that keeps the info , uses in several applications and is remotely controlled without the necessity to download certain applications on computers.

A number of potential benefits that apply to most sorts of cloud computing includes the following:

- 1. Cost Savings:** Companies can utilize operational expenses and reduce their capital expenses for the sake of increasing their computing capabilities.
- 2. Flexibility:** The pliability of cloud computing allows companies to use additional resources in peak times, to enable them to satisfy consumer demands.
- 3. Reliability:** Services using multi-redundant sites can help in business continuity and disaster recovery.
- 4. Reduce Maintenance:** Cloud service providers do the system

maintenance that doesn't require application installations onto PCs.

5. Mobile Accessible: Mobile workers have increased productivity to systems accessibility in an infrastructure available from anywhere.

6. Transparency: Additional servers to be added to the provisioned service without interrupting the service or requiring reconfiguration of the appliance delivery solution. If the appliance delivery solution is integrated via a management API, then transparency is additionally achieved through the automated provisioning and de-provisioning of resources. .

The explanation of “cloud computing” from the National Institute of Standards and Technology (NIST) [2] is that cloud computing enables ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) which will be rapidly provisioned and released with minimal management effort or service provider interaction. According to the reason, cloud computing provides a convenient on-demand network access to a shared pool of configurable computing resources. Resources ask computing applications, network resources, platforms, software

services, virtual servers, and computing infrastructure. Cloud computing is often considered as a replacement computing archetype which will provide services on demand at a minimal cost. The three well-known and commonly used service models within the cloud paradigm are software as a Service(SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS)

In SaaS, software with the related data is deployed by a cloud service provider, and users can use it through the online browsers. In PaaS, a service provider facilitates services to the users with a group of software programs which will solve the precise tasks. In IaaS, the cloud service provider facilitates services to the users with virtual machines and storage to enhance their business capabilities.

Data security becomes more serious within the cloud computing environment, because data is scattered in different machines and storage devices including servers, PCs, and various mobile devices like wireless sensor networks and smart phones. Data security within the cloud computing is more complicated than data security within the traditional information systems.

Cloud computing environment provides two basic functions: computing and data storage. In the cloud computing environment, consumers of cloud services don't need anything and they can get access to their data and finish their computing tasks just through the web connectivity. During the access to the information and computing, the clients don't even know where the information are stored and which machines execute the computing tasks. Coming to data storage, protection of data and providing security are the main factors for gaining user's trust and making the cloud technology successful.

A number of knowledge protections and data security techniques are proposed within the research field of cloud computing. However, data protection related techniques have to be further enhanced. Services of cloud computing are provided across the whole computing spectrum. Nowadays, organizations and companies are moving and extending their business by adopting the cloud computing to lower their cost. The cloud is being used increasingly as it provides high performance computational services at lower cost.

Popular IT companies such as Amazon, Microsoft Azure, Google, Rock space have provided cloud service on the Internet

Cloud computing brings a number of attributes that require special attention when it comes to trusting the system. The trust of the whole system depends on the information protection and prevention techniques utilized in it. Different tools and techniques are tested and introduced by the researchers for data protection and prevention to realize and take away the hurdle of trust but there are still gaps which need attention and are required to be lined up by making these techniques better and effective.

The major issues within the cloud computing include resource security, resource management, and resource monitoring. Currently, there are no standard rules and regulations to deploy applications in the cloud, and there is a lack of standardization control in the cloud. In general there are three major threats that are identified in cloud computing, namely, security, privacy, and trust.

Security plays a critical role within the current era of long dreamed vision of computing as a utility.

2. CLOUD COMPUTING COMPONENTS & MODELS

Cloud Computing has been considered as the next generation architecture of IT Enterprise. The cloud computing is a type of network in which no central controller is present due to which security is a major issue of the network. This new paradigm makes many new security challenges.

Components in a cloud refers to platforms like front end, back end and cloud based delivery and the network that is used .The basic components of cloud computing in a simple topology are divided into 3 parts, namely clients, data center, and distributed servers.

Clients on cloud computing architecture are plain, old, and local area networks (LANs). They are mostly desktops, but they could even be laptops, tablet computers, mobile phones, and PDAs . Clients are interacting with cloud drivers to manage their information on the cloud.

Data center is a collection of servers, it might be an outsized room within the basement of your building filled with servers, or could be on the opposite side of the planet that you simply access via the web. A growing trend within the IT world is virtualizing servers.

That is, software are often installed allowing multiple instances of virtual servers to be used. In this way, you will have half a dozen virtual servers running on one physical server.

Distributed Servers may be a server placed in different locations. But the servers do not have to be housed in the same location. Often, servers are in geographically disparate locations.

Cloud Computing services have several components namely [3]

a. Cloud Clients, a computer or software specifically designed for the utilization of cloud computing based services

Example:

Mobile - Windows Mobile, Symbian

Thin Client - Windows Terminal Service, Cherry Pal

Thick Client - Internet Explorer, Fire Fox, Chrome

b. Cloud Services, services refer to products, solutions that are utilized are delivered through the media of internet.

Example : Identity - Open ID, OAuth, etc.

Integration - Amazon Simple Queue Service.

Payments - PayPal, Google Checkout.

Mapping - Google Maps, Yahoo! Maps.

c. Cloud Applications, Applications that use Cloud Computing in software architecture in order that users don't install but they will use the appliance employing a computer.

Example : Peer-to-peer - Bit Torrent, SETI, and others.

Web Application - Facebook.

SaaS - Google Apps, Salesforce.com, and others

d. Cloud Platform, a service within the sort of a computing platform consisting of hardware and infrastructure software. This service may be a service within the sort of a computing platform which contains infrastructure hardware and software.

Example : Web Application Frameworks - Python Django,

Ruby on Rails, .NET

Web Hosting Proprietary - Force.com

e. Cloud Storage, involves the method of storing data as a service.

Example

Database - Google Big Table, Amazon Simple DB.

Network Attached Storage - Nirvanix CloudNAS,

MobileMe iDisk.

f. Cloud Infrastructure, it is a service that delivers infrastructure as a service.

Example:

Grid Computing - Sun Grid.

Full Virtualization - GoGrid, Skytap.

Compute - Amazon Elastic Compute Cloud

Service Models of Cloud Computing

SAAS (Storage-as-a-service) - This refers to the disc space we use once we lack a storage platform and thus request it as a service

Database-as-a-service - This component acts as a database directly from a foreign server where its functionality and other features work as if physical DB is present on the local machine.

Information-as-a-service-Information which will be accessed remotely from anywhere called Information-as-a-Service. Highlight the flexibility of accessing information remotely.

Process-as-a-service-Unlike other components, this component combine various resources like data and services. This is mainly used for business processes where various key services and knowledge are combined to make a process.

Application-as-a-service (AaaS)-Because the name suggests, this is often an entire package for accessing and using applications. This is made to attach end users to the web and end users usually use browsers and therefore the internet to access this service.

Platform-as-a-service (PaaS) - During this component, the whole application development process takes place including creating, implementing, storing, and testing the database.

Integration-as-a-service - Mostly associated with application components that are built but must be integrated with other applications. This helps in mediating between remote servers and native machines.

Security-as-a-service - Because security is what most of the people expect within the cloud, this is often one among the foremost needed components. Management / governance-as-a-service (MaaS and GaaS) - this is often associated with cloud management, like resource utilization, virtualization, and server up and downtime management.

Testing-as-a-service(TaaS)-Using these components, remote-hosted applications are tested against design requirements, database

functionality, and security measures among other testing features.

Infrastructure-as-a-service (IaaS) - this is often an entire virtual consideration of networks, servers, software, and hardware on cloud platforms. Users won't be ready to monitor the backend process, but they're going to be presented with a system that's fully configured with all processes found out for direct use.

Deployment Models of Cloud Computing

We may have different types of deployment models, users may select a deployment model based on their requirements and availability[4].

a. Private Cloud: a cloud that is used exclusively by one organization. The cloud may be operated by the organization itself or a third party. If the private cloud is properly implemented and operated, it has reduced potential security concerns.

b. Public Cloud: a cloud that can be used (for a fee) by the general public, and involves an organization using a cloud infrastructure which is shared via the Internet with many other organizations and other members of the public; such as Microsoft, Google and Amazon [14]. Public cloud has variety of inherent security risks that need to

be considered.

c. Community Cloud: is shared by several organizations and is usually setup for their similar security requirements and a need to store or process data of similar sensitivity; such as several agencies of the same government [14].

d. Hybrid Cloud: is a combination of cloud deployment models. Each cloud is independently managed while applications and data would be allowed to move across the hybrid cloud. If more resources are required private cloud can be transferred into public cloud.(14) A specific business and technology requirements are used in designing hybrids, which helps to optimize security and privacy with a minimum IT costs

3. CLOUD COMPUTING SECURITY THREATS

Cloud computing provides cost savings and operational efficiencies to the users and organizations , it also leads to new security risks and uncertainties. The increased attack surface in a Cloud environment allows for other vulnerabilities to be exploited, thereby increasing the organization's risk .The risk is defined as a given threat that exploits vulnerabilities of an asset or group of assets

and thereby cause harm to the organization. The increased attacks in cloud environment are virtual switches and hypervisor that are not present in the traditional data center, allows for other vulnerabilities to be exploited, thereby increasing the organization's risk.

The most important threats are identified as below [5],[6] :

Data breaches: The most important thing is to prevent data violation.

The challenge addressing the threats of data loss and data leakage is that "the measures you put in place to improve one can worsen the other". Data is encrypted to reduce the impact of a violation, but if the encryption key is lost, then data

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a. Data breaches: The most important thing is to prevent data violation. The challenge addressing the threats of data loss and data leakage is that "the measures you put in place to improve one can worsen the other". Data is encrypted to reduce the impact of a violation, but if the encryption key is lost, then data will be lost. However, if offline backups of knowledge are chosen to scale back data loss, exposure data breaches are increased.

b. Data Loss/Leakage: There are some ways to compromise data due to insufficient authentication, authorization, and audit (AAA) controls, like deletion or alteration of records without a backup of the original content. Loss of an encoding key may end in effective destruction. Unauthorized parties may gain access to sensitive data. A malicious hacker might delete a target's data.

c. Account or Service hijacking: Different hijacking methods like phishing, fraud, and exploitation of software vulnerabilities still

produce results. If an attacker gains access to user credentials, he can pay attention to user activities and transactions, modifying the data, adding false information, and redirect the user clients to illegal sites.

d. Insecure Application Programming Interfaces APIs: These interfaces must be designed to protect the user against both accidental and malicious attempts. Some types of attacks including Anonymous access and reusable tokens or passwords, clear-text authentication or transmission of content, inflexible access controls or improper authorizations, limited monitoring and logging capabilities; are samples of this sort of threats.

e. Malicious insiders: A provider might not reveal how it allows employee's access to physical and virtual assets, how it monitors these employees, or how it analyzes. In cloud computing, the organization doesn't need to know the technical details of how the services are delivered. In situations, the risk is great. Without full knowledge and control, your organization could also be in danger.

f. Unknown risk Profile: in order to know about organizations security status some important factors that are to be considered are

Versions of software, modifications in the code , security policies and applications, vulnerability reports, interference attempts, and security design, and Information about who is sharing your infrastructure .

g. Cloud abuse: Some providers offer free limited trial periods. At this time , spammers, malicious code authors, and other criminals are ready to conduct their activities with relative vulnerabilities , such as password and key cracking. By using cloud servers a malicious hacker incorporates a Distributed Denial of Service (DDoS) attack, propagate malware, or share illegally copied software. The biggest challenge for cloud providers is how much data is hacked or modified by the hackers

h. Shared Technology Issues: (IaaS) is predicated on shared infrastructure (e.g. disk partitions, CPU caches, GPUs, etc.), were not designed to offer strong isolation properties for a multitenant architecture. A virtualization hypervisor mediates access between guest operating systems and therefore the physical compute resources. Overlooked flaws have allowed guest operating systems to realize unauthorized levels of control and/or influence on the

platform.

4. CLOUD COMPUTING SECURITY RISKS

Virtualized servers are less secure than the physical servers. Even though it's not possible to reduce, all risks by moving operations to a cloud environment, while some risks are reduced, other risks may increase. With the addition of virtual network switches, hypervisors and virtual images, the attack surface increases. A single host with multiple virtual machines may be attacked by one of the guest operating systems, or a guest operating system may be used to attack other guest operating systems.

- vulnerabilities are particularly risky because other virtual machines residing on the host and the data files stored outside the owner's trusted domain.
- Movement from one provider to other while unencrypted or logged access. Anyone sniffing the network has an opportunity to extract sensitive data such as passwords or logins.
- With virtualization, a customer's sensitive data is stored over a shared infrastructure that may be distributed on multiple sharing of servers and data centers.

- Organizations should consider their risks through anonymous signup, lack of validation, service fraud, and ad-hoc services.

Virtualized platforms Risks are:

- Management console vulnerabilities
- Management server vulnerabilities
- Administrative VM vulnerabilities
- VM vulnerabilities
- Hypervisor vulnerabilities
- Hypervisor escape

5. DATA SECURITY PROBLEM OF CLOUD COMPUTING

Security problems are identified as follows [7]

A. Security Problem Drive from VM

Whether the IBM's Blue Cloud or the Microsoft's Windows Azure, the virtual machine technology is taken into account as a cloud computing platform of the elemental component, the differences between Blue Cloud and Windows Azure is that virtual machine running on Linux operating system or Microsoft Windows operating system.

Virtual Machine technology bring obvious advantages, it allows

the operation of the server which is not any longer hooked in to the physical device, but on the virtual servers. In virtual machine, a phase change or migration doesn't affect the services provided by the service provider. If user need more services, without considering the hardware the provider can satisfies the user's needs.

However, the virtual server from the logical server group brings tons of security problems. The traditional data centre security measures on the sting of the hardware platform, while cloud computing could also be a server during a number of virtual servers, the virtual server may belong to different logical server group, therefore there's the likelihood of attacking one another ,which brings virtual servers tons of security threats. Virtual machine extending the sting of clouds makes the disappearance of the network boundary, thereby affecting most aspects of security.

B. The Existence of Super-user

For the enterprise providing cloud computing services, they need proper idea to hold out the management and maintenance, the existence of super-users greatly simplify the information

Management function, but it's a significant threat to user

privacy. Super-powers is a double edged sword, it brings convenience to users and at the same time poses a threat to users. In an era of private privacy, personal data should be really protected, and therefore the fact is that cloud computing platform can supply personal services within the confidentiality of private privacy on the existence of defects. Individual users and also the organizations have similar potential threats, e.g. corporate users and trade secrets stored within the cloud computing platform could also be stolen. Therefore the utilization of super user rights must be controlled within the cloud.

C. Consistency of Data

In Cloud environment the user's data transmits from the data centre to the user's client.

For the system, the user's data is changing all the time. In a virtual machine, there could also be different users' data which must be strictly managed. The traditional model of access control is made within the fringe of computers, so it's weak to regulate reading and writing among distributed computers. It is clear that traditional access control is clearly not suitable for cloud computing

environments. In the cloud computing environment, the normal access control mechanism has serious shortcomings.

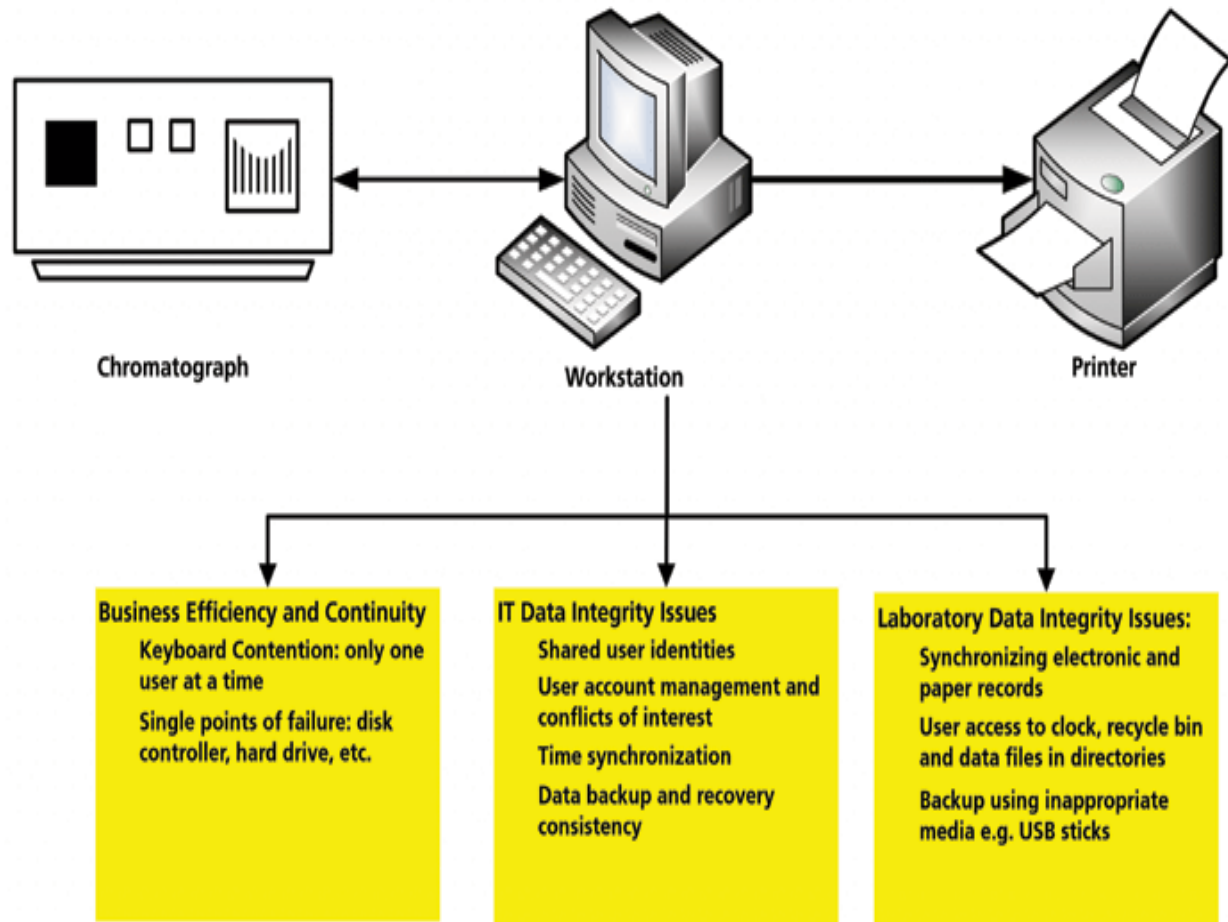
D New Technology

The concept of cloud computing is made on new architecture. The new architecture comprised of a spread of latest technologies, like Hadoop, Hbase, which reinforces the performance of cloud systems but brings in risks at an equivalent time. In the cloud environment, users create dynamic virtual organizations, first co-operation usually occurs during a relationship of trust between organizations instead of individual level. So those users supported the expression of restrictions on the idea of proof strategy is usually difficult to follow; which regularly occurs in many of the interactive nodes between the virtual machines.

6. DATA SECURITY ISSUES OF CLOUD COMPUTING

Cloud computing security means providing guard to virtualized IP, data, applications, services by using broad set of policies, technologies, applications, and controls .There are several types of threats associated with cloud data services like network eavesdropping, denial of service attacks, side channel attacks,

several vulnerabilities abuse of cloud services.



Data Integrity Issues

Data integrity demands maintaining and assuring the accuracy and completeness of data. A data owner always expects that her or his data during a cloud are often stored correctly and trustworthily. It means the info shouldn't be illegally tampered, improperly modified, deliberately deleted, or maliciously fabricated. If any

undesirable operations corrupt or delete the information, the owner should be ready to detect the corruption or loss. Further, when some of the outsourced data is corrupted or lost, it can still be retrieved by the information users.

Data integrity is one among the foremost critical elements in any data system. Generally, data integrity means protecting data from unauthorized deletion, modification, or fabrication. Data integrity is definitely achieved during a standalone system with one database. Data integrity in the standalone system is maintained via database constraints and transactions, which is usually finished by a database management system. Transactions should follow ACID (atomicity, consistency, isolation, and durability) properties to ensure data integrity.

Most databases support ACID transactions and may preserve data integrity. Authorization is employed to regulate the access of knowledge. It is the mechanism by which a system determines what level of access a specific authenticated user should need to secure resources controlled by the system.

Data integrity within the cloud system means preserving

information integrity. The data shouldn't be lost or modified by unauthorized users. Data integrity is that the basis to supply cloud computing service like SaaS, PaaS, and IaaS. Besides data storage of large-scaled data, cloud computing environment usually provides processing service.

The monitoring mechanisms offer the greater visibility into determining who or what may have altered data or system information, potentially affecting their integrity. Cloud computing providers are trusted to take care of data integrity and accuracy. However, it's necessary to create the third party supervision mechanism besides users and cloud service providers. Verifying the integrity of knowledge within the cloud remotely is that the prerequisite to deploy applications

Protecting Data Integrity

There are two traditional ways of proving the integrity of knowledge outsourced during a remote server; they are often by a client or by a 3rd party [10].

The first one is downloading the file then checking the hash value. In this way, a message authentication code algorithm is

employed. MAC algorithms take two inputs, which are a secret key and variable length of data, which produce one output, which is a Message authentication code or message digest. In this way this algorithm is run on the client side. After getting a MAC, the info owner outsources those data to the cloud. For checking the integrity after receiving the data , the data owner downloads the outsourced data and then calculates the MAC for it and compares it with the one calculated before outsourcing that data. By using this method accidental and intentional changes are going to be detected. Also, by using the key, the authenticity of knowledge are going to be protected and only the one who has the key can check the info authenticity and integrity.

For a large file, downloading and calculating the MAC of the file is an overwhelming process and takes a lot of time. Also, it's not practical since it consumes more bandwidth. Therefore, there's a requirement for employing a lighter technique, which is calculating the hashing value.

The other is to compute that hash value within the cloud by employing a hash tree. In this technique, the hash tree is made from

bottom to top. The owner of data only stores the root. When the owner must check his data, he asks for just root value and compares it with the one he has. This is also to some extent isn't practical because computing the hash value of an enormous number of values consumes more computation.

Sometimes, when the provided service is simply storage without computation, the user download the file, an equivalent as within the first case, or send it to 3rd party, which will consume more bandwidth. Therefore, there's a requirement to seek out how to see data integrity while saving bandwidth and computation power.

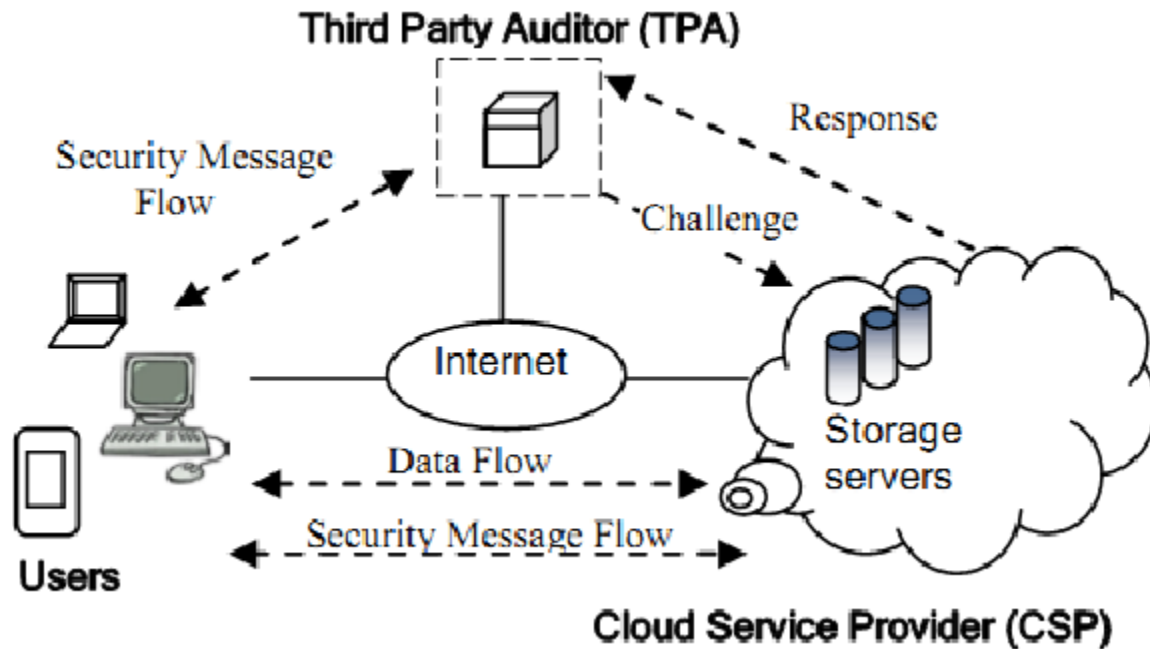
Remote data auditing, by which the info integrity or correctness of remotely stored data is investigated, has been given more attention recently [11], [12], [13], [14],[15], [16]

A. Third Party Auditor

Third Party Auditor (TPA) is the person who has the skills and experience to carry out all auditing processes. TPA scheme is employed for checking the info integrity. Since there are many incidents and doubtful actions, users of cloud storage depend upon third party auditors [17]. In [18], this scheme involves the data owner

in the auditing process. The owner is conscious of all his resources on the cloud. Therefore, this scheme guarantees the integrity of knowledge for all owner resources on the cloud. First, TPA uses normal auditing processes. Once they discover any modification to the information, the owner is notified about those changes.

The owner checks the logs of the auditing process to validate those changes. If the owner of the data suspects that unusual actions have happened, he can check his data by himself or by another auditor assigned by him. Therefore, the owner is usually tracking any modification to his own data. There is an assigned threshold value that a response from the third party auditor shouldn't exceed. The data owner validates all modifications lesser than or adequate to this threshold. If the time exceeds this threshold, the info owner is meant to try to surprise auditing.



B. Proof of Retrievability

Proof of Retrievability is a cryptographic approach based on a challenge response protocol in which a piece of data is proved to be intact and retrievable without retrieving it from the cloud. The simplest sort of proof of Retrievability is taking the hash of block employing a keyed hash function.

Owner of data takes the hash values of the file by using keyed hash function. After getting the hash values, the info owner keeps the key and therefore the hash values. the data owner sends the file to a foreign server. When the info owner must check his data Retrievability, he sends his key and asks the server to send the hash

values by using his key so as to compare them with the hash values that data owner has. The advantage of this solution is that it is simple and implementable.

However, there are many disadvantages such the info owner must store many keys so as to use one whenever . Also, the amount of checking is restricted by the amount of keys since the remote server could store all keys and therefore the hash values and use them when it is asked to prove having that file. In addition, it costs more resources on the side of a client and server since the hash values need to be calculated each time when the proof is required. Moreover, some thin client such mobile device and PDA does not have the resources to calculate the hash values of big files. In [21], they used an error correction code and spot checking to prove the possession and Retrievability of the information.

Before sending them to the remote server the verifier hides some sentinels. When the verifier wants to see Retrievability of the information , it only asks the server for those sentinels. In order to stay those sentinels indistinguishable for the remote server, the info owner encrypts the file after adding sentinels. In contrast to the

straightforward one, it uses one key no matter the dimensions of the file. Also, unlike the straightforward solution that the whole file is processed, it accesses only parts of file. Therefore, the I/O operations is less. This scheme has disadvantages such that the files need to be in encrypted form so it incurs computation overhead in clients.

C .Proof of Ownership

In this notation, the client proves ownership of the file outsourced by the client to server. The proof of ownership comes after the necessity to save lots of storage by duplication. The owner of the files needs to prove to the server he owns this file. In order to prove the ownership are the Collision Resistant Hash functions and Merkle Hash Tree. In [22],The owner of a file creates a Merkle Hash Tree (MHT) and sends the file to the cloud, called verifier.

Once it's received by cloud, the file is split into bits using pairwise independent hash then the verifier creates a Merkle Hash Tree for this file. Once the prover asks for the ownership of the file, the verifier sends a challenge, which is the root and the number of leaves. The prover calculates the sibling path and returns it to verifier as proof of ownership of this file. After receiving the sibling path, the

verified checks this path against what the merkle tree has and validates the prover.

Data Confidentiality Issues

Data confidentiality is important for users to store their private or confidential data in the cloud. Authentication and access control strategies are used to ensure data confidentiality. The data confidentiality, authentication, and access control issues in cloud computing could be addressed by increasing the cloud reliability and trustworthiness. Because the users do not trust the cloud providers and cloud storage service providers are virtually impossible to eliminate potential insider threat, it is very dangerous for users to store their sensitive data in cloud storage directly.

Simple encryption is faced with the key management problem and cannot support complex requirements such as query, parallel modification, and fine-grained authorization.

Data confidentiality is the property that data contents are not made available or disclosed to illegal users. Outsourced data is stored in a cloud and out of the owners' direct control. Only authorized users can access the sensitive data while others, including CSPs,

should not gain any information of the data. Meanwhile, data owners expect to fully utilize cloud data services, e.g., data search, data computation, and data sharing, without the leakage of the data contents to CSPs or other adversaries.

Usually the data is encrypted before it is outsourced. The service provider gets encrypted data. Therefore, it is considered not useful or meaningless. However, the client is responsible for handling the access control policy, encrypting the data, decrypting it and managing the cryptographic keys[56]. Even this would cause a burden to the user; sharing it with others exposes it to risks. When the data is shared among many users, there has to be more flexibility in the encryption process to handle users of the group, manage the keys between users, and enforce the access control policy in order to protect the data confidentiality[28]. Sharing the data among a group of users adds more burden on the owner of the outsourced data. In [30], the authors describe a cryptosystem in which the data owner encrypts the data by using his public key and identifiers called a class on the encryption process. Also, the owner has a master key to create others secret keys for one, some classes of data, or all classes

of cipher text. Once the user gets his aggregate key, he only decrypts the class of cipher text this key is for. It is an aggregate key where each part of it can decrypt part of the ciphertext. The whole key can decrypt the whole cipher text. Therefore, this cryptosystem helps in sharing data among a group of users with fine grain access control and without giving them a key that can decrypt all that data.

A. Access control:

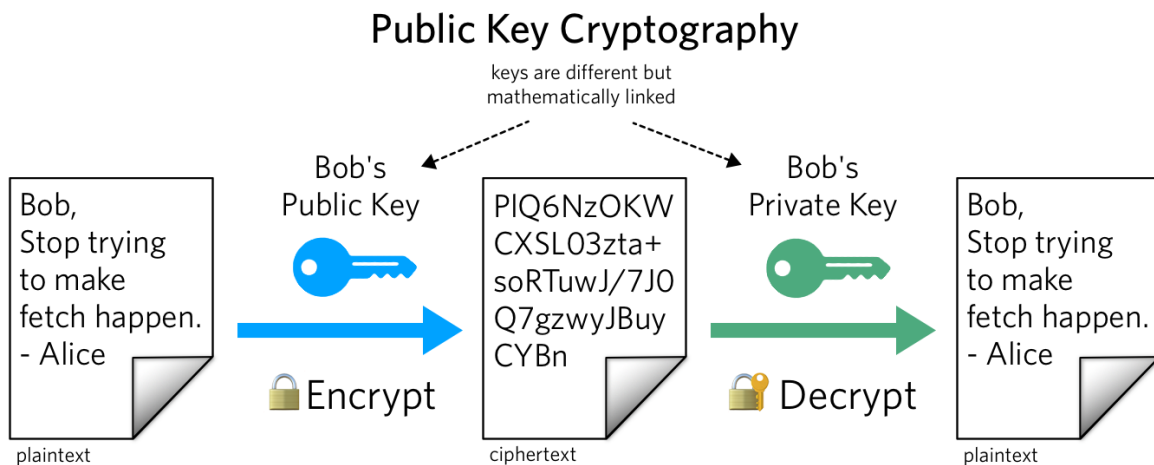
When data is outsourced to the cloud, which is untrusted because it is in a domain where security is not managed by the data owner, data security has to be given more attention. When one entity wants to share data, there has got to be a mechanism to limit who can access that data.

So many techniques were proposed to stay data content confidential and keep unauthorized entity from accessing and disclosing the info by using access control while permitting many authorized entities to share those data.

B. Public Key Encryption

Public key encryption is used to encrypt the data by using the public key. Only the one who has the private key can decrypt this

data. There are many issues that make this way hard to apply in the cloud when many people need to access those files. In [60], Sana et al. proposed a light-weight encryption algorithm by utilizing symmetric encryption performance to encrypt files and utilizing asymmetric encryption efficient security to distribute keys. There are many disadvantages of using this method. This solution is not flexible and scalable because encryption and decryption is needed when a user leave the group in order to prevent him from accessing the data



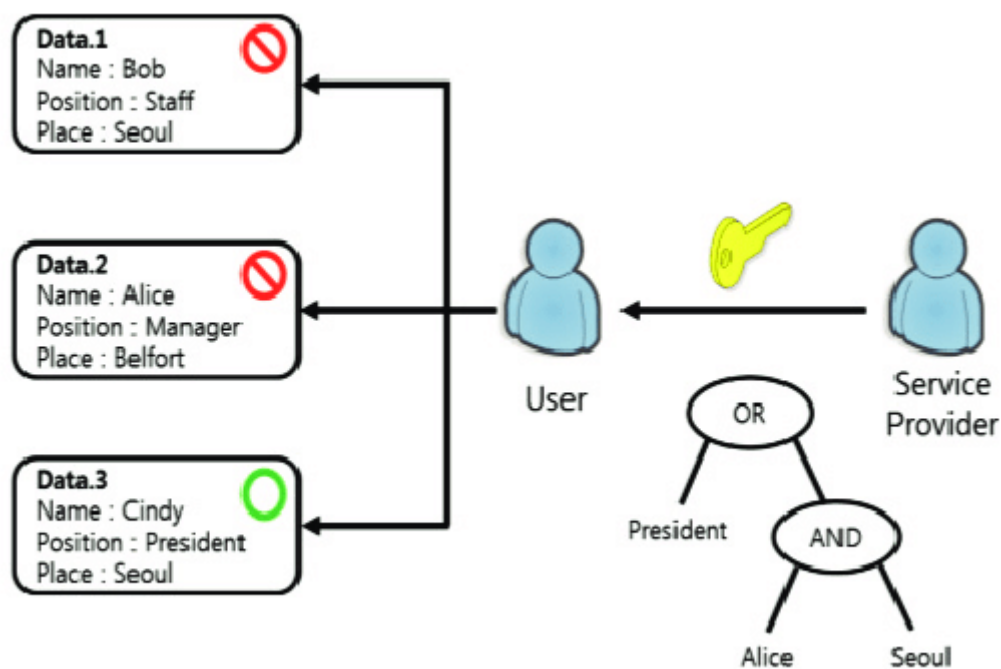
C. Identity-Based Encryption (IBE)

The owner of data can encrypt his data by specifying the identity of the authorized entity to decrypt it based on that entity's identity, which must match the one specified by the owner.

1. Attribute Based Encryption (ABE) In attribute based encryption, an identity of a user is identified by a set of attributes. This set of attributes generates the secret key. Also, it defines the access structure used for access control. This access controls are using encryption to encrypt data for confidentiality and share it among group of users. It is a kind of integrating the encryption with the access control. In [33], attribute-based encryption, know as fuzzy identity based encryption, was proposed a few years after IBE. In this scheme, a group of attributes identify someone's identity. Data owner encrypts his data and only the one who has attributes that overlap with the attributes specified in the cipher text can decrypt it.

2. Key Policy Attribute Based Encryption (KP-ABE): This is more general than ABE because it expresses more conditions than just matching the attributes to enforce more control. In this mechanism, cipher text is linked with a set of attributes. The private key is linked to monotonic access structure. This access structure is predicated on a tree to specify the identity of the user. When the user's private key has the attributes that satisfy the attribute in cipher text, the user decrypts the cipher text. The disadvantage of

this method is that the descriptor must trust the key generator to get keys for an accurate person with the proper access structure. If the info must be re-encrypted, the new private keys need to be issued so as to stay accessing that data. Therefore, there's a requirement to urge the policy related to the key.



Data Availability Issues

Data availability means the following: when accidents like hard disc damage, IDC fire, and network failures occur, the extent that user's data are often used or recovered and the way the users verify their data by techniques instead of counting on the credit guarantee by the cloud service provider alone.

The issue of storing data over the transaction servers may be a serious concern of clients because the cloud vendors are governed by the local laws and, therefore, the cloud clients should be cognizant of those laws. Moreover, the cloud service provider should make sure about the data security, particularly data confidentiality and integrity.

The cloud provider should share all such concerns with the client and build trust relationship during this connection. The cloud vendor should provide guarantees of knowledge safety and explain jurisdiction of local laws to the clients.

7. SECURITY CHALLENGES IN THE CIA

Confidentiality, Integrity and Availability (CIA) losses can make a big impact in the business of the cloud because the data is the core component for any business. Data integrity is that the assurance given to the digital information is uncorrupted and only be accessed by those authorized users. Thus, integrity involves maintaining the accuracy, consistency and trustworthiness of knowledge over its entire life cycle [8].

Maintaining CIA is simpler in enterprise computing but in cloud computing it's more complicated due to the multi-tenant architecture and therefore the distributed nature of the infrastructure. The following steps are to be maintained a correct CIA in cloud computing [8].

1. Once the data is created, classify the data, identify the sensitive data, define policies, and create access methods for different types of data. Also, create policies for data archive and data destroy.
2. Store data with proper physical and logical security protection, including the backup and recovery plan.
3. Identify which type of data can be shared, whom and how it can be shared and define data sharing policies. In cloud computing, many such policies are collectively called as Service Level Agreements (SLA).
4. Create a corrective action plan and apply in case data is corrupted or hacked due to network or communication devices.
5. Computation integrity refers to only the authorized applications are allowed to access the data and use it for computation. Any abnormality from normal computing should be avoided. An effective

Identity and Access Management (IAM) can avoid loss of confidentiality and integrity.

6. Loss of availability can happen through loss of knowledge and data inaccessibility. Cloud computing employs few techniques like scalability and high availability at the architecture level. There are different methods and procedures that are followed to enhance data security associated with the CIA at different stages of the information lifecycle. Some of the important methods are listed below:

1. Apply data encryption when the data is at rest and also when the data is in transit. Apply strong encryption algorithms like Advanced Encryption Standard (AES) and Rivest Shamir Adleman (RSA) algorithms.

2. Encryption methods are generally to provide confidentiality against attacks from a cloud provider, but it cannot protect data against configuration errors and software bugs [4]. Hash methods are often wont to determine accidental and intentional data changes. But they consume more bandwidth and time-consuming.

3. Third Party Auditing (TPA) can be employed to check for the data integrity. Many researchers [4, 18, 19] insists to audit data integrity

by third-party auditors because they are specialized there in .

4. Do not store the encryption keys along with the encrypted data .

5. Implement proper Identity and Access Management (IAM) techniques for users to access data.

8. HOW SAFE IS CLOUD STORAGE?

For data and security practices Cloud provides end-to-end visibility.

Vendors frequently offer centralized cloud storage controls for managing users and data. Clouds reduce and sometimes eliminate the necessity for on-premises security architecture which will be configured inconsistently or incorrectly. In order to reflect changing security threats Cloud storage providers update systems quickly .Clearly, cloud storage adds additional concerns and sometimes complexity to a knowledge security strategy that result in lower costs and better overall data protection[9].

Cloud Storage Security Best Practices

It's vital to determine a cloud storage framework and cloud storage security standards. Here are five cloud storage best practices[9].

1. Assess your cloud framework

Secure cloud storage requires a corporation to spot all the devices and apps that hook up with the cloud. It's also vital to know what cloud storage systems exist within an enterprise, who uses them and the way they use them. An organization are able to do high security cloud storage by mapping how data flows across systems, devices, applications, APIS and clouds.

In general many cloud storage applications display other apps and services they connect with. This can greatly simplify the task of mapping, and, if necessary, disconnecting from another app service.

2. Determine how cloud storage providers address privacy and security

Terms of service agreements are a good starting point for identifying the general protections a cloud provider offers. But it's not enough to make sure secure file storage. Cloud vendors frequently update terms of service and user agreements. This makes it relatively easy to overlook a seemingly minor change that can have a major impact on privacy and security. In addition, most agreements don't cover the details of how a cloud storage provider implements security,

what specific protections it uses, and what happens in the event of a breakdown or breach. As a result, it's important to define policies and procedures clearly.

3. Know what protections are in place

Cloud security encryption is a fundamental requirement. It's important to know how a cloud storage provider uses encryption, including in transit between data centres, servers and storage devices – along with who controls encryption keys and how they are applied to specific data sets. Likewise, an organization using a cloud provider should know who has access to systems and what other protections it has in place to protect against everything from distributed denial-of-service (DDoS) attacks to application security flaws.

4. Put data classification methods into motion

All data is not created equal. Treating it an equivalent may be a recipe for security failures inside or outside a cloud environment. What's more, data security is becoming more complex as organizations accumulate larger volumes of unstructured data. Consequently, it's important to understand the value of data, whether it should be stored in the cloud or archived on media such

as disk or tape, and how all of this translates into risk tolerance for the enterprise. Some cloud storage services offer built-in tools to provide these processes.

5. Use multi-factor authentication across all devices and systems.

The widespread use of multi-factor authentication can reduce the risk of someone gaining unauthorized access to a system or application and using it to unleash malware or gain a backdoor into other data.

While the danger could also be greater for administrator accounts, it doesn't disappear for normal applications and tools. Multi-factor authentication can aid in protecting sensitive data from hackers, disgruntled employees and other insiders that may intentionally or inadvertently put data at risk. In the end, an enterprise can achieve strong cloud data security by focusing on computing and data frameworks across vendors, and learning how to use and manage new tools and techniques. It's also essential to figure closely with cloud providers to make sure that data storage security methods meet their requirements. A best practice approach

helps an enterprise achieve the foremost secure cloud storage possible.

9. CONCLUSIONS

Cloud computing may be a promising and emerging technology for subsequent generation of IT applications.

The barrier and hurdles toward the rapid climb of cloud computing are data security and privacy issues. Reducing data storage and processing cost may be a mandatory requirement of any organization, and knowledge is usually the foremost important tasks altogether the organizations for decision making. So no organizations will transfer their data or information to the cloud until the trust is made between the cloud service providers and consumers. However, there are many security issue concerns with this technology as it is natural with any emerging technology.

Those issues are related to confidentiality of data from unauthorized people in remote sites, integrity of stored data in remote servers and therefore the availability of the information when it is needed. Also, when sharing data in cloud, if the cloud service provider is mistrusted it is an issue. These issues include issues

related to the previous issues of the internet, network issues, application issues, and storage issues. Storing data in a remote server leads to some security issues .A number of techniques have been proposed by researchers for data protection and to attain highest level of data security in the cloud.

Many studies have been conducted to discover the issues that affect confidentiality, integrity, and availability of data to find a solution for them. Those solutions will lead to more secure cloud storage, which will also lead to more acceptance from the people and the trust on the cloud will increase. More work is required in the area of cloud computing to make it acceptable by the cloud service consumers. In order to provide a secure environment and to protect sensitive static and dynamic data on cloud computing, firstly, components and service models and deployment models are explained, and then different threats, vulnerabilities and risks are explained.

With the increase in the growth of cloud computing, security needs to be analyzed frequently. The users should be aware of the different security problems present in the current cloud computing

environment before being a part of the environment. In This paper we have identified the most data security and Data Integrity, confidentiality, and availability issues, which may be considered in cloud computing both by users and providers.

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62

A THEORETICAL STUDY ON AMONG NETIZENS BEHAVIOUR IN SOCIAL MEDIA AND CYBER BULLYING IN INDIA

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Abstract:

Teenagers spend most of their free time posting pictures, constantly updating status messages, peeking at friends' profiles to see what they have been up to, liking and commenting on posts that show up in their news feed for everybody in their circle to see. Internet has also enabled students to socialize with complete strangers from even the remotest parts of the world. All these have not only gotten them hooked but is also exposing them to trouble that they may find very hard to recover from, if hit, trouble that is otherwise known as Cyber Bullying or more popularly known as online Bullying. In a recent Global Youth Online Behavior Survey by Microsoft in 25 countries such as United States, United Kingdom, Australia, Germany, Pakistan, India, Japan etc., has India ranked third in cyber-bullying. Several cases of suicides among adolescents due to Online harassment by peers, like the Amanda Todd incident, has been reported around the world.

Introduction:

India is the third biggest Facebook market with nearly four crore, 98 lakh Facebook users according to the social media company Socialbakers. SemioCast, a social media monitoring tool, has rated India as the sixth highest user of Twitter. While globally the negative side of unmitigated use of social media is articulated, India has embraced social media without being too bothered about its possible hazards.

Television is no longer the king as Socialogue; recent research shows that a survey on social media trends and behaviour, Indians would prefer giving up television than social networking sites. It is revealed that people preferred a large network of new friends group as compared to close friends. India may have reason to celebrate its rising social media usage rankings, but it is yet to come to terms with its potential negatives, especially for teenagers, who form the bulk of the users in the country

A Microsoft study sounded off alarm bells when it revealed that more than 50% of the children in India using the net were either threatened or harassed online.

The 'Global Youth Online Behaviour Survey' conducted by Microsoft, revealed that 53% of the surveyed children aged between eight and 17 in India admitted they were victims of cyber bullying. Cyber bullies come in all shapes and sizes—almost anyone with an Internet connection or mobile phone can cyber bully someone else, often without having to reveal their true identity. cyber bullies can torment their victims 24 hours a day and the bullying can follow the victim anywhere so that no place, not even home, ever feels safe, and with a few clicks the humiliation can be witnessed by hundreds or even thousands of people online. Technology means that bullying is no longer limited to schoolyards or street corners.

Cyberbullying can occur anywhere, even at home, via email, texts, cell phones, and social media websites 24 hours a day, seven days a week, with potentially hundreds of people involved. For those who suffer cyberbullying, the effects can be devastating, leaving you feeling hurt, humiliated, angry, depressed, or even suicidal. But no type of bullying should ever be tolerated. Cyberbullying occurs when a child or teen uses the Internet, emails, text messages, instant messaging, social media websites, online forums, chat rooms, or

other digital technology to harass, threaten, or humiliate another child or teen. Unlike traditional bullying, cyberbullying doesn't require physical strength or face-to-face contact and isn't limited to just a handful of witnesses at a time.

Cyber bullying is defined by Smith *et al.* as an “aggressive, intentional act carried out by a group or individual, using electronic forms of contact, repeatedly and over time against a victim who cannot easily defend himself or herself. Most definitions of bullying rely upon three criteria; intent to harm, imbalance of power, and repetition of the act. Cyber bullying also can happen accidentally. The impersonal nature of text messages, instant messages, and e-mails makes it very hard to detect the sender's tone – one person's joke could be another's hurtful insult. However, a repeated pattern is rarely accidental.

In case of cyber bullying, this becomes relatively easy, where the power of one click is immense and increases the audience by thousands, thus increasing the humiliation and impact of bullying exponentially. The scope of cyber bullying is vast, in terms of means as well as content.

It includes bullying through text messages, phone calls, e-mails, instant messengers, social media platforms, or in chat rooms. It varies from posting hurtful words, derogatory comments, posting fake information on public forums or blogs, hacking accounts for personal vendetta to rape or death threats. It can be as ruinous as revenge porn, which is posting sexually explicit images or videos of a person on the Internet, typically by a former sexual partner, without the consent of the subject and in order to cause them distress or embarrassment.

The impact of such acts can be catastrophic, especially for young adults, who feel so embarrassed and humiliated that they cannot imagine surviving the next morning, and end up taking extreme steps which include harm to self and occasionally, others. It deeply reflects the real-world problems arising out of the virtual cyberspace. No longer limited to schoolyards or street corners, it has now moved to WhatsApp, Snapchat, Twitter, Facebook, etc., where online polls are conducted to body shame the victim and groups are made to spread false rumors or share morphed pictures and videos, to a rather vast audience with the power of the Internet, which would

not have been so easily possible in the physical world otherwise. Cyber bullying also differs from traditional bullying in offering potential anonymity to the bully and difficulty in identifying the victim. This combined with the obvious lack of monitoring and regulation in cyberspace makes the issue more intricate and strenuous to address.

Children and adolescents are naturally curious and, more often than not, more competent with technology than adults. Most of these children exploring the Internet are not old enough to detect or understand the risks online as well as the consequences of their own behavior online. Despite minimum age requirements for joining popular social media platforms such as Facebook and Twitter, many children join these platforms by misrepresenting their age mainly because these do not have any stringent guidelines for the age limit of joining.

According to Intel Security Teens, Tweens and Technology Study conducted over a period of 5 years in India, the results published in 2015 claim that 81% of the children aged 8 to 16 years are already active on social media. Nearly 77% of these children had

a Facebook account before they were 13 years of age. Almost 22% of these children, that is, one in five children, face online abuse. These 2015 data are alarming and make us wonder what the figures might be now. Children become vulnerable to the dark underbelly of the Internet where an anonymous person sitting on computer miles away can permanently scar their self-esteem by the power of a click, making cyberspace a dangerous and largely unmonitored playground. As a rule, Indian parents warn their children about strangers lurking on the street. There is a dire need of doing the same for online behavior as well, yet it is hardly done or even considered worrisome.

Types of Bullying:

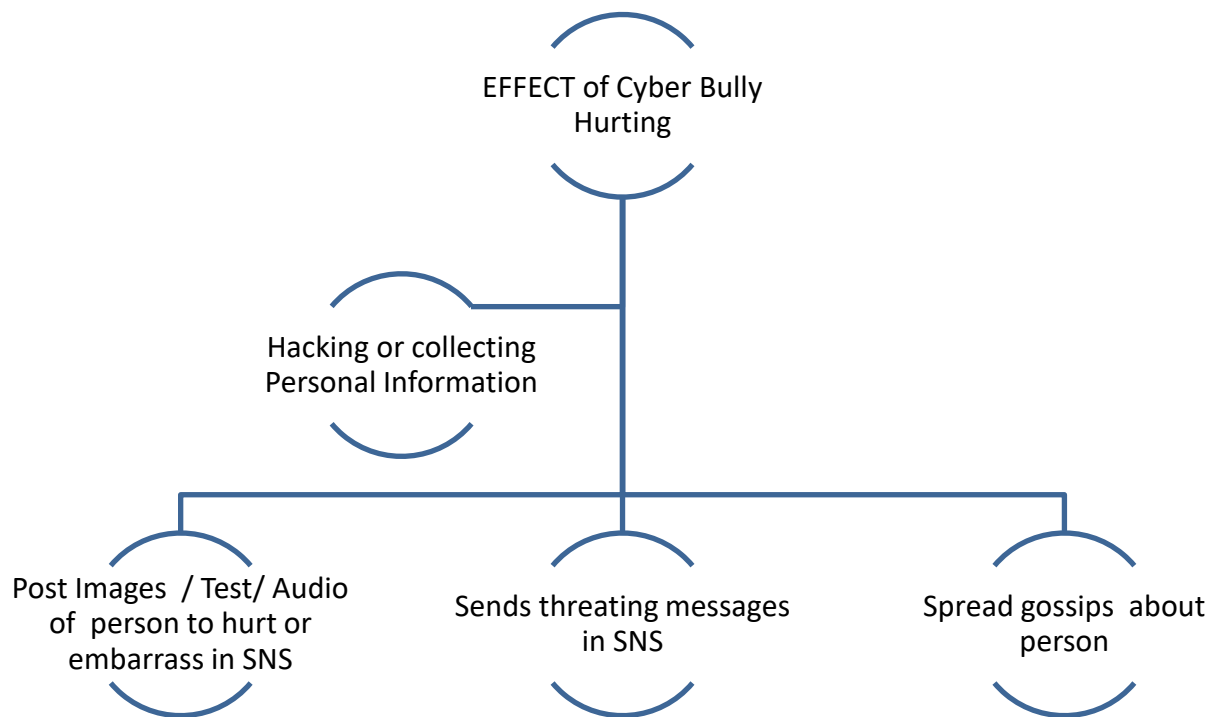
- a) Direct Bullying: (more typical of boys)
 - Open physical attacks on victim
 - Verbal (threats, emotional harm)
- b) Indirect (Relational) Bullying: (more typical of girls)
 - Social isolation
 - Peer rejection
- c) Cyber bullying/ electronic aggression

- Social network sites, Facebook, WhatsApp, twitter, hike, MySpace, email
- Blow down pages → fake sites created to spread rumors

INFLUENCE:

Because cyberbullying is so easy to perpetrate, a child or teen can easily change roles, going from cyberbullying victim at one point to cyber bully the next and then back again. As with traditional bullying, both boys and girls cyber bully, but tend to do so in different ways. Boys tend to bully by "sexting" (sending messages of a sexual nature) or with messages that threaten physical harm. Girls, on the other hand, more commonly cyberbully by spreading lies and rumors, exposing your secrets, or by excluding you from emails, buddy lists, or other electronic communication.

The methods kids and teens use to cyberbully can be as varied and imaginative as the technology they have access to. It ranges from sending threatening or taunting messages via email, text, or IM to breaking into your email account or stealing your online identity to hurt and humiliate you. Some cyber bullies may even create a website or social media page to target you.



Pictorial representation of Cyber bullying

Effects of cyberbullying

Any type of bullying can make you feel hurt, angry, helpless, isolated, even suicidal, or lead to problems such as depression, anxiety, and low self-esteem. In many cases, cyberbullying can be even more painful than face-to-face bullying because:

- Cyberbullying can happen anywhere at any time, even in places where you normally feel safe, such as your home, and at times you'd least expect, such as at the weekend in the company of

your family. It can seem like there's no escape from the taunting and humiliation.

- A lot of cyberbullying can be done anonymously, so you may not be sure who is targeting you. This can make you feel even more threatened and can embolden bullies, as they believe online anonymity means they're less likely to get caught. Since cyber bullies can't see your reaction, they will often go much further in their harassment or ridicule than they would do face-to-face with you.
- Cyberbullying can be witnessed by potentially thousands of people. Emails can be forwarded to hundreds of people while social media posts or website comments can often be seen by anyone. The more far-reaching the bullying, the more humiliating it can become gossips

Prevent cyberbullying before it starts

- To stay safe with technology, teach your kids to:
- Refuse to pass along cyberbullying messages.
- Tell their friends to stop cyberbullying.

- Block communication with cyber bullies; delete messages without reading them.
- Never post or share their personal information online (including full name, address, telephone number, school name, parents' names, credit card number, or Social Security number) or their friends' personal information.
- Never share their Internet passwords with anyone, except you.
- Talk to you about their life online.
- Not put anything online that they wouldn't want their classmates to see, even in email.
- Not send messages when they're angry or upset.
- Always be as polite online as they are in person.

According to the recently-released Intel Security's "Teens, Tweens and Technology Study 2015", 81% of Indian respondents between eight and 16 are active on the social media networks. Of these, 22% have reported being bullied online — the highest in the four countries surveyed (Australia, USA and Singapore being the other three). That's not all. As many as 52% of Indian children indicated that they had bullied people over the social media — again

the highest of the four countries surveyed. A whopping 65% of respondents report witnessing cruel behaviour online. “Cyberbullying is a fast-growing trend that Indian parents and educators can’t afford to ignore,” says Melanie Duca, marketing director, consumer-Asia Pacific at Intel Security.

There are mainly six broad categories that encompass forms of cyber bullying according to VAW learning network:

1. **Hacking:** The use of technology essentially to gain illegal or even unauthorized access to resources or systems for the sole purpose of acquiring personal information, modifying or altering information or even slandering and denigrating the victim organization. For instance: Violation of passwords and also controlling computer functions such as freezing the computer and also even logging off the user
2. **Impersonation:** To assume the identity of the victim the use of technology or someone else in order to access private information at times embarrass or shame the victim, contact the victim or even create fraudulent identity documents. For example: Sending

- offensive emails mostly from victims email account, calling a victim from unknown number to avoid the call being blocked
3. **Surveillance/Tracking:** To stalk and even monitor a victim's overall activities with the use of technology and then behaviors either in real time or historically. Example: GPS tracking via mobile phone, tracking the keystrokes to recreate a victim/survivor's overall activities on a computer
 4. **Harassment/Spamming:** the use of technology to continuously contact, annoy, threaten, and/or scare the victim. This is ongoing behaviour and not one isolated incident; e.g., persistent mobile calls/texts; filling up voicemail with messages so no one else can leave a message
 5. **Recruitment:** use of technology to lure potential victims into violent situations; e.g., fraudulent postings and advertisements (dating sites; employment opportunities); traffickers using chat rooms, message boards, and websites to communicate/advertise.
 6. **Malicious Distribution:** use of technology to manipulate and distribute defamatory and illegal materials related to the victim and/or VAWG organizations; e.g., threatening to or leaking

intimate photos/video; using technology as a propaganda tool to promote violence against women.

Findings and Suggestions

- **Free from technology.** Taking a break from your computer, tablet, iPod, video games, and cell phone can open you up to meeting new people.
- **Find others who share your same values and interests** take up a new hobby such as chess, art, or music.
- **Boost your confidence.** Exercise is a great way to help you feel good about yourself, as well as reduce stress. Punch a mattress or take a kick boxing class to work off your anger.

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