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Research of Artificial Intelligence in Medicine

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Abstract:- AI is transforming the world in every walk of life. It is collection of technologies that in future will probably rule the entire world. AI is a technology that thinks like human, learns like human but performs like super-human. In this paper, we will discuss about the application of AI in healthcare industry and all the pros and cons it is having, starting from decision making to integrating information, analysing data and use of its own results to improve itself. The technologies like Magnetic Resonance Imaging (MRI), Computed Tomography Scan (CT scan), are a part of AI that's been widely used in healthcare industry. The use of automated classification techniques like Machine Learning and Natural Language Processing has proved greater accuracies than manual classification. AI's aid the physicians in countless ways in health care industries. There are certain limitations and demerits of AI too. AI can't be trusted since it's a technology that can be tampered. Privacy of patients is also a matter of concern. There is lack of transparency in performing certain jobs. Mainly certain diseases are focused only now days. The ways to improve are discussed here and new ideas are proposed for its betterment and fast growth.

Keywords:- *Artificial Intelligence; health; machine learning; deep learning; artificial neural network; MRI; CT scan; supervised learning; semi-supervised learning; medicine.*

I. INTRODUCTION

This paper provides a wholesome study of AI since it has been in the healthcare industry. Various technologies of AI have been implemented in the medical field such as magnetic resonance imaging (MRI), Computed tomography scan (CT scan), which are one of the most used product of AI. AI has been a great help for physicians since long. Machine learning algorithms have been studied here. Decision making tendency of AI have been complimented by many, for good. Still AI has a long way to go for its proper full implementation in healthcare industry. Rules and regulations regarding its transparency and trust issues are providing constraints. Ways to improve AI in near future have been discussed later.

II. WHAT IS AI

AI stands for artificial Intelligence. As the name suggests it's an artificial human brain. In real world, when it comes to AI, it is seamlessly the integration of pack of technologies. Majority of these technologies affect healthcare directly but they differ by certain ways for particular tasks. The technologies that are manipulated to behave like human brain in terms of thoughts, engagement, adaptation, sensible feelings, etc. are referred as AI. Alan Turing first brought this question to spotlight that, can AI think like humans? [20]. Logic theory machine was the 1st AI program that can copy the style of humans in problem solving aspects [21]. Due to this kind of thinking abilities, game like chess can be played by AI [24, 25]. AI plays a vital role in human life not only in healthcare industry but also in social media, technical gadgets, etc. AI is a hugely growing field now days for its opportunities in coming future [27].

III. AI IN HEALTHCARE INDUSTRY

According to history, AI hands on the medical field mostly around 1960s and 1970s (the term was coined by Jhon Mc Carthy in 1995) [19]. Healthcare industry is aided by the technologies of AI. AI and the field of robotics are enormously developing so as to benefit the healthcare industry. In field of medicine, AI got a lion's share of work, in aiding health practitioners to ease tasks, figure out complex procedures, etc. [31]. AI eases the tasks of physicians in taking healthcare actions by providing them information from journals, textbooks, previous records [8, 9]. Modern technologies enhance the AI abilities to self-correct it and learn from mistakes to become more precise in decision making [10].

IV. APPLICATIONS OF AI

AI is performing in different aspects of healthcare or medicines like clinical, surgical, therapies, disorders and predictive practices. AI is also doing crucial works in decision making and patient diagnosis. Here AI is making an enormous impact. The very best thing of AI is that it can digest large volumes of dates across different platforms and it can analyse them to determine the diseases and provide decisions precisely [28, 30]. Ai is essentially needed in early detection and diagnosis works. AI and robotics are getting developed for this application especially. AI can now do perform human works in a much more effective way with low cost. Diseases like cancer are hard to detect without the help of AI. Ai especially detects these kind of harmful diseases quickly reliably in a more accurate way. Ai makes the works of the routine check-up automatic; otherwise there have to be people to do medical practice of patients.

V. MACHINE LEARNING (ML)

ML is a way of dealing with technologies by putting data through the help of models in a statistical way. It's the most use form of AI [1]. ML with the help of data through different platforms, help to predict which kind of medicine or treatment will be best suitable for a particular patient based in his health care status. It basically provides the ways based on previous treatment data. For it to work, it majorly requires enormous amount of patient dataset to provide the treatment precisely [2].

VI. TYPES OF AI

AI is majorly divided into two categories based on their approaches to work [11].

A. Machine Learning Technique

It is the AI which make of ML techniques to make decisions in a more statistical way by dealing with vast amount of structured data. In healthcare industry the ML techniques gives the most probable output based on the input dataset provided of patients character. ML techniques use structured data [3].

B. Natural Language Processing Technique

As the name suggests, this model of AI tries to understand, analyse, manipulate and generate human language [17]. It is a type of the AI which extract information from unstructured data (for example clinical prescriptions, journals, etc.) [26].

VII. CATEGORIES OF ML

A. Supervised Learning

It is a Machine Learning method. It is the basic way how ML works. Takes input of labelled dataset (i.e. how to deal with patient's disease) and then training process is done. After it get test data to predict the output. The aim of a supervised learning algorithm is to find a mapping function to map the input variables with the output variables. It is a mathematical model which has the inputs and the desired outputs.

Types of supervised-learning algorithms include

1. Classification
2. Regression

B. Unsupervised Learning

It is a little advanced technologically. It scoops the desired information from hand written medical notes. It analyses and clusters unlabelled data sets. These algorithms discover hidden patterns or data groupings without the need for human intervention. Unsupervised machine learning, uses machine learning algorithms to analyse and cluster unlabelled datasets. Unsupervised learning method takes the data and searches the hidden pattern in them and groups the data into sub-groups according to the pattern. When new data comes, unsupervised learning method detects for which pattern is being used there and puts the newest data into that sub-group [12].

C. Semi-supervised Learning

There is a midway between supervised and unsupervised learning, named as semi supervised learning. It is basically follows the trend of disease pattern and makes the bridge where data are missing. It combines small amount of labelled data with huge amount of unlabelled data. It is a self-training model of Machine Learning.

From the above categories of ML, most trustworthy among all is supervised learning. Neither it makes the data like semi-supervised learning nor does it try to find informative data like unsupervised learning.

VIII. ARTIFICIAL NEURAL NETWORK (ANN)

It is a type of computing system inspired from biological neural networks. It is also known as stimulated neural networks or the neural nets. Their name and structure are inspired by the human brain, mimicking the way that biological neurons signal to one another [39]. It basically works like our brain's neural network system. ANN mimics the process of working of our brain's neural system [22, 23]. It provides a probability of an event or disease to happen in an individual. ANNs are created by programming regular computers to behave as though they are interconnected brain cells. ANN would be provided by the training set that would provide thousands of images tagged as a particular thing to be determined in future, so the network would begin to learn [14]. Once it has been trained with the significant amount of data, it will try to classify future data based on what it thinks it's seeing (or hearing, depending on the data set) throughout the different layers of neurons.

IX. DEEP LEARNING

As the name suggests, it simplifies how far the AI is processing the data for providing the most accurate result. The name given to the length of processing is "deep". So it is known as "deep learning". The term "deep" signifies the number of neural networks connected with each other so as to go through each of the probability of upcoming outcome and proving the desired outcome. Deep learning is actually a part of Artificial Neural Network [4, 5]. ANN has actually one neural network connected to several neuron networks (say 10 for example) and if those neuron networks (as example 10) are again connected to several networks and this chain repeats for several times, then this chain is between the input variable and output data and known as deep learning [16]. It is regarded as the most complex form of ML. It helps in detecting diseases like cancer etc. from scanned images in radiology by taking the very insignificant details /data which is beyond the human eye to detect. Classical neural network is different from deep learning which in turn is a highly developed version of classical neural network. Deep learning has more layers unlike classical neural network [13].

A. Types of Deep Learning:

- Learning rate decay
- Transfer learning
- Training from scratch
- Dropout

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X. TEXT MINING

It is a technology of AI that works on Neural Language Processing (NLP). It merely works as extracting hidden texts from different texts sources (given texts). It is similar to data mining, which extracts data from pile of data. Text mining can play a vital role in healthcare industry for processing medical information.

XI. DATA MINING

This is an AI algorithm that discovers the data from the pile of data unlike machine learning that predicts the outcome based on the data set. While Machine Learning outcomes are the predictions of the possibilities of the events (disease) to happen on the other hand, data mining focuses on discovery of unknown things from the given data. Many Machine Learning methods are used in Data mining technique. Data mining in turn also uses many machine learning techniques.

XII. PROBLEMS IN AI

AI has given subtle examples of its supremacy but still it has a long way to go before termed as fully reliable. There are vast amount of problems among which few are discussed.

A. Disease Focus

Though AI is getting better day by day, but it only focuses on certain problems (medical conditions) in health sector only, like cancer, neurovascular diseases and cardiovascular diseases [15].

B. Trust

After all AI is certain technology which can be tampered maliciously. Doctors may not be able to build the trust with the data provided by AI cause of possible susceptibility [33].

C. Biasing

Can provide results or AI outcomes can be based on racial views. Race can be considered while deciding outcomes for criminal behaviour [33, 37].

D. Data Biasing

AI is trained by enormous data set. Problem lies if the data set used doesn't reflect the targeted population. Data may be in sufficient for AI to provide wholesome result, like if there is a minority with less health support then their data will not be considered [35].

E. Regulations of AI

Implementing AI technologies in imaginary world and implementing them in real world have tons of difference. In real world due to the rules and regulations formed on AI technologies, its way difficult to improve its safety standards [32]. There should be new laws or old laws should be amended to make the implementation of AI in real world [41].

XIII. LIMITATIONS OF AI IN MEDICINE

A. Need human surveillance

It doesn't matter how smart AI becomes, there's still lot of dilemma for its functioning.
Still there are lot of rules and regulations for AI so it can't be led to operate on its own.
So the human hand is still in need [38].

B. May overlook social variables

Social factors may be neglected by AI while making decisions. For example, for a specific diagnosis, AI can show proper care centres but may not consider the person's economic or social restrictions and personalised preferences [38].

C. Unemployment

History has proven, whenever technology evolves, unemployment evolves simultaneously.
Professionals who got trained for years may be displaced cause of AI. Their time and money may get wasted [38].
So factors like social ramifications have to be considered before implementation of AI.

D. Inaccuracies are still possible

As AI survives on data, so data set should be large enough for proper diagnosis [38]. If less data (limited data) available then outcomes of AI can be treated as miss-diagnosis. Limited data can be caused by many factors. Inaccuracies are highly possible while prescribing a particular new type of medicine as patient diagnosed data will be very less regarding that medicine.

E. Accountability

There are certain requirements for companies using AI systems. The medical organisation will be accountable if any harm is caused by the AI system they handle or work with [34].
If faults will be done, then accounting a computer system is in vain.

XIV. IMPORTANT TO KNOW BEFORE WORKING WITH AI

A. Transparency

With proper data set, deep learning model of AI can produce promising outcomes, but deep learning model is full of complexities and explaining some medical professional about how the outcome came is very difficult or nearly impossible, which cuts off AI's transparency [33].

B. Personal

It is very vital to protect the privacy of an individual. It is patient's autonomy and personal identity. Protecting person's personal information is not that promising about AI as, at last it is a technology which can be tampered in a wrong way [36].

C. Benefits of AI

AI is relentlessly potential for betterment of health care system. Clinicians can use AI for getting rid of routine check-ups and those can be automated by AI and clinicians can get time for more important things in their schedule [7].

D. Patient Engagement

Surveys have reportedly said that "patient engagement" is a very crucial part in patient's own wellbeing. More interest shown by patients for their own health, better their health becomes [6].

E. Automation of non-crucial works only

Automation of direct patient contact is very unlikely, which is good news for medical practitioners. Only works, related to pathology, radiology, etc. that deals with information will be automated.

F. Clinical decision making

As AI is developed by feeding data, so it can make better clinical judgements by analysing tons of data. According to Bennett and Hauser, algorithms can be beneficial for making clinical decisions by accelerating the process [29]**.** This will positively impact the cost of healthcare services also. There clinical technicians can be aided by AI technologies and AI can make cost of healthcare services cheaper.

XV. AI IN SPECIFIC AREAS

A. Early detection and diagnosis of stroke

AI are implemented in smart watches, phones etc. to track human body movement. Before the period of heart stroke, movement of patient will be significantly changed. At that point of time AI alerts for a stroke. AI algorithms are developed to detect a stroke before it happens to save patient's life [18].

B. Patient data and diagnosis

AI is feed by the data set so**,** through the help of medical big data, AI algorithms can show clinicians the similarities generated from diagnosis, screening, CT scan, MRI etc. among particular disease pattern to make clinicians aware for that.

XVI. WAYS FOR IMPROVEMENT OF AI

- Algorithms can be developed to make AI question human being when there is lack of data in a report instead of bridging the gap by approximate output to finalise the result**.**
- To improve the transparency, algorithms may be developed so that AI robots will answer physicians' questions regarding the generated output**.**
- The biasing of AI on the basis of race can be eliminated by feeding AI with the past criminal records from the crime branch in detecting the person's criminal record.
- AI should practice by carrying out real type medical operations on a dummy human body so that at certain needs AI doctors will be able to replace human doctors**.**

XVII. PERSONAL VIEWS

AI is undergoing pretty much in a decent rate of development. The infrastructure of AI has to be developed up to the mark so that it can be implemented in other areas too. The algorithms of AI are not that strong till now to produce the exact desired result in an operation. Developers have to widen the area of focus of AI into many other diseases also. For replacing the human doctors, AI has to indulge not only in assisting the physicians but also have to perform the jobs of physicians without involvement of any human hand. AI's interaction with patients is a must for talking AI to a next level.

XVIII. CONCLUSION

AI has been able to impress people for many years. In healthcare industries it is assisting healthcare physicians in many activities. AI technologies like Machine Learning, Natural Language Processing are performing more than decent amount of jobs to aid the physicians. Machine Learning methods like supervised learning, unsupervised learning and semi-supervised learning are taking technology of AI into a new level. Deep learning methods though making AI complicated but is performing up to the mark in most cases. With the help of AI technologies like data mining we are now able to discover unknown data from the big data.

After studying all of its pros and cons, the near future of AI is not that optimistic because of many reasons. Privacy issues concerns the most among all. After all it is a technology, can be tampered. In today's world there are lots of rules and regulations on AI in not only healthcare sector but in many fields, so implementing the technologies brings the biggest hurdles. As of AI no transparency is there. What goes inside the deep learning layers is hardly explainable for every output. AI is still now good at only certain diseases, like cancer, cardiovascular and neurovascular diseases. It has to be developed for many other diseases and for unknown future diseases. AI does a good job in detecting some particular diseases in very preliminary stage but not for all. As of now, AI doctors don't seem to replace the human doctors quite for a long time.

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