



**Kabul University**  
Computer Science Faculty  
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# **Hybrid Recommendation System for Islamic Dari-Textual Information Context using Machine Learning and AI**

Submitted by  
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*This thesis is submitted for the fulfillment of  
master's degree requirements*

Supervisor: **Dr. Jawid Ahmad Baktash**

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2020



[Besm-ullah-rahman-urahem]

[In the name of Allah, the Most Gracious, the Most Merciful.]

يَرْفَعُ اللَّهُ الَّذِينَ ءَامَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ

صَدَقَ اللَّهُ الْعَلِيُّ الْعَظِيمُ

سُورَةُ الْمَجَادَلَةِ: ١١

بالا میبرد الله جلاله برای ایمانداران از شما و اهل علم پایه ها را

(Allah elevates those among you who believe, and those given knowledge, many steps.)

(Allah will raise those who have believed among you and those who were given knowledge,  
by degrees.)

# Declaration

This thesis is a presentation of our original research work. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature, and acknowledgment of collaborative research and discussions. The work was done under the guidance of Dr. Jawid Ahmad Baktash at the Department of Information Technology, Computer Science Faculty, Kabul University, Kabul Afghanistan.

.....  
Mojeeb Rahman Sedeqi

In my capacity as supervisor of the candidate's thesis, I certify that the above statements are true to the best of my knowledge.

.....  
Dr. Jawid Ahmad Baktash, 2020

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Mojeeb Rahaman Sedeqi

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## Abstract

Life in the world of massive data is too challenging. Although, more information is good but few relevant information brings better decision, quality, and simplicity in life. Islam's religion has considerable amount of important textual information in the format of books and papers in all areas of life. Therefore, through modern technology, personalizing and prioritizing information retrieval or filtering techniques should be used. And by utilizing of these techniques, we can effectively overcome the information overload problem. Implementation of all aforementioned techniques in a single system and develop a compact pipeline of data is called recommendation system (RS). In this case we developed five individual RS models such as (Content-based, Sequence-based, Deep neural network collaborative filtering: DNN CF Model, DNN CF plus descriptive attributes Model and finally popularity-based) with the capability of 10 ways to individually generate recommendation, and 45 possible ways to combine two RS together to improve power of their final recommendation which is called hybridization or assembling Methods. Finally, evaluation of our individual trained models and weighted hybridized forms are done on our mini dataset, as well as on 100K movielens global dataset.

**Keywords**— Islamic Textual Information, AI, Deep Learning, Neural Networks, Recommendation Systems, Hybrid, Data Preprocessing, Assembling Methods

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# Chapter 1

## Introduction

We live as a human being in a world which for each task and steps of life, correct and related information is required. Islam as a final and complete religion that Allah (S.W.T) (Arabic: ﷻ) mentioned in Quran Karim (Arabic: قرآن الكريم) 'Al-Mai'dah:3' <sup>1</sup> [*This day I have perfected for you your religion and completed My favor upon you and have approved for you Islam as religion.*] , 'Ali'-Imran:19' <sup>2</sup> [*Indeed, the religion in the sight of Allah is Islam.*] , 'Ali'-Imran:85' <sup>3</sup> [*And whoever desires other than Islam as religion - never will it be accepted from him, and he, in the Hereafter, will be among the losers.*]; with approximately 2 billion followers and comprehensively growth as shown in Fig.1.1 which stated by Lipka and Hackett (2017); Pew Research Center (2015), cover almost all parts of life through correct, persistent laws, principles and guidance. These are conveyed to Allah's last and final beloved messenger Muhammad Mustafa <sup>S.A.W</sup> (Arabic: محمد مصطفي ﷺ): Allah (S.W.T) mentioned in Quran Karim 'Al-Ahzab:40' <sup>4</sup> [*And Muhammad <sup>S.A.W</sup> is not the father of [any] one of your men, but [he is] the Messenger of Allah and last of the prophets. And ever is Allah, of all things, Knowing.*]; through, Quran Karim which is the complete and final holy book 'Speech and orders of Allah <sup>(S.W.T)</sup>' form Allah <sup>(S.W.T)</sup>. Every instructions and statement of Quran Karim is explained and applied in each parts of life by our beloved messenger <sup>S.A.W</sup> that called Sunnah which include orders, speeches, behaviors of our beloved messenger <sup>S.A.W</sup>, and those right actions that were done by others (Companions) that Allah's messenger <sup>S.A.W</sup> accepted. The arrangement, compilation, commentary, interpretation, classification, abstraction, and translation to other languages of these two main and core source of guidance (Quran Karim and Sunna) as stated by Imam Malik (1982), are done by highly respected and reliable scholars during these 14 centuries which forms a highly valuable, big collection of data about more than one hundred thousand effective books in textual format. Additionally, Seraht (Character, life style, biography and events in life) of our beloved messenger Muhammad Mustafa <sup>S.A.W</sup>, Seraht of companions and Seraht of high scholars generate important information and guidance to us - Muslims. The above mentioned resources form Islamic information context in general. Developing a solution for

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<sup>1</sup>Quran Karim: Al-Maidah:3 \*\*\* الْيَوْمَ أَكْمَلْتُ لَكُمْ دِينَكُمْ وَأَتِمَمْتُ عَلَيْكُمْ نِعْمَتِي وَرَضِيتُ لَكُمُ الْإِسْلَامَ دِينًا \*\*\*

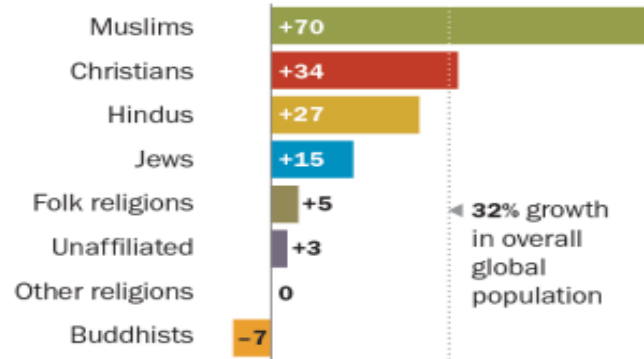
<sup>2</sup>Quran Karim: Ali'-Imran:19 \*\*\* إِنَّ الدِّينَ عِنْدَ اللَّهِ الْإِسْلَامُ \*\*\*

<sup>3</sup>Quran Karim: Ali'-Imran:85 وَمَنْ يَبْتَغِ غَيْرَ الْإِسْلَامِ دِينًا فَلَنْ يُقْبَلَ مِنْهُ وَهُوَ فِي الْآخِرَةِ مِنَ الْخَاسِرِينَ ﴿٨٥﴾

<sup>4</sup>Quran Karim: Al-Ahzab:40 مَا كَانَ مُحَمَّدٌ أَبَا أَحَدٍ مِنْ رِجَالِكُمْ وَلَكِنْ رَسُولَ اللَّهِ وَخَاتَمَ النَّبِيِّينَ وَكَانَ اللَّهُ بِكُلِّ شَيْءٍ عَلِيمًا ﴿٤٠﴾

## Muslims projected to be fastest-growing major religious group

*Estimated percent change in population size, 2015-2060*



Source: Pew Research Center demographic projections. See Methodology for details.  
"The Changing Global Religious Landscape"

Figure 1.1: Comprehensively Growth of Islam Religion. Source: Lipka and Hackett (2017)

the problems such as storage, retrieval, search, mainly personalize view (recommendation) of these textual information by use of current data science, web and mobile technologies is our goal.

### 1.1 Problem statement

All Islamic information specially in Dari language are more often available in non-digital formats as unstructured and semi-structured forms such as printed textual books or non-searchable PDF format and sometime in searchable PDF formats. Each Muslims and researchers of non-Muslims need to have access to relevant information depending on the situation easily and on-time. No one can carry a thousand of books physically to read and search for a fact each time. But now by using of technology (Internet, Laptop, Tablet and Smart-phones) we are capable to have even more access to the data. Still, parts of the problem exist that need more research. For instance, we have collected some of them as follows:

- What can be the initial learning stage in a specific Islamic area?
- What are other similar issues regarding a specific Islamic topic?
- What are the more important topics in a specific Islamic category of information?
- What are the opinions of others with similar interest in a specific Islamic area?
- How to track the progress of knowledge in an Islamic area?

In other word, in data science field the mentioned problems are in the following areas:

- **user-profiles:** user history, interest, knowledge, and need.

- **Information overload:** big pool of information without filtering mechanism.
- **Item self definition:** characteristics of data, classification or clustering of data.
- **Prioritizing of information:** ranking and importance.
- **Personalize information retrieval:** combined and complex model for retrieving of information by processing of group of inputs.

## 1.2 Goal and Objectives

Through this research, we develop a solution model for our main question, which is: How to develop a complete hybrid recommendation system for Islamic Dari-textual information context?

### 1.2.1 General Objectives

- What are the more general available layouts of Islamic textual information?
- What is the more flexible and general data structure to store Islamic information in current technology?
- How to recommend more topics with consideration of similarity between previously seen topics, popularity of topics, importance of topics for specified group of people with realization of (age, gender, language, collaborative relation etc), knowledge level of people in a part and also interest and history of people?
- What are the common categorization of the Islamic information that provide efficiency in navigation and browsing through web and mobile interface?
- How to show Islamic Dari textual information that cover various forms of data such as (Quran Karim with its translation in Dari, Hadith Sharif with its translation in Dari, Citations, Quotations, and poetry) in a single topic?
- How to effectively search a topic with consideration of importance, category, relevancy, popularity of information and also knowledge level of people.

In this research, our main focus is in Islamic information and recommendation systems, and it's implementation.

## 1.3 Hypothesis

Hybrid Recommendation System helps to convey Islamic textual information to people more effectively and efficiently. Therefore, through this research we develop a complete hybrid recommendation system model solution by combination of (information system (IS), database system, web technologies, artificial intelligence (AI), machine learning (ML), data mining (DM), text mining, information retrieval (IR), Natural language Processing (NLP), information extraction (IE) and information filtering (IF)) techniques which provide the following:

- Accessibility of structured, personalized, categorized Islamic Dari textual information for web and mobile data request.
- Efficient search.
- Recommendation of topics with consideration of similarity between previously seen topics, popularity of topics, importance of topics for specified group of people with realization of (age, gender, life part, life cycle and etc), category of topics, knowledge level of people in a part and also interest and history of people.

The mentioned system cover storage of data, retrieve of data, search, and recommendation of Islamic Dari data.

## 1.4 Motivation

Allah<sup>(S.W.T)</sup> gives to everyone a special ability, gift, and chance to use it, and achieve Allah's will and pleasure. From these gifts in the day of judgment, he will ask as Allah<sup>(S.W.T)</sup> mentioned in Quran Karim 'At-Takathur:8'<sup>5</sup> [*Then on that day you will surely be asked about the verity of pleasures.*] I as Muslims that Allah<sup>(S.W.T)</sup> gifted me the knowledge of day which is technology, want to use it to convey Allah's and his beloved messenger<sup>"S.A.W"</sup> messages and order to people. By consideration of importance of recommendation system, I motivate to implement this technology to convey Islamic information.

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<sup>5</sup>Quran Karim: At-Takathur:8

## Chapter 2

# Background Information & Literature Review

The core purpose of this chapter is to provide sufficient background information for the readers which is organized as the following items:

- A basic introductory information about Islam religion
- Islamic information context (*Quran Karim, Tafsir/Commentary of Quran Karim, Respected Hadith of Beloved Muhammad Mustafa<sup>"S.A.W"</sup>, Muslims Believes: Haqaeed, Orders and Ways of Doing Actions: Feeqia, Allah's Love, Will, Pleasure and Relationship: Horfan, (Seerat) Life of Beloved Muhammad Mustafa<sup>"S.A.W"</sup>, Summary of information context*)
- What we have for processing of information in Current Century?
  - Client - Servers Architecture (*Client, Server, Network and Internet*)
  - Services and Systems (*Information Systems, Types of information system, Database Systems, Web Applications, RESTful-API, Mobile Applications, Search Engines*)
  - Techniques (*Artificial Intelligence (AI), Machine Learning (ML), Deep Learning, Data Mining (DM), Text Mining, Information Retrieval (IR), Natural Language Processing (NLP), Information Extraction (IE), Information Filtering (IF), Recommendation System*)
- Study of available Islamic systems for Dari or Persian language
- Study of natural language processing (NLP) in Dari or Persian language
- Study of recommendation systems real world applications (Amazon.com, Netflix, Netflix Prize Contest, Google News, Facebook)

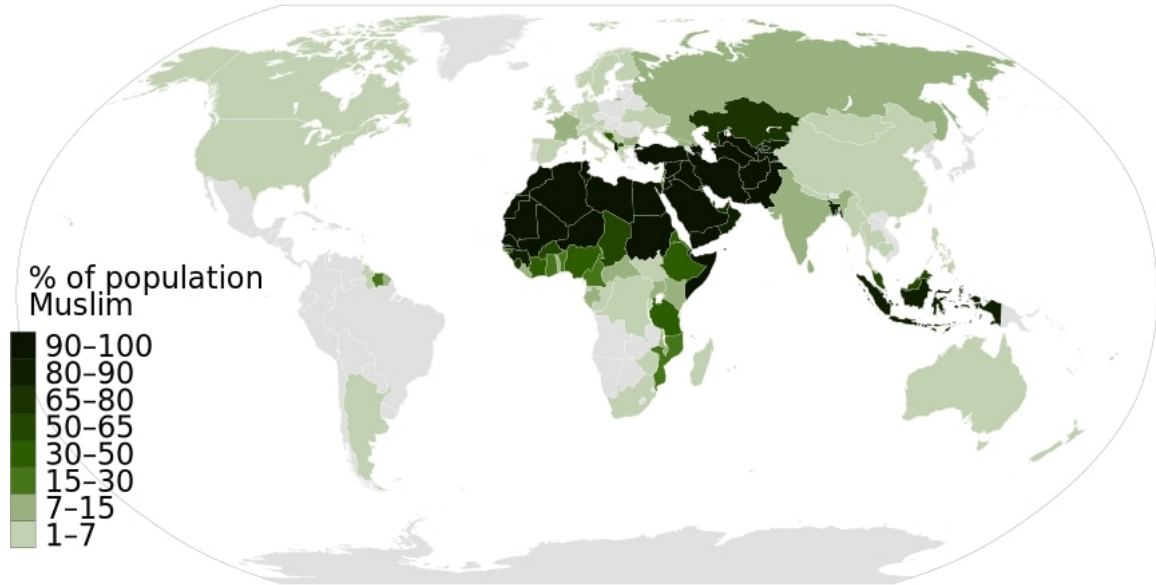


Figure 2.1: Muslim Percentages in the World Countries. Source: Pew Research Center

## 2.1 Islam Religion

As the qurandictionary <sup>1</sup>, Arabic-English Lexicon <sup>2</sup> mentioned, the **Islam** (Arabic: إسلام) is a verbal noun originating from the triliteral root S-L-M which forms a large class of words mostly relating to concepts of **wholeness, submission, sincerity (purity), safeness, and peace**. In a religious context, it means "voluntary submission to God (Allah<sup>(S.W.T)</sup>)". In other word, Islam means "submission to God" or "surrender to God". Islam is an Abrahamic, monotheistic religion whose adherents believe to one and only God (Allah<sup>(S.W.T)</sup>) and Muhammad<sup>"S.A.W"</sup> that is final messenger of Allah<sup>(S.W.T)</sup>. This believe is the core and way of entrance to Islam. Muslim, the word applied to an adherent of Islam.

According to Lipka and Hackett (2017) report, Islam religion is the fastest-growing religion in the world as shown in Fig.1.1, with over 1.8 billion followers which is 24.1% of the world's population. Muslims make up a majority of the population in 49 countries. Fig.2.1 is showing the percentage of Muslims in each countries.

As Campo (2009) an (Encyclopedia of Islam), Ayduz (2014) (The Oxford Encyclopedia of Philosophy) and Esposito (2009) (The Oxford Encyclopedia of the Islamic World) mentioned, Islam teaches that God is merciful, all-powerful, and unique, and has guided mankind through prophets, revealed scriptures and natural signs.

The primary scriptures of Islam are the Quran Karim, the word of Allah<sup>(S.W.T)</sup> (God), and the orders, teachings, actions and normative examples of our beloved messenger, Muhammad<sup>"S.A.W"</sup> (called the Sunnah, or the Hadith).

As Allah<sup>(S.W.T)</sup> mentioned in Quran Karim 'Al-Mai'dah:3' <sup>3</sup>[*This day I have perfected for you your religion and completed My favor upon you and have approved for you Islam as*

<sup>1</sup><http://corpus.quran.com/qurandictionary.jsp?q=sIm>

<sup>2</sup>[http://www.studyquran.co.uk/20\\_SIIN.htm](http://www.studyquran.co.uk/20_SIIN.htm)

<sup>3</sup>Quran Karim: Al-Maidah:3 \*\*\* الْيَوْمَ أَكْمَلْتُ لَكُمْ دِينَكُمْ وَأَتَمَمْتُ عَلَيْكُمْ نِعْمَتِي وَرَضِيتُ لَكُمُ الْإِسْلَامَ دِينًا \*\*\*

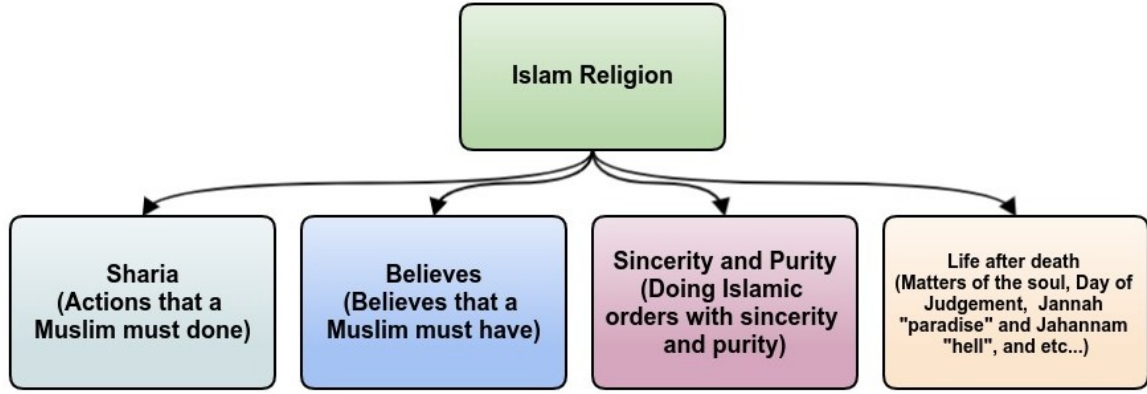


Figure 2.2: Islamic Information Context According to the Hadith of Jibril<sup>"A.S"</sup>

religion.], ‘Ali’-Imran:19’<sup>4</sup> [Indeed, the religion in the sight of Allah is Islam.], ‘Ali’-Imran:85’<sup>5</sup> [And whoever desires other than Islam as religion - never will it be accepted from him, and he, in the Hereafter, will be among the losers.]; that by given of Islam as a complete and final religion to the human being, Allah<sup>(S.W.T)</sup> has completed his favor upon us. And Muhammad<sup>"S.A.W"</sup> said<sup>6 7</sup> [Abu Hurayra reported that the Messenger of Allah, may Allah bless him and grant him peace, said, "I was sent to perfect good character"].

## 2.2 Islamic Information Context

Islamic information could be categorized in various prospective and ways, such example of categorization is described by one important Hadith of Rasollallah<sup>"S.A.W"</sup> that also called Hadith of Gabriel (Hadith Jibril) or Hadith of religion (Deen, Arabic: دين) and the concept of this Hadith is shown in Fig.2.2.

This Hadith is narrated by two most respected Companions’ of beloved Muhammad<sup>"S.A.W"</sup> (Hazrat Umar Ibn Khatab<sup>"R.A"</sup> (Arabic: حضرت عمر ابن خطاب رض) [2<sup>th</sup> Khalifa of Islam] and Hazrat Abu Huraira<sup>"R.A"</sup> (Arabic: حضرت ابوهريره رض) in two must valuable books (collections) of Hadith (Sahih al-Bukhari and Sahih Muslim). According to the Sahih Muslim, translated text of mentioned Hadith is ( Umar<sup>"R.A"</sup> said, "While we were sitting with the Messenger of Allah<sup>"S.A.W"</sup>, may Allah bless with him and grant him peace, one day a man came up to us whose clothes were extremely white, whose hair was extremely black, upon whom traces of traveling could not be seen, and whom none of us knew, who sat down knee-to-knee with the Prophet<sup>"S.A.W"</sup>, may Allah bless with him and grant him peace. [The man] said, ‘Muhammad, tell me about Islam (Arabic: اسلام).’ [Muhammad<sup>"S.A.W"</sup>, may Allah bless with him and grant him peace,] said, ‘Islam is that you witness that there is no god but Allah and that Muhammad is the Messenger of Allah, and you establish the prayer, and you give the Zakat, and you fast Ramadan, and you perform the hajj to the House if you are able.’

<sup>4</sup>Quran Karim: Ali’-Imran:19 \*\*\*إِنَّ الدِّينَ عِنْدَ اللَّهِ الْإِسْلَامُ\*\*\*

<sup>5</sup>Quran Karim: Ali’-Imran:85 وَمَنْ يَبْتَغِ غَيْرَ الْإِسْلَامِ دِينًا فَلَنْ يُقْبَلَ مِنْهُ وَهُوَ فِي الْآخِرَةِ مِنَ الْخَاسِرِينَ ﴿٨٥﴾

<sup>6</sup>Al-Adab Al-Mufrad Book 1, Hadith 273. عَنْ أَبِي هُرَيْرَةَ، أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ: إِذَا بُعِثْتُ لِأَتَمِّمَ صَالِحَ الْأَخْلَاقِ.

<sup>7</sup>Sunan al-Kubra lil Behaqi عَنْ أَبِي هُرَيْرَةَ، قَالَ: قَالَ رَسُولُ اللَّهِ (ص): إِذَا بُعِثْتُ لِأَتَمِّمَ مَكَارِمَ الْأَخْلَاقِ

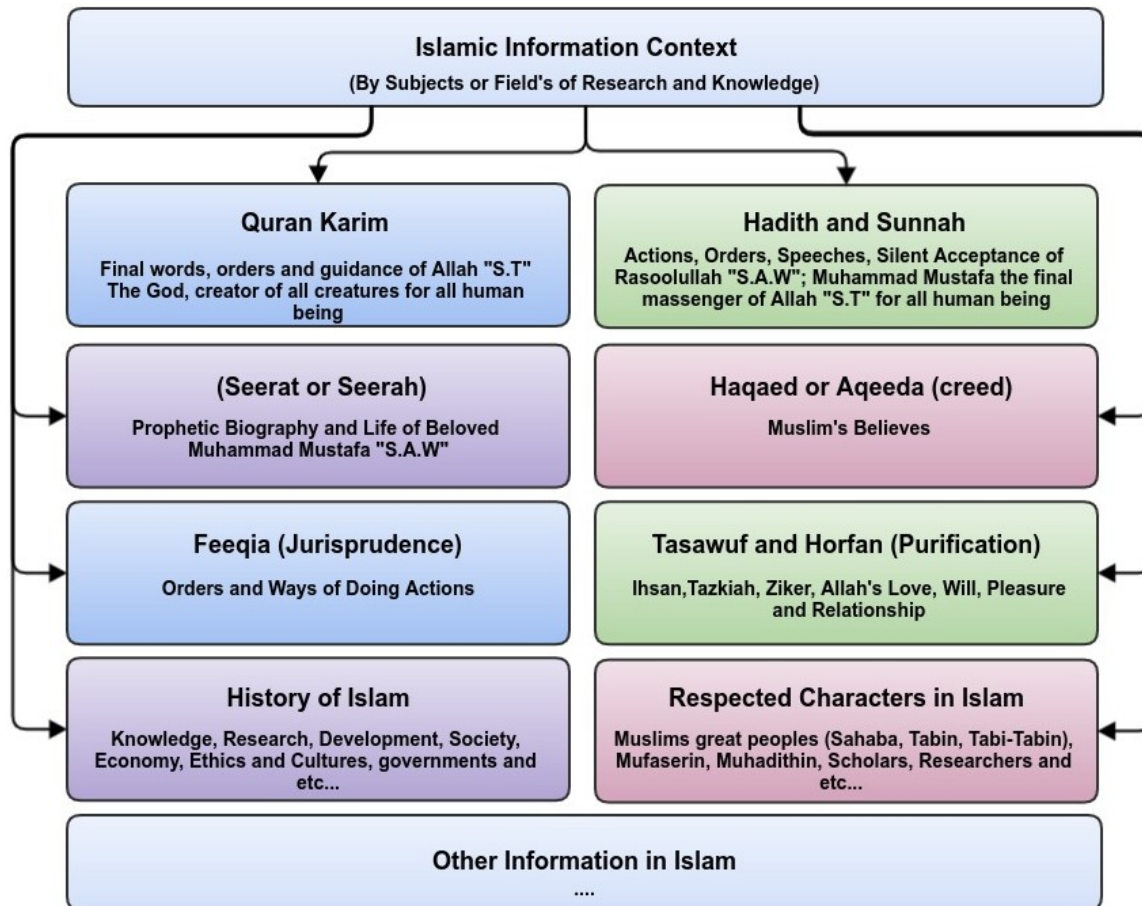


Figure 2.3: Islamic Information Context According to the subjects and fields of research and knowledge

He said, 'You have told the truth,' and we were amazed at him asking him and [then] telling him that he told the truth. He said, 'Tell me about Iman (Arabic: إيمان).' He said, 'That you affirm Allah, His angels, His books, His messengers, and the Last Day, and that you affirm the Decree [predestination], the good of it and the bad of it.' He said, 'You have told the truth.' He said, 'Tell me about Ihsan (Arabic: إحسان).' He said, 'That you worship Allah as if you see Him, for if you don't see Him then truly He sees you.' He said, 'Tell me about the Hour (Arabic: الساعة) [Islamic theology concerning about the life after death, matters of the soul, and the "Day of Judgement," known as Yawm al-Qiyamah (Arabic: يوم القيامة)].' He said, 'The one asked about it knows no more than the one asking.' He said, 'Then tell me about its signs.' He said, 'That the female slave should give birth to her mistress, and you see poor, naked, barefoot shepherds of sheep and goats competing in making tall buildings.' He went away, and I remained some time. Then he asked, 'Umar, do you know who the questioner was?' I said, 'Allah and His Messenger know best.' He said, 'He was Jibril who came to you to teach you your deen [religion]'.<sup>8</sup>

Additionally, Islamic information context could be study by viewing in separate subjects and fields of research and knowledge such as shown in Fig.2.3.

<sup>8</sup>Sahih Muslim Hadith (8) <https://sunnah.com/muslim/1>

### 2.2.1 Quran Karim

Allah<sup>"S.W.T"</sup> self describe Quran Karim in the various verses of Quran Karim such as in "Al-Baqara:2"<sup>9</sup> [This is the Book in which there is no doubt, a guidance for those conscious of Allah.], "Al-Furqan:1"<sup>10</sup> [Blessed is He who sent down the Criterion upon His Servant, to be a warning to humanity.], "As-Sajda:2"<sup>11</sup> [The revelation of the Book, without a doubt, is from the Lord of the Universe.].

Quran Karim is the biggest miracle of beloved Muhammad Rasollullah<sup>"S.A.W"</sup>, that Allah<sup>"S.W.T"</sup> secure it from any changes up to the end of world, as Quran Karim mentioned in "Al-Hijr:9"<sup>12</sup> [Indeed, it is We who sent down the Qur'an and indeed, We will be its guardian.]. As well, Allah<sup>"S.W.T"</sup> challenge all the humans from sent down time of Quran Karim up to the end of the world to bring just a chapter like Quran Karim, if you are in doubt about Quran Karim. This challenge is in the "Al-Baqara:23"<sup>13</sup> [And if you are in doubt about what We have sent down upon Our Servant [Muhammad<sup>"S.A.W"</sup>], then produce a surah [Chapter] the like these and call upon your witnesses other than Allah, if you should be truthful].

Quran Karim as the main root of Islamic information source, from the time of our beloved prophet<sup>"S.A.W"</sup> up to now (1400<sup>th</sup> SH) referred by other categories of Islamic information, and as well as, itself creates various zone's of information, knowledge and research as separate fields, as shown in Fig.2.4. Therefore, for every fields and area different objectives, proficiency, tools and effort are required, such as the following:

- **Quran Karim with its translation:** almost in every language in all over the world the translation of Quran Karim exist.
- **Commentary (Tafser) of Quran Karim :** Tafser Quran Karim is almost available in all over the world with various methodologies in every language.
- **Miracles of Quran Karim:** Quran Karim has lots of Miracles to prove to the humanity that Quran is word of Allah<sup>"S.W.T"</sup>.
- **Modern Scientific Miracles of Quran Karim:** In the technological world of today, Quran's Miracles are revealed to prove itself as the one and only unchanged word of Allah<sup>"S.W.T"</sup>.
- **Reading Standards of Quran Karim:** for better reading of Quran Karim, we have some standards and rules.
- **Quran Karim and Knowing of Allah<sup>"S.W.T"</sup> (God):** in Quran Karim Allah<sup>"S.W.T"</sup> explain his names and adjectives by his self.

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<sup>9</sup>Quran Karim: Al-Baqara:2

ذَٰلِكَ الْكِتَابُ لَا رَيْبَ فِيهِ هُدًى لِّلْمُتَّقِينَ ﴿٢﴾

<sup>10</sup>Quran Karim: Al-Furqan:1

تَبَارَكَ الَّذِي نَزَّلَ الْفُرْقَانَ عَلَىٰ عَبْدِهِ لِيَكُونَ لِلْعَالَمِينَ نَذِيرًا ﴿١﴾

<sup>11</sup>Quran Karim: As-Sajda:2

نَزِيلُ الْكِتَابِ لَا رَيْبَ فِيهِ مِن رَّبِّ الْعَالَمِينَ ﴿٢﴾

<sup>12</sup>Quran Karim: "Al-Hijr:9"

إِنَّا نَحْنُ نَزَّلْنَا الذِّكْرَ وَإِنَّا لَهُ لَحَافِظُونَ ﴿٩﴾

<sup>13</sup>Quran Karim: Al-Baqara:23 وَإِن كُنتُمْ فِي رَيْبٍ مِّمَّا نَزَّلْنَا عَلَىٰ عَبْدِنَا فَأْتُوا بِسُورَةٍ مِّثْلِهِ وَادْعُوا شُهَدَاءَكُم مِّن دُونِ اللَّهِ إِنْ كُنتُمْ صَادِقِينَ ﴿٢٣﴾

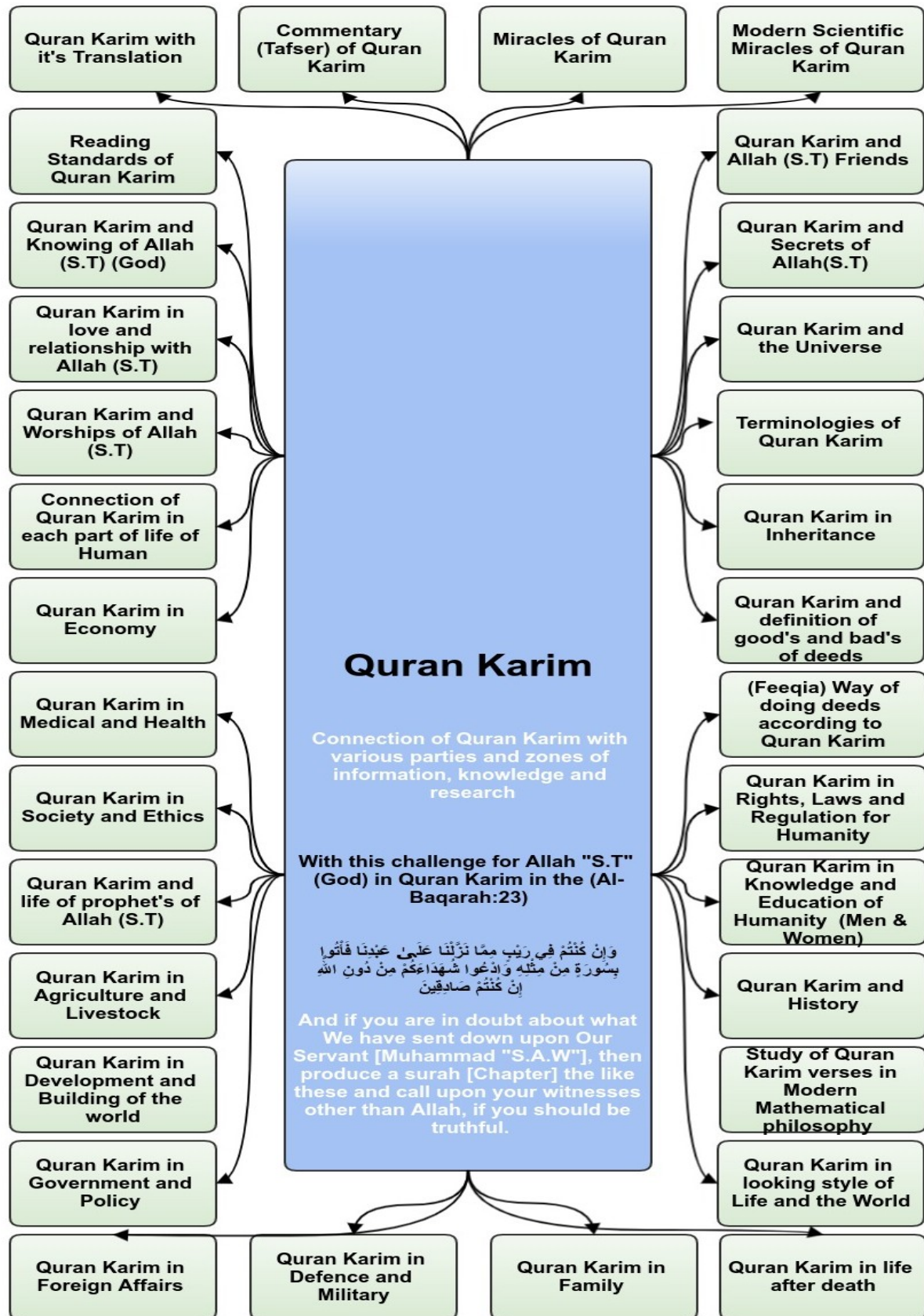


Figure 2.4: Connection of Quran Karim with various parties and zones of information, knowledge and research

- **Quran Karim and Allah<sup>"S.W.T"</sup> Friends:** in Quran Karim Allah<sup>"S.W.T"</sup> mentioned his friends and his characteristics and the way that a human can be Allah<sup>"S.W.T"</sup> friend.
- **Quran Karim and Secrets of Allah<sup>"S.W.T"</sup> :** Quran Karim has several secrets.
- **Quran Karim in love and relationship with Allah<sup>"S.W.T"</sup> :** relationship and love with Allah<sup>"S.W.T"</sup> also exists in Quran Karim.
- **Quran Karim and the Universe:** Quran Karim describe the fundamental and core facts about universe. As knowledge of human being rise to that points, facts of that phenomena revealed by Quran Karim such as **the Big Bang**.
- **Quran Karim and Worships of Allah<sup>"S.W.T"</sup> :** Quran Karim is the only source to describe the main worships of Allah<sup>"S.W.T"</sup> in Islam religion.
- **Terminologies of Quran Karim:** a separate field of study is the taxonomy and terminologies of Quran Karim.
- **Quran Karim in Inheritance:** inheritance and heritage is essential field of knowledge for humanity that can overcome form disorders and kills among people in society.
- **Quran Karim and definition of good's and bad's of deeds:** Allah<sup>"S.W.T"</sup> explain the good and bad deeds of humanity with its goodness and badness, as well as, it's rewards and punishments.
- **Connection of Quran Karim in each part of life of Human:** Quran Karim clearly described orders and laws for every step and position of human being in all length of life such as childhood, Youth and adult age.
- **Quran Karim in Economy:** Quran Karim described the economy laws for humanity.
- **Quran Karim in Medical and Health:** Allah<sup>"S.W.T"</sup> explained the medical signs and health guidelines for humanity.
- **(Feeqia) Way of doing deeds according to Quran Karim:** answers the questions of how? Such as how to act in every required deeds and worships?
- **Quran Karim in Society and Ethics:** In Islam every part and deeds has a dimension of ethics which guarantee the virtue, morality and best rights for man and woman, family, society, country, religions, nationality, color etc.
- **Quran Karim in Rights, Laws, and Regulation for Humanity:** Quran Karim define the rights, laws, and regulation for goodness of humanity.
- **Quran Karim and life of prophet's of Allah<sup>"S.W.T"</sup> :** Allah<sup>"S.W.T"</sup> in Quran Karim mentioned living and important events of some prophets as time required.
- **Quran Karim in Knowledge and Education of Humanity (Men & Women):** Quran Karim categorized orders for general men and women, as well as, for Muslim men and women etc.
- **Quran Karim in Agriculture and Livestock:** Agriculture and livestock are mentioned as an essential job and proficient for humanity.

- **Quran Karim in Development and Building of the world:** Orders of Allah <sup>"S.W.T"</sup> for development of the world is also mentioned by Islam and by which norm and standard and ethical points.
- **Quran Karim and History:** Quran Karim and Hadith of beloved prophet Muhammad <sup>"S.A.W"</sup> is the source that has several historical points from the beginning of the mankind, prophet's of Allah <sup>"S.W.T"</sup> and their nation and customs etc.
- **Study of Quran Karim verses in Modern Mathematical philosophy:** Very Quanic verses has mathematically ordered that by today science and technologies mankind can reveal the miracles and importance of it.
- **Quran Karim in Government and Policy:** Islam draw the specific line for government and country for mankind.
- **Quran Karim in looking style of Life and the World:** Quran Karim and Hadith of beloved prophet Muhammad <sup>"S.A.W"</sup> both paint a big picture of life, world, universe, goals, and responsibilities in front of each human.
- **Quran Karim in Foreign Affairs:** Islam has specific way for dealing and economical transaction events between non-Muslims.
- **Quran Karim in Defense and Military:** Islam has defined defense and military laws and regulations for serving each Muslims and non-Muslim rights.
- **Quran Karim in Family:** Family as a building block in the society couch more attention of Quranic verses. Rights of parents (mother, and father), brothers, sisters and all relatives are mentioned in Quran Karim and Hadith of our beloved Muhammad <sup>"S.A.W"</sup>.
- **Quran Karim in life after death:** Quran Karim and Hadith of beloved Muhammad <sup>"S.A.W"</sup> explained the facts of life after death (Matters of the soul, Day of Judgment, Jannah "paradise" and Jahannam "hell", etc...)

#### 2.2.1.1 Science and Quran Karim

Science meaning knowledge Harper et al. (2001) (a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe) Wilson (1999); Webster (2014). Now we live in the age of Modern science (natural science, social science, and formal science) Bunge (2017); Matthews (2014); O'Brien (2020); Boyack et al. (2007). And every day with the advance tools and techniques discoveries are made by the scientist (human beings). Moreover, some beliefs and information of old generations about many things in the world are now proven to be wrong and some of them have completely opposite facts.

Actually, for everyone some questions may raise; if, someone from more than 1400 years ago, said the keenest, vital, core and important part of facts which matches with the current scientific knowledge without any tools, technology, university, teacher, or even reading or writing ability. How is it possible! To prove the mentioned case which is related with Quran Karim and life of Mohammad Mustafa <sup>"S.A.W"</sup> we have listed below some related modern science discoveries.

- In the field of **Cosmology** "*Science of the origin and evolution of the universe*" and, according to NASA, "*the scientific study of the large scale properties of the universe as a whole.*" Quran karim mentioned the: (Shape of Universe: curvature of space, Seven Heavens: mass in extra dimensions, Age of Universe: age of earth 1/3 age of universe, Expanding Universe: expanding since the Big Bang, Big Bang: creation of the universe, Sound Waves: earliest sound waves in the universe, Isotropy: no preferred directions in space, Primordial Smoke: right after the Big Bang, Dark Energy: causes the universe to expand, Galaxy Filaments: largest known structure in the universe)<sup>14</sup>Miracles of Quran (2021e); phys.org (2021); Di Valentino et al. (2020); Universetoday (2021); Kelly et al. (2018); Britannica (2021a,b); rationalreligion.co.uk (2021); Silk (2000); University of Washington (2021); Kelly et al. (2018); Montani et al. (2011); sciencemag.org (2021); Horvath et al. (2013).
- In the field of **Biology** "*Science of living organisms*" Quran karim mentioned the: (Fingerprints: unique to each individual, Skin Nerves: burning sensation from outer skin, Fasting: has medical benefits, Brain Functions: frontal part handles lies, Evolution: God made, Pupil: dilates when lying, Hypoxia: lack of oxygen, White Hair: linked to shock, Cholesterol: clogs arteries, Fats: slowest source of energy, Bacteria: microscopic organisms, Perspiration: reduces body temperature, Bedsores: caused by extended pressure, Honey: natural antibiotic, Meiosis: cell division, Vision: astronauts experience blurred vision, Bones: form before muscles, Milk: nutrients come from blood stream, Cataracts: linked to depression, Inner Ear: responsible for balance, Keraunoparalysis: caused by lightning strike, Male Fertility: linked to bones, Breastfeeding: social bonding, Eardrum: rapture causes hearing loss, Exoskeleton: leaf-cutter ants coated with crystals, Fear: linked to the heart, Reading: newborn brains prewired to read)<sup>15</sup>Miracles of Quran (2021b).
- In the field of **Zoology** "*Animal science*" Quran karim mentioned the: (Ants: wingless ants are all females, Raptors: flesh eating birds, Spider Web: built by females, Honey Bees: worker bees are all females, Colonies: social colonies, Animal Languages: animals have their own languages, Mosquito: mosquitoes have their own parasites, Crow: hold funerals for their dead, Nocturnal Animals: active at night, Housefly: can only suck fluids, Fossils: preserves naturally)<sup>16</sup>Miracles of Quran (2021l).
- In the field of **Physics** "*Science of motion and behavior through space and time*" Quran karim mentioned the: (Work: force times displacement, Speed of Light: Angels travel at the speed of light, Terminal Velocity: highest speed in free-fall, Rayleigh Scattering: causes sky to appear blue, Pairs: all matter in pairs, Atoms: smallest particle is a string, Singularity, Light: most of electromagnetic spectrum is invisible, Time Relative—Wormholes: Time slows in gravity/acceleration, Wormholes: angels use wormholes for transportation, Pulsars: Black holes, Gravity: curvature of space-time, Spacetime: mass curves spacetime, Armor Piercing: use of copper, Gravitational Waves: ripples in spacetime, Sonic Weapons: can incapacitate or kill, Mass: vibrations of strings, String Theory: mass in extra dimensions, Equivalence Principle: acceleration is equivalent to gravity, Red shifting: stretching of light waves)<sup>17</sup>Miracles of

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<sup>14</sup><https://www.miracles-of-quran.com/cosmology.html>

<sup>15</sup><https://www.miracles-of-quran.com/biology.html>

<sup>16</sup><https://www.miracles-of-quran.com/zoology.html>

<sup>17</sup><https://www.miracles-of-quran.com/physics.html>

Quran (2021k).

- In the field of **Mathematics** "*Science of quantity, structure, space and change*" Quran karim mentioned the: (Prime Numbers: Divisible by 1 and by itself, Distance: Meters, Kilometers, Miles, Light-Years, Pi:  $\pi = 3.14$ , Arithmetic: Multiple of 19, Relational Algebra: Relations between sets, Encoding: Character encoding, Base-19: Numeral system)<sup>18</sup>Miracles of Quran (2021i).
- In the field of **Astronomy** "*Science of celestial objects*" Quran karim mentioned the: (Full Moon: can only be seen at night, Iron: strongest bound nucleus among all elements, Meteorites: burn in atmosphere, Exoplanets: planets outside our solar system, Planetary Orbits: all stars and planets have orbits, Water: water on Earth from outer-space, Sunlight: it took some time before the sun shone, Magnetosphere: shields from radiation, moonlight: moon doesn't radiate, Day: day getting longer, Multi-Star System: planet orbiting multiple stars, Solar Flare: coronal mass ejections, Starlight: luminosity varies with stage, Sirius: distance in light-years)<sup>19</sup>Miracles of Quran (2021a).
- In the field of **Embryology** "*Science of prenatal development*" Quran karim mentioned the: (Fetal Development: face features, Miscarriage: linked to stress, Human Embryo: attaches to mother to feed, Gender: chromosomes, Human Senses: hearing develops before vision, Womb: lining changes thickness, Amniotic Fluid: complete darkness)<sup>20</sup>Miracles of Quran (2021f).
- In the field of **Meteorology** "*Study of the atmosphere*" Quran karim mentioned the: (Weight of Clouds: average is a million pounds, Sea Breeze: change in wind direction, Orographic Effect: mountains can trigger rain, Atmosphere: shields from meteorites, Wind: can snap trees, Volcanic Gases: can cause acid rain, Microburst: threat to aviation, Acid Rain: caused mass extinction, Dew: reaches driest regions, Cloud Seeding: triggers rain, Shorelines: recede due to global warming, Fire Whirl: induced by fire, Freshwater: On mountains, Flash Flood: sudden surge in water, Atmospheric Pressure: decreases with altitude)<sup>21</sup>Miracles of Quran (2021j).
- In the field of **Botany** "*Science of plants*" Quran karim mentioned the: (Photosynthesis: forms sugar, Antioxidants: protect our bodies, Pollination: role of wind, Plant Stress: turns leaves yellow, Gardens: natural Anti-depression, Frost: kills plants, Fluorescence: chlorophyll emits invisible light)<sup>22</sup>Miracles of Quran (2021c).
- In the field of **Geology** "*Study of the Earth*" Quran karim mentioned the: (Desertification: rivers turn into deserts, Landslide: dislocation of land, Weathering & Erosion: smoothes rocks, Porous Rocks: can store water, Mountains: have roots, Internal Waves: seas have internal waves, Earth: rotating sphere, Pumice: least dense stone on Earth, Photic Zone: ocean section with visible light, Tectonics: mountains move, Dead Sea: lowest point on Earth, Sinkhole: natural depression or hole in the ground, Volcano: earthquakes or tremors precede eruptions, Coal: combustible rock,

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<sup>18</sup><https://www.miracles-of-quran.com/mathematics.html>

<sup>19</sup><https://www.miracles-of-quran.com/astronomy.html>

<sup>20</sup><https://www.miracles-of-quran.com/embryology.html>

<sup>21</sup><https://www.miracles-of-quran.com/meteorology.html>

<sup>22</sup><https://www.miracles-of-quran.com/botany.html>

Shorelines: recede due to global warming, Minerals: have different colors, Hydrothermal Vents: hot water from deep underground, Rocks Crack: water can crack rocks, Subduction: sinking of plates, Fault Lines: cracks and faults in Earth, Earthquake: caused by sudden displacement of land, Soil Expansion: causes potholes)<sup>23</sup> Miracles of Quran (2021g).

- In the field of **History** "*Study of the past*" Quran karim mentioned the: (Paper Money: used instead of metal coins, Flight: man reached the sky, Hieroglyphs: deciphered in the 19th century, Digital Books: replace paper books, Calendar: Solar vs lunar, Moses: name means "newborn", Pharaoh's Mummy: Drowned Pharaoh found, Haman: in Egypt, Karnak Temple: pillars built by Pharaohs, Pharaoh: New Kingdom, Noah: local flood, not global, Pompeii Frozen in their final act, North: direction standard for maps, Petra: the lost city, Ubar: lost city, Crucifixion: by Pharaoh)<sup>24</sup> Miracles of Quran (2021h).
- In the field of **Chemistry** "*Science of elements and compounds*" Quran karim mentioned the: (Hydrogen: sun predominantly hydrogen, Supersonic Water: black and viscous, Acid Rain: caused mass extinction, Steam Explosions: superheated water can explode, pyramids: upper parts are backed clay, Viscosity: resistance to flow, Water Stratification: halocline, Rust: oxidized iron, Celsius: melting point of silver)<sup>25</sup> Miracles of Quran (2021d).

### 2.2.1.2 Tafsir/Commentary of Quran Karim

As Hazrat Alma Mufti Muhammad Shafi<sup>R.A</sup> in Tafsir Mahrif-u-Quran described that, Tafsir means to open or to explain the meaning of some statements. And in Islamic world, Tafsir is a specific Knowledge and field that interpret, explain and describe meaning and different orders of Quranic verses and words. This great knowledge has been started from our beloved prophet Muhammad Mustafa<sup>S.A.W</sup> as mentioned by Allah<sup>S.W.T</sup> in "An-Nahl':44"<sup>26</sup> [And We revealed to you [Muhammad Mustafa<sup>S.A.W</sup>] the message that you may make clear to the people what was sent down to them and that they might give thought.], "Aal-e-Imran:164"<sup>27</sup> [Allah has blessed the believers, as He raised up among them a messenger from among themselves, who recites to them His revelations, and purifies them, and teaches them the Scripture and wisdom; although before that they were in evident error.], his self and carry on to now (1400<sup>th</sup> SH).

Commentator / Mufasiren [the great scholars of Tafsir field of knowledge in Islam which has certain standards and quality] used the methodologies and standards of Commentary steps such as (Commentary of Quran Karim with Quran Karim, Commentary of Quran Karim with Hadith (Sunnah) of our beloved prophet Muhammad Mustafa<sup>S.A.W</sup>, Commentary of Quran Karim by use of compilation of first three generations of Muslims (Sahaba,

<sup>23</sup><https://www.miracles-of-quran.com/geology.html>

<sup>24</sup><https://www.miracles-of-quran.com/history.html>

<sup>25</sup><https://www.miracles-of-quran.com/chemistry.html>

<sup>26</sup>Quran Karim: "An-Nahl':44"

بِالْبَيِّنَاتِ وَالزُّبُرِ وَأَنزَلْنَا إِلَيْكَ الذِّكْرَ لِتُبَيِّنَ لِلنَّاسِ مَا نُزِّلَ إِلَيْهِمْ وَلَعَلَّهُمْ يَتَفَكَّرُونَ ﴿٤٤﴾

<sup>27</sup>Quran Karim: "Aal-e-Imran:164" لَقَدْ مَنَّ اللَّهُ عَلَى الْمُؤْمِنِينَ إِذْ بَعَثَ فِيهِمْ رَسُولًا مِنْ أَنْفُسِهِمْ يَتْلُوا عَلَيْهِمْ آيَاتِهِ وَيُزَكِّيهِمْ وَيُعَلِّمُهُمُ الْكِتَابَ وَالْحِكْمَةَ وَإِنْ كَانُوا مِنْ قَبْلُ لَفِي ضَلَالٍ مُبِينٍ ﴿١٦٤﴾

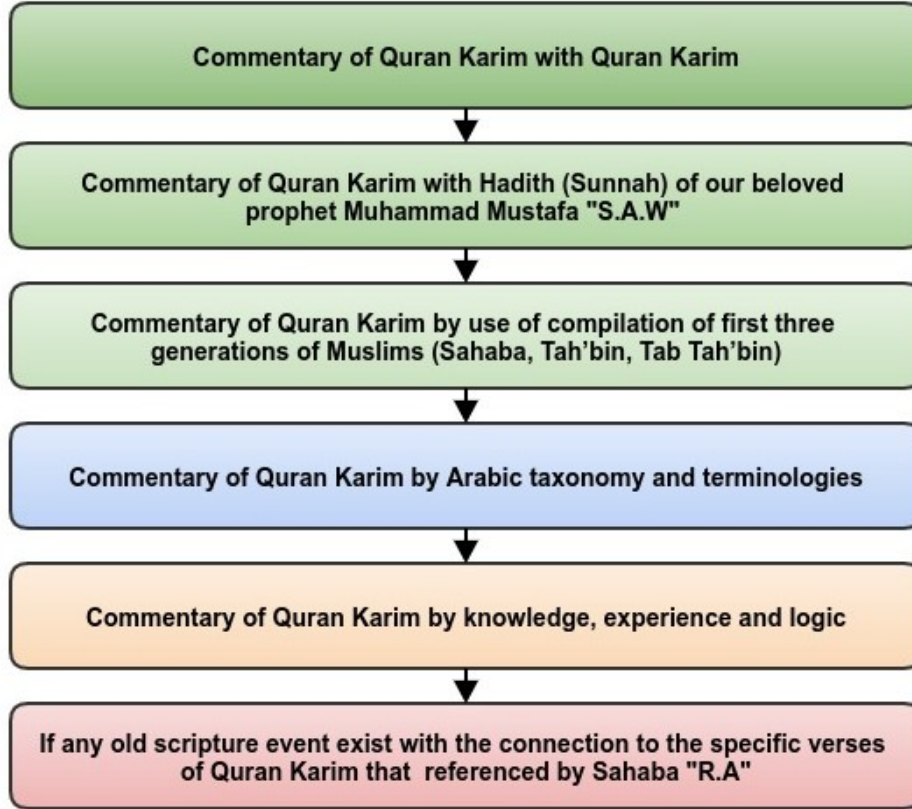


Figure 2.5: Commentary Methodologies of Quranic Verses

Tah'bin, Tab Tah'bin "R.A"), Commentary of Quran Karim by Arabic taxonomy and terminologies, Commentary of Quran Karim by knowledge, experience and logic and finally, if any old scripture event exist with the connection to the specific verses of Quran Karim that referenced by Sahaba "R.A"). As Hazrat Alma Mufti Muhammad Shafi "R.A" in Tafsir Mahrif-u-Quran described the Commentary steps of Quranic verses is shown in Fig.2.5.

Several collections or books of Tafsir that are used in Islamic nation are named in Table.2.1 and described with their commentators / Mufasiren biographies and about Tafsir in Table.B in Appendices.

Table 2.1: Collection or Books of Tafsir that are used in Islamic Nation

No	Tafsir Name	Name of Commentator / Mufasir
1	Gami al-bayan an ta'wil ay al-Quran (Tafsir Garir at-Ṭabari) (تفسير جرير طبري - تفسير جامع البيان)	Abu Gafar Muhammad b. Garir at-Ṭabari (Arabic: أبو جعفر محمد بن جرير الطبري) (d. 923 A.D. / 310 AH)
2	Kashf al-Asrar wa 'Iddat al-Abrar (تفسير كشف الاسرار و عدة الابرار)	Khawaja Abdullah Ansari (Persian: خواجه عبدالله انصاری) (d. 1088 A.D. / 481 AH)
3	Tafsir Al-Kashshaaf (تفسير الكشاف)	Abu al-Qasim Mahmud ibn Umar al-Zamakhshari (Persian: ابو القاسم محمود بن عمر الزمخشري) (d. 1144 A.D. / 538 AH)

( To be continued)

No	Tafsir Name	Name of Commentator / Mufasir
4	<b>Mafatih al-Ghayb</b> (Arabic: مفاتيح الغيب , 'Keys to the Unknown') <b>al-Tafsir al-Kabir</b> ( تفسير الكبير )	Abu Abdullah Muhammad ibn Umar ibn al-Husayn at-Taymi al-Bakri at-Tabaristani Fakhr al-Din al-Razi (Arabic: أبو عبدالله محمد بن عمر بن الحسن بن علي التيمي البكري غفرالدين الرازي ) ( d. 1210 A.D. / 606 AH)
5	<b>Tafsir al-Qurtubi</b> (Arabic: تفسير قرطبي - تفسير جمال الحكم القرآن ) or <b>Al-Jami'li Ahkam al-Qur'an</b>	Abu 'Abdullah Muhammad ibn Ahmad ibn Abu Bakr al-Ansari al-Qurtubi (Arabic: أبو عبدالله محمد ابن احمد ابن ابى بكر الانصارى القرطبي رح ) ( d. 1273 A.D. / 671 AH)
6	<b>Anwar al-Tanzil wa-Asrar al-Ta'wil</b> (Arabic: أنوار التنزيل وأسرار التأويل , lit. 'The Lights of Revelation and the Secrets of Interpretation'), better known as <b>Tafsir al-Baydawi</b> Arabic:( تفسير البيضاوي )	Nasir al-Din Abu al-Khayr 'Abd Allah ibn 'Umar al-Bayḍawī, (Persian: ناصر الدين أبو الخير عبد الله بن عمر بن محمد البيضاوي ) ( d. 1286 A.D. / 685 AH)
7	<b>Tafsir al-Bahr al-Muhit</b> (Explanation of the Ocean) ( تفسير البحر المحيط )	Muhammad ibn Yūsuf bin 'Alī ibn Yūsuf ibn Hayyān (Arabic: مُحَمَّد ابْن يُوسُف ابْن عَلِي ابْن يُوسُف ابْن حَيَّان ) ( d. 1344 A.D. / 744 AH)
8	<b>Tafsir Ibn Kathir</b> ( تفسير ابن كثير )	Hafiz Imad Ad-Din Abu al-Fida Isma'il bin Kathir al-Qurashi Al-Damishqi Shafi' (Arabic: حافظ عماد الدين ابوالفدا اسماعيل ابن كثير قرشي دمشقي شافعي رح ) ( d. 1373 A.D. / 774 AH)
9	<b>Tafsir al-Jalalayn 'Tafsir of the two Jalals'</b> ( تفسير الجلالين )	Abu 'Abd Allah Muḥammad ibn Shihab al-Din Jalal al-Din al-Maḥallī (Persian: جلال الدين أبو عبد الله محمد بن شهاب الدين المحلى ) ( d. 1460 A.D. / 864 AH) Abd al-Raḥman ibn Abi Bakr ibn Muhammad Jalal al-Din al-Khuḍayri al-Suyutī (Arabic: جلال الدين عبد الرحمن بن أبي بكر بن محمد الخضيرى السيوطي رح ) ( d. 1505 A.D. / 911 AH)
10	<b>Tafsir Al-Durr Al-Manthur Fi Tafsir Bil-Ma'thur</b> (Arabic: تفسير الدر المنثور في تفسير بالمأثور )	Abd al-Raḥman ibn Abi Bakr ibn Muhammad Jalal al-Din al-Khuḍayri al-Suyutī (Arabic: جلال الدين عبد الرحمن بن أبي بكر بن محمد الخضيرى السيوطي رح ) ( d. 1505 A.D. / 911 AH)
11	<b>Tafsir al-Mazhari</b> ( تفسير مظهرى )	Qazi Muhammad Sanaullah Panipati <sup>RA</sup> (Arabic: قاضى محمد نزالله پانى ) ( d. 1810 A.D. / 1225 AH)
12	<b>Ruh al-Ma'ani</b> ( تفسير روح المعاني )	Abu al-Thana' Shihab ad-Din Sayyid Mahmud ibn 'Abd Allah al-Ḥusayni al-Alusi al-Baghdadi (Arabic: أبو الثناء شهاب الدين سيد محمود بن عبد الله بن محمود الحسيني الألويسي البغدادي ) ( d. 1854 A.D. / 1270 AH)
13	<b>Ma'ariful Qur'an</b> ( تفسير معارف القرآن )	Mufti Muhammad Shafi' ibn Muhammad Yasin 'Uṣmani Deobandi <sup>RA</sup> (Persian: مفتی محمد شفیع بن محمد یاسین عثمانی دیوبندی رح ) ( d. 1976 A.D. / 1396 AH)

## 2.2.2 Respected Hadith of Beloved Muhammad Mustafa<sup>"S.A.W"</sup>

Hadith of our beloved Muhammad Mustafa<sup>"S.A.W"</sup> are the record of the words, actions, and the silent approval of some action that were done by the companion's<sup>"RA"</sup> in-front of our prophet<sup>"S.A.W"</sup>. Hadith in Islam have been called "the backbone" of Islamic civilization. The deep level details, correct direction and explanation of Quranic verses (orders of Allah<sup>"S.W.T"</sup>) are drive from Hadith and Sunnah of our beloved Muhammad Mustafa<sup>"S.A.W"</sup>. The sunnah is defined as "a path, a way, a manner of life"; "all the traditions and practices" of our [Muslims] beloved prophet Muhammad Mustafa<sup>"S.A.W"</sup> that "have become models to be followed" by all Muslims.

Allah<sup>"S.W.T"</sup> in Quran Karim in a lot of verses says, that we should follow and obey the orders of Allah<sup>"S.W.T"</sup> and his beloved prophet Muhammad Mustafa<sup>"S.A.W"</sup>. Such verses are, in "Al-Ahzab':21"<sup>28</sup> [There has certainly been for you in the Messenger of Allah an excellent pattern for anyone whose hope is in Allah and the Last Day and [who] remembers Allah often.], "An-Noor':54"<sup>29</sup> [Say, "Obey Allah and obey the Messenger; but if you turn away – then upon him is only that [duty] with which he has been charged, and upon you is that with which you have been charged. And if you obey him, you will be [rightly] guided. And there is not upon the Messenger except the [responsibility for] clear notification."]

Actually, doing all actions and fundamental beliefs in Islam in every part of life for human being is related and acceptable whenever those are being according to the orders of Allah<sup>"S.W.T"</sup> and with the way of Rasooluallah<sup>"S.A.W"</sup> practice and teach them.

Sunnah / Hadith of Rasooluallah<sup>"S.A.W"</sup> are the most valuable source of knowledge after Quran Karim; which form the Islamic information context. Sunnah and Hadith needs to be dedicated profession, knowledge and tools, and as well as, develop a great and separate field of knowledge and research in Islamic information context.

In the history of Islam, knowledge field of Hadith of Rasooluallah<sup>"S.A.W"</sup> passed several step, iteration, and phases and as well as have dedicated works area that are shown in Fig.2.6, these all laying out the modern knowledge and information of Hadith.

### 2.2.2.1 Primary Collections of Hadith

As mentioned in iteration and phases of Hadith field, primary collections or books of Hadith are those that collect from **Sahaba, Tabhin, Tabh-tabhin (Companions' of beloved Muhammad<sup>"S.A.W"</sup>, students of companions, students of Tabhin)** with the full links and hierarchy of narration. As well as, these are called original collections of Hadith that are more used in Islamic nation through the life of Islam until now. Important collections are named in Table.2.2.

Table 2.2: Primary Collection or Books of Hadith that are used in Islamic Nation

No	Book Name	Author / Brief Description
1	<b>Sahih Bukhari</b> (Arabic: صحيح البخاري)	<b>Imam al-Bukhari</b> Abu Abd Allah Muhammad ibn Isma'il ibn Ibrahim ibn al-Mughirah ibn Bardizbah al-Ju'fi al-Bukhari (Arabic: أبو عبد الله محمد بن إسماعيل بن إبراهيم بن المغيرة بن بردزبه الجعفي البخاري) (d. 870 A.D. / 256 AH) includes 7,563 hadith <sup>30</sup> <b>Sahih</b> = The Authentic - <b>Kutub al-Sittah</b> = sometimes referred to as <b>al-Sihah al-Sittah</b> , which translates as "The Authentic Six Collection of Hadith of Rasoolullah <sup>"S.A.W"</sup>

( To be continued)

<sup>28</sup>Quran Karim: "Al-Ahzab':21" لَقَدْ كَانَ لَكُمْ فِي رَسُولِ اللَّهِ أُسْوَةٌ حَسَنَةٌ لِّمَن كَانَ يَرْجُوا اللَّهَ وَالْيَوْمَ الْآخِرَ وَذَكَرَ اللَّهَ كَثِيرًا ﴿٢١﴾

<sup>29</sup>Quran Karim: "An-Noor':54" قُلْ أَطِيعُوا اللَّهَ وَأَطِيعُوا الرَّسُولَ فَإِن تَوَلَّوْا فَإِنَّمَا عَلَيْهِ مَا حُمِّلَ وَعَلَيْكُمْ مَا حُمِّلْتُمْ وَإِن تُطِيعُوهُ تَهْتَدُوا وَمَا عَلَى الرَّسُولِ إِلَّا الْبَلْغُ الْمُبِينُ ﴿٥٤﴾

<sup>30</sup><https://sunnah.com/bukhari/about>

No	Book Name	Author/ Brief Description
2	<b>Sahih Muslim</b> (Arabic: صحيح مسلم)	<b>Imam al-Muslim</b> Abu al-Husayn 'Asakir ad-Din Muslim ibn al-Ḥajjaj ibn Muslim ibn Ward ibn Kawshadh al-Qushayrī an-Nayshapuri (Arabic: أبو الحسين عساكر الدين مسلم بن الحجاج بن مسلم بن وَرْد بن كَوْشَاذ القشيري النيشاپوري) (d. 875 A.D. / 261 AH) <i>includes 7,500 hadith</i> <sup>31</sup> Kutub al-Sittah
3	<b>Sunan Ibn Majah</b> (سنن ابن ماجه)	Abu Abdillah Muhammad ibn Yazid Ibn Majah al-Rab i al-Qazwini (Arabic: أبو عبد الله محمد بن يزيد بن ماجه الربيعي القزويني) (d. 887 A.D. / 273 AH) <i>includes 4,341 hadith</i> <sup>32</sup> Kutub al-Sittah
4	<b>Sunan Abu Dawud</b> (سنن أبي داود)	Abu Dawud Sulayman ibn al-Ash'ath ibn Ishaq al-Azdi al-Sijistani (Arabic: أبو داود سليمان بن الأشعث الأزدي السجستاني) (d. 889 A.D. / 275 AH) <i>includes 5,274 hadith</i> <sup>33</sup> Kutub al-Sittah
5	<b>Jami' at-Tirmidhi</b> (جامع الترمذي)	Abū Isa Muhammad ibn Isa as-Sulami ad-Darir al-Bughi at-Tirmidhi (Arabic: أبو عيسى محمد بن عيسى السلمي الضرير البوغي الترمذي) (d. 892 A.D. / 279 AH) <i>includes 4,400 hadith</i> <sup>34</sup> Kutub al-Sittah
6	<b>Al-Sunan al-Sughra</b> (السنن الصغرى), known as <b>Sunan an-Nasa'i</b> (سنن النسائي)	Abu 'Abd ar-Rahman Ahmad ibn Shu'ayb ibn Ali ibn Sinan al-Nasa'i, (Arabic: أبو عبد الرحمن أحمد ابن شعيب ابن علي ابن سنن النسائي) (d. 915 A.D. / 303 AH) <i>includes 5,270 hadith</i> <sup>35</sup> Kutub al-Sittah
7	<b>Al-Muwatta</b> (الموطأ)	<b>Imam Malik</b> Malik bin Anas bin Malik bin 'Abi Amir bin Amr bin al-Ḥarith bin Ghayman bin Khuthayn bin 'Amr bin al-Ḥarith al-Aṣbaḥiy (Arabic: مالك ابن انس ابن مالك ابن عمرو ابن عمر) (d. 795 A.D. / 179 AH) <i>includes 1,720 hadith</i> according to Siddiqī (1961)
8	<b>Kitab ul-Aathaar</b> (كتاب الآثار)	Abu 'Abdullah Muhammad ibnu-l-Hasan Ibn Farqad ash-Shaybani (Arabic: محمد بن الحسن الشيباني) (d.805 A.D. / 189 AH) Yaqub ibn Ibrahim al-Ansari, better known as Abu Yusuf (Arabic: أبو يوسف) (d.798 A.D. / 182 AH) students of Imam Abu Hanifa <sup>RA</sup> (Arabic: أبو حنيفة نعيمان بن ثابت بن أبو حنيفة نعيمان بن ثابت بن) (c. 699 A.D./ 80 AH) (d. 767 A.D. / 150 AH) The book contains almost 1,000 hadiths according to Maktaba Shamila and compiled from a total of 70,000 hadith.
9	<b>Musnad al-Shafi'i</b> (Arabic: مسند الشافعي)	Abi 'Abdillah Muhammad ibn Idris al-Shafi'i (Arabic: أبو عبد الله محمد بن إدريس الشافعي) (d. 820 A.D. / 204 AH) contains almost <i>two thousand</i> (2000) hadiths according to Maktaba Shamila.
10	<b>Musannaf Abd Al-Razzaq</b> (Arabic: مصنف عبد الرزاق)	Abd al-Razzaq ibn Hammam ibn Nafi' al-San'ani (Arabic: عبد الرزاق سناني) (d. 827 A.D. / 211 AH) It contains almost <i>twenty thousand</i> (20000) Hadiths according to Maktaba Shamila. Besides Prophet Hadiths, it contains narrations of Sahaba and early Muslim Scholars.
11	<b>Musannaf Ibn Abi Shaybah</b> (Arabic: مصنف ابن ابي شيبه)	Imam Abu Bakr Ibn Abi Shaybah (Arabic: امام ابو بكر ابن ابي شيبه) (d. 849 A.D. / 235 AH) It is one of the largest compilations of Hadiths, including <i>more than thirty seven thousand</i> (37,000) Hadiths. The goal of these authors was to collect whatever they found, not to extract the best, nor to refine them, nor to make them more accessible for use.

( To be continued)

<sup>31</sup><https://sunnah.com/muslim/about>

<sup>32</sup><https://sunnah.com/ibnmajah/about>

<sup>33</sup><https://sunnah.com/abudawud/about>

<sup>34</sup><https://sunnah.com/tirmidhi/about>

<sup>35</sup><https://sunnah.com/nasai/about>

No	Book Name	Author/ Brief Description
12	<b>Musnad Ishaq Ibn Rahwayh</b> (Arabic: مسند إسماعيل بن راهويه)	Ishāq ibn Rāhwayh (Arabic: إسماعيل بن راهويه) who is the teacher of famous Scholars of Hadiths including Imam Muhammad al-Bukhari, Imam Muslim, Imam Al-Tirmidhi & Imam Al-Nasa'i. (d. 853 A.D. / 238 AH) contains two thousand four <i>hundred &amp; twenty five (2425)</i> hadiths according to Maktaba Shamila.
13	<b>Musnad Ahmad ibn Hanbal</b> (مسند احمد ابن حنبل)	Abu ʿAbdillāh Ahmad Ibn Muhammad Ibn Hanbal Ash-Shaybani (Arabic: أبو عبد الله أحمد بن محمد بن حنبل الشيباني) (d. 855 A.D. / 241 AH) It is one of the largest hadith book written in Islamic History containing more than <i>twenty seven thousand (27000)</i> hadiths according to Makaba Shamila.
14	<b>Sunan al-Darimi</b> (Arabic: سنن الدارمي) or Musnad al-Darimi (Arabic: مسند الدارمي)	Abu Muhammad Abdullah Bin Abdur Rahman Al-Darimi (Arabic: أبو محمد عبد الله بن عبد الرحمن الدارمي) (d. 869 A.D. / 255 AH) It contain almost <i>three thousand five hundred hadith (3500)</i> according to Maktaba Shamila. The arrangement of Hadiths are by subject matter. Most of Hadiths in Sunan are authentic, only few of Hadiths are weak (Dhaif).
15	<b>Al-Adab al-Mufrad</b> (ادب المفرد)	<b>Imam al-Bukhari</b> Abu Abd Allah Muhammad ibn Isma'il ibn Ibrahim ibn al-Mughirah ibn Bardizbah al-Ju'fi al-Bukhari (Arabic: أبو عبد الله محمد بن إسماعيل بن إبراهيم بن المغيرة بن بردزبه الجعفي البخاري) (d. 870 A.D. / 256 AH) The book has hadith about the manners of Islamic prophet Muhammad. It has <i>1,322</i> hadiths according to Maktaba Shamila.
16	<b>Musnad al-Bazzar</b> (مسند البزار)	Hafiz Abu Bakr Ahmed al-Bazzar (Arabic: حافظ أبو بكر أحمد البزار) (d. 905 A.D. / 292 AH) The book contains <i>three hundred &amp; twenty seven (327)</i> hadiths according to Maktaba Shamila. The books contain both Authentic and weak narrations.
17	<b>Musnad Abu Ya'la al-Mosili</b> (مسند أبي يعلى الموصلي)	Abu Ya'la Ahmad bin Ali bin Muthanna bin Yahya al-Tamimi al-Mosuli (Arabic: أبو يعلى أحمد بن علي بن مثنى بن يحيى التميمي الموصلي) (d. 919 A.D. / 307 AH) This book is containing among <i>7555</i> hadith of the prophet Muhammad s.a.w that is considered as one of the authentic books of Hadith.
18	<b>Tahdhib al-Athar</b> (تهذيب الآثار)	Abu Ja'far Muhammad ibn Jarir al-Tabari (Arabic: أبو جعفر محمد بن جرير بن يزيد الطبري) (d. 923 A.D. / 310 AH) Al-Tabari compiled this work as inclusive of hadith, an examination of their authenticity, and the explanation of each. He arranged his work according to the companion narrating it, beginning with Abu Bakr al-Siddiq <sup>RA</sup> (Arabic: أبو بكر صديق رضي). He completed the hadith of the ten companions promised paradise, Ahl al-Bayt and their clients, as well as a large segment of 'Abd Allah ibn 'Abbas's hadith. He died in 923 before completing it.
19	<b>Sahih Ibn Khuzaymah</b> (صحيح ابن خزيمة)	Abu Bakr Muhammad ibn Ishaq ibn Khuzaymah (Arabic: أبو بكر محمد بن إسماعيل بن خزيمة) (d. 924 A.D. / 311 AH) The book contains almost three thousand ( <i>3000</i> ) hadiths according to Maktaba Shamila.
20	<b>Sahih Ibn Hibban</b> (Arabic: صحيح ابن حبان)	Abu Hatim Muhammad ibn faisal al-Tamimi al-Darimi al-Busti (Arabic: أبو حاتم محمد بن إسماعيل التميمي الدارمي البستي) (d. 965 A.D. / 354 AH) The book contains almost seven and a half thousand ( <i>7500</i> ) hadiths according to Maktaba Shamila. There are only four books in Hadith collection which started with term 'Saheeh' or 'Sahih' which means authentic and <b>Sahih Ibn Hibban</b> is one of them as most of its Hadiths are authentic. (other three books are <b>Sahih al-Bukhari</b> , <b>Sahih Muslim &amp; Saheeh ibn Kuzaima</b> ).
21	<b>Al-Mu'jam al-Kabir</b> (Arabic: المعجم الكبير)	Abu 'l-Qawsim Sulayman Ibn Ahmad ibn Ayyoob ibn Muṭawwiyir al-Lakhmi ash-Shami at-Ṭabarani Al-Hanbali (Arabic: أبو القاسم سليمان بن أحمد بن أيوب الطبراني حنبلي) (d. 971 A.D. / 360 AH) It is one of the largest hadith collection book contains almost <i>sixteen thousand (16000)</i> hadiths according to Maktaba Shamila.

( To be continued)

No	Book Name	Author/ Brief Description
22	<b>Sunan al-Daraqutni</b> (Arabic: سنن الدارقطني)	Abu 'l-Ḥasan 'Alī ibn 'Umar al-Baghdadi ad-Daraqutni (Arabic: أبو الحسن علي بن عمر البغدادي الدارقطني) (d. 995 A.D. / 385 AH) The total number of Hadiths in this book are <b>4836</b> according to al-Maktaba al-Shamila. In this book al-Daraqutni deliberately collected the famous Moudu (fabricated) and Dhaif (weak in Narration) Hadiths. Beside that al-Daraqutni also mentioned some Sahih (Authentic) Hadiths as well.
23	<b>Sunan al-Kubra lil Behaqi</b> (سنن الكبرا البيهقي)	Abū Bakr Aḥmad ibn Ḥusayn Ibn 'Alī ibn Mūsā al-Khosrojerdi al-Bayhaqi (Arabic: أحمد بن الحسين بن علي بن موسى الخراساني البيهقي المشهور بالبيهقي) (d. 1066 A.D. / 458 AH) It is the largest Sunan Book available in history of Hadith collection, containing almost twenty two thousand ( <b>22,000</b> ) Hadiths according to Maktaba Shamila.
24	<b>al-Jami' li Shu'ab al-Iman</b> (الجامع لشعب الإيمان)	Abū Bakr Aḥmad ibn Ḥusayn Ibn 'Alī ibn Mūsā al-Khosrojerdi al-Bayhaqi (Arabic: أحمد بن الحسين بن علي بن موسى الخراساني البيهقي المشهور بالبيهقي) (d. 1066 A.D. / 458 AH) It is one of the major collection of Hadiths compiled by Imam Behaqi besides his other major work in the field of Hadiths. According to Maktaba Shamila it contains almost eleven thousands ( <b>11000</b> ) Hadiths (narrations).

### 2.2.2.2 Secondary Collections of Hadith

Secondary collections or books of Hadith are the compilation form original collections of Hadith which means categorizing, classifying, ordering of Hadith according to the needs of time and life parts and style by the respected Imams of Hadith (Best Researchers) with the respect of not any changing to the text of Hadith. This type of Hadith books are more usable for public Muslims than the original once. Important collections are named in Table.2.3.

Table 2.3: Secondary Hadith Collections that are used in Islamic Nation

No	Book Name	Author / Brief Description
1	<b>Tarhib Wat Tarhib</b> (English: Encouragement and Warnings or Inspiring & Disheartening) (Arabic: الترغيب والترهيب)	<b>Imam Mundhiri</b> Imam Zakiyud-Din Abdul Azhim Al-Mundhiri (Arabic: امام ذكي الدين عبد العظيم المنذرى) (d. 1258 A.D. / 656 AH) The book contains almost <i>one thousand (1000)</i> hadiths according to Maktaba Shamila. The author of the book basically compiled those Hadiths which are dealing with virtues of various good deeds and warning to avoid some Evil Deeds.
2	<b>Riyad as-Salihin or The Meadows (Gardens) of the Righteous</b> (Arabic: رياض الصالحين)	<b>Imam Al-Nawawi</b> Abu Zakariyya Yahya ibn Sharaf al-Nawawi (Arabic: أبو زكريا يحيى بن شرف النووي) (d. 1277 A.D. / 676 AH) Contains a total of <b>1,896</b> hadith divided across <b>344 chapters</b> , many of which are introduced by verses of the Quran.
3	<b>Mishkat al-Masabih</b> (مشكاة المصابيح)	<b>Imam Khatib Al-Tabrizi</b> Muhammad ibn Abd Allāh Khatib Al-Tabrizi (Arabic: محمد ابن عبدالله خطيب تبريزي) (d. 1341 A.D. / 741 AH) It contains <i>between 4434 and 5945</i> hadith, divided into <b>29 books</b> and is considered by Sunni scholars an important writing. Al-Tabrizi added <b>1511</b> hadith to the hadith contained in the collection <b>Masabih al-Sunnah</b> of Al-Baghawi. Al-Baghawi did not mention the <b>isnad</b> of the hadith he collected, Al-Tabrizi mentions the source from where the hadith is originally found making the text more reliable. Khatib Al-Tabrizi rendered this version of the original text more accessible to those not having an advanced knowledge of the science of hadith.

( To be continued)

No	Book Name	Author / Brief Description
4	<b>Talkhis al-Mustadrak</b> (Arabic: تلخيص المستدرک)	<b>Imam adh-Dhahabi</b> Shams ad-Din adh-Dhahabi (Arabic: شمس الدين الذهبي), also known as Shams ad-Din abu ‘Abdillah Muhammad ibn Ahmad ibn ‘Uthman ibn Qaymaz ibn ‘Abdillah at-Turkumani al-Fariqi ad-Dimashqi (d. 1348 A.D. / 748 AH) Talkhis al-Mustadrak’ is an abridged (Summarized) version of Al-Mustadrak alaa al-Sahihain (Arabic: المستدرک على الصحيحين) or Mustadrak Al Hakim (Arabic: مستدرک الحاكم) which is a five volume hadith collection, with 9045 hadith, written by Hakim al-Nishapuri (Arabic: الحاكم النيسابوري). He wrote it in the year AH 393 (1002 - 1003 CE), when he was 72 years old. Imam adh-Dhahabi commented on its authenticity. It has become the habit of scholars today working in the field of hadith, when compiling them and determining their authenticity, to say things like "It is authenticated by al-Hakim and al-Dhahabi concurs".
5	<b>Majmau’ al-Zawa’id wa Manba’ al-Fawa’id</b> (Arabic: مجمع الزوائد ومنبع الفوائد)	<b>Imam al-Haythami</b> Nur al-Din ‘Ali ibn Abi Bakr ibn Sulayman, Abu al-Hasan al-Haythami (Arabic: أبو الحسن نور الدين علي بن أبي بكر بن سليمان الهيثمي) (d. 1404 A.D. / 807AH) It compiles the 'unique' hadith of earlier primary collections. It contains hadith extracted from Musnad of Ahmad ibn Hanbal, the Musnad by Abu Ya’la al-Mawsili, the Musnad of Abu Bakr al-Bazzar, and three of al-Tabarani’s collections: Al-Mu’jam al-Kabir, Al-Mu’jam Al-Awsat and Al-Mu’jam As-Saghir. The author provides commentary on the authenticity of each hadith and evaluates some of the narrators.
6	<b>Bulugh al-Maram min Adillat al-Ahkam</b> (Arabic: بلوغ المرام من أدلة الأحكام) English: Attainment of the Objective According to Evidences of the Ordinances	<b>Imam Al-Asqalani</b> al-Hafidh ibn Hajar al-Asqalani (Arabic: الحافظ ابن حجر العسقلاني) (d. 1449 A.D. / 852 AH) Bulugh al-Maram contains a total of 1358 hadiths. At the end of each hadith narrated in Bulugh al-Maram, al-Hafidh ibn Hajar mentions who collected that hadith originally. Bulugh al-Maram includes hadith drawn from numerous primary sources of hadith in it including, <b>Sahih al-Bukhari, Sahih Muslim, Sunan Abu Dawud, Jami at-Tirmidhi, Sunan al-Nasa’i, Sunan ibn Majah, and Musnad Ahmad ibn Hanbal and more.</b> It holds a unique distinction as all the hadith compiled in the book have been the foundation for <b>Shafi’i Islamic Jurisprudence rulings</b> . In addition to mentioning the origins of each of the hadith in Bulugh al-Maram, ibn Hajar also included a comparison between the versions of a hadith that came from different sources. Because of its unique qualities, it still remains a widely used collection of hadith regardless of school of thought.
7	<b>Jami’ al-Saghir Fi Ahadith al-Bashir al-Nadir</b> (الجامع الصغير في أحاديث النبشير النذير)	<b>Imam al-Suyuti</b> Abd al-Rahman ibn Abi Bakr ibn Muhammad Jalal al-Din al-Khudayri al-Suyuti (Arabic: جلال الدين عبد الرحمن بن أبي بكر بن محمد الخضرى السيوطي رح) (d. 1505 A.D. / 911 AH) Al-Jaami As-Saghir is a collection of prophetic traditions by Imam Suyuti, which contains ten thousand and thirty one (10,031) hadiths. He has also compiled a more comprehensive and detailed collection by the name 'Jami Al-Kabir'.
8	<b>Kanz al-Ummal Fee Sunan al-Aqwal wa al-Af’al</b> (Arabic: كنز العمال في سنن الأقوال والأفعال)	<b>Imam al-Muttaqi al-Hindi</b> Ala al-Din Ali ibn Abd-al-Malik al-Muttaqi al-Hindi (Arabic: علاء الدين علي بن حسام متقى هندی) (d. 1567 A.D. / 974 AH) It contains around 46,000 hadith, which are an assortment of varying reliability. Ali al-Muttaqi’s major work is Kanz al-‘Ummāl regarding which his teacher Abu Hasan al-Bakrī al-Şiddiqī says: "Al-Suyuti has done a great favor upon the entire world by writing al-Jami’ al-Saghir and ‘Ali al-Muttaqī has done a great service to al-Suyuti by compiling and arranging his work of al-Jami’ al-Saghir."

### 2.2.2.3 Commentaries (Sharh) and Revision of Hadith collections

Commentaries (Sharh) of Hadith collections are the sufficient explanation of each Hadith from different primary and secondary books for better understanding according to the need of time and people knowledge. In Sharh or commentary of Hadith, explanation and study of every Hadith has been done through the connection of quran karim verses, other related



Figure 2.6: Hadith of Rasooluallah "S.A.W" passed steps and dedicated working areas

Hadith from different sources, scholars view and achievement, science of Hadith, connection with the modern science, knowledge and research, and etc...

This type of Hadith books are more and more usable and recommendable for public Muslims than the primary and secondary types. Important collections are named in Table.2.4.

Table 2.4: Commentaries (Sharh) and Revision of Hadith collections that are used in Islamic Nation

No	Book Name	Author / Brief Description
1	<b>Fath al-Bari fi Sharh Sahih al-Bukhari</b> (English: Victory of the Creator) (Arabic: فتح الباري)	<b>Imam Al-Asqalani</b> Al-Hafidh ibn Hajar al-Asqalani (Arabic: الحافظ ابن حجر العسقلاني) (d. 1449 A.D. / 852 AH) Fath al-Bari is a multi-volume commentary on the hadith collection <b>Sahih al-Bukhari</b> . It is the most celebrated hadith commentary. It is reported that it took Ibn Hajar <b>25 years</b> to finish his work. Abd al-Hakim Murad said of Fath al-Bari in the introduction to the translation of Ibn Hajar al-Asqalani's commentary on selected hadith (published as a booklet by the Muslim Academic Trust): <i>"The importance of this literature may be gauged by the fact that at least <b>seventy (70) full commentaries</b> have been written on Imam al-Bukhari's great Sahih... the most celebrated [of which] is without question the magnificent Fath al-Bari (Victory of the Creator) by Imam Ibn Hajar al-Asqalani, a work which was the crown both of its genre and of the Imam's academic career"</i> .
2	<b>Al-Minhaj Sharh Sahih Muslim</b> (Arabic: المنهاج - صحيح (مسلم بشرح النووي)	<b>Imam Al-Nawawi</b> Abu Zakariyya Yahya ibn Sharaf al-Nawawi (Arabic: أبو زكريا يحيى بن شرف النووي) (d. 1277 A.D. / 676 AH) Imam al-Nawawi's commentary on Sahih Muslim is one of the most highly regarded works in Islamic thought and literature, and often referred to as a super-commentary. Accepted by every sunni school of thought, and foundational in the Shafi'i school, this text, available for the first time in English, alongside the original Arabic text and translation of all the Hadiths, is famed throughout the Muslim world. An essential for any student of knowledge: the unmissable explanation of Sahih Muslim by Imam Nawawi. This book is a must, as well as Fath al-Bari to Sahih Al-Bukhari, which are the absolute references in terms of explanation of the Sahihayn.
3	<b>Sharah Arbaeen e Nawawi (Commentary on the 40 Ahadith of Imam Nawawi)</b> (Arabic: شرح اربعين (النوي)	<b>Imam Al-Nawawi</b> Abu Zakariyya Yahya ibn Sharaf al-Nawawi (Arabic: أبو زكريا يحيى بن شرف النووي) (d. 1277 A.D. / 676 AH) Nawawi's Forty (sc. "Forty Hadith", in Arabic: al-arbaʿn al-nawawīyah) is a compilation of forty hadiths by Imam al-Nawawi, most of which are from Sahih Muslim and Sahih al-Bukhari. This collection of hadith has been particularly valued over the centuries because it is a distillation, by one of the most eminent and revered authorities in Islamic jurisprudence, of the foundations of Islamic sacred law or Shari'ah. In putting together this collection, it was the author's explicit aim that "each hadith is a great fundament (qaʿida ʿazima) of the religion, described by the religious scholars as being 'the axis of Islam' or 'the half of Islam' or 'the third of it' or the like, and to make it a rule that these forty hadith be classified as sound (sahih)."
4	<b>Al Jami al Masaneed Wa'sunan</b> (Arabic: جامع المسانيد و السنن)	<b>Imam Ibn Kathir</b> Hafiz Imad Ad-Din Abu al-Fida Isma'il bin Kathir al-Qurashi Al-Damishqi Shafi' (Arabic: حافظ عماد الدين ابوالفدا اسماعيل ابن كثير قرشي دمشقي شافعي رح) (d. 1373 A.D. / 774 AH) Al Jami is a grand collection of Hadith texts intended for encyclopedic use. It is an alphabetical listing of the Companions of the Prophet and the sayings that each transmitted, thus reconstructing the chain of authority for each hadith.

( To be continued)

No	Book Name	Author / Brief Description
5	<b>Mirqat al-Mafatih Sharh Mishkat al-Masabih</b> (مرقاۃ المفاتیح شرح مشکاة المصابيح)	<b>Mulla Ali al-Qari</b> Nur ad-Din Abu al-Hasan Ali ibn Sultan Muhammad al-Hirawi al-Qari (ملا علی القاری) known as Mulla Ali al-Qari (نور الدین أبو الحسن علی بن سلطان محمد الهروي القاري) (d. 1605 A.D. / 1014 AH) Mirqat al-Mafatih is the most comprehensive and excellent Arabic commentary on Mishkat al-Masabih. The Mishkat al Masabih has enjoyed wide popularity in the world of Islamic learning Since 516 AH when it was first compiled by Waliuddin Abu Abdullah Mahmud Al-Tabrizi.
6	<b>Bahishti Zewar</b> (بهشتی زیور) "paradis-aical jewels" English: Heavenly Ornaments	<b>Mawlana Ashraf Ali Thanvi</b> Muhammad Ashraf 'Ali Thanvi (Urdu: مولانا اشرف علی تھانوی) (d. 1943 A.D. / 1362 AH) Bahishti Zewar is a volume of Islamic beliefs and practices written by Mawlana Ashraf Ali Thanvi. The book is comprehensive handbook of fiqh, Islamic rituals and morals, it is especially aimed at the education of girls and women. The volume describes the Five Pillars of Islam and also highlights more obscure principles. Thanvi and Metcalf (1992) [Barbara Daly Metcalf's book by Oxford University Press] <b>Perfecting Women</b> is a commentary and history of the Bahishti Zewar.
7	<b>Faza'il-e-A'maal</b> (Arabic: فضائل اعمال) Virtues of deeds	<b>Muhammad Zakariyya al-Kandhlawi</b> Shaykh al-Hadith Muhammad Zakariyya al-Kandhlawi (Arabic: شیخ الحدیث محمد زکریا کاندھلوی) (d. 1982 A.D. / 1402 A.H) Faza'il-e-A'maal is a joined collection of Faza'il-e-Namaaz (Arabic: فضائل نماز), Faza'il-e-Zikr (Arabic: فضائل ذکر), Faza'il-e-Tabligh (Arabic: فضائل تبلیغ), Faza'il-e-Quran (Arabic: فضائل قرآن), Faza'il-e-Ramadan (Arabic: فضائل رمضان), Faza'il-e-Durood-Sharif (Arabic: فضائل درود شریف), Hikayat-e-Sahabah (Arabic: حکایت صحابه) and etc...
8	<b>Maariful Hadith - Meaning and Message of the Traditions</b> (Arabic: معارف الحديث)	<b>Maulana Manzoor Nomani</b> Mu ammad Manzoor Nomani (Arabic: محمد منظور نعمانی) (d. 1997 A.D. / 1418 AH) Ma'ariful Hadith spread in 4 volumes is a collection of Hadith on all topics of religion. These are explained in lucid language by Maulana Muhammad Manzoor Nu'mani (RA). Beginning with the Hadith about the 'importance of intention in performance of deeds', the book takes us through Hadith on faith, on the duties in Islam and ends up with Hadith on supplication. In explaining the Hadith, the Maulana has relied upon Shah Wali'Ullah (RA) for the final word. The Hadith are chosen mainly from Mishkaat Al-Masaabih, but some directly from the main books of Hadith.

#### 2.2.2.4 Hadith studies & Terminologies

Hadith studies and Terminologies are also called *Science of Hadith*, are the sufficient exploration of Hadith field. It includes the laws, rules, principles, and guidance for better utilizing the authentic Hadiths in each part of Muslim's life. These rules are gathered by best researchers (Imams of Hadith) of Islam religion during the studying of Hadith of Rasooluallah "S.A.W" in his researches in all times. This type of Hadith books are more and more usable and recommendable for researcher (Ulama - Arabic: علما) of Muslims Imma (Teachers and Lecturers of Islam (Mobalighin - Arabic: مبلغین), Student of Islam, those that want to research in Hadith of Nabi Karim "S.A.W" in more academical standards). The basic concept and terminologies are also recommended for all public Muslims as well. Important books are named in Table.2.5.

Table 2.5: Hadith studies and Terminologies books that are used in Islamic Nation

No	Book Name	Author / Brief Description
1	Usool as-Sunnah (Arabic: أصول السنة)	<b>Imam Ahmad ibn Hanbal</b> Abu Abdillah Ahmad Ibn Muhammad Ibn Hanbal Ash-Shaybani (Arabic: أبو عبد الله أحمد بن محمد بن حنبل الشيباني) (d. 855 A.D. / 241 AH) Foundations of the Prophetic Tradition (in Belief). <b>Usul As-Sunnah of Imam Ahmad</b> has lots of Explanation (Sharh) such as Explanation of Usul As-Sunnah of Imam Ahmad by Al-Jibreen, Ahmad b. Hanbal “Usool as-Sunnah” Explanation of Ahmad an-Najmee
2	Tawil Mukhtalif al-Hadith (Arabic: تأويل مختلف الحديث) The Interpretation of Conflicting Narrations	<b>Ibn Qutaybah</b> Abu Muhammad Abd-Allah ibn Muslim ibn Qutayba al-Dinawari al-Marwazi or simply Ibn Qutaybah (Arabic: ابن قتيبة) (d. 885 A.D. / 276 AH) a renowned Islamic scholar of the Golden Age of Islam, in which he defends and reconciles hadiths that Mu'tazilites and Quranists had dismissed as contradictory or irrational. <b>Tawil Mukhtalif al-Hadith</b> defence of hadiths against Mu'tazilite critics.
3	al-Ilma' ila Ma'rifa Usul al-Riwaya wa Taqyid al-Sama (Arabic: الإلماع إلى معرفة أصول الرواية وتقيد السماع)	<b>Qadi Ayyad</b> Qadi Iyad ibn Musa (Arabic: القاضي عياض بن موسى) (d. 1149 A.D. / 544 AH) a detailed work on the science of Hadith.
4	Muqaddimah ibn al-Salah fi 'Ulum al-Hadith (Arabic: مقدمة ابن الصلاح في علوم الحديث) Introduction to the Science of Hadith	<b>Ibn al-Salah</b> Abu 'Amr 'Uthman ibn 'Abd il-Rahman Salah al-Din al-Kurdi al-Shahrazuri (Arabic: ابن صلاح، تقي الدين ابو عمرو عثمان بن عبد الرحمان بن عثمان ابن موسى بن ابي نصر نصرى شهرزورى) (d. 1245 A.D. / 643 AH) Muqaddimah ibn al-Salah fi 'Ulum al-Hadith is the written which describes the Islamic discipline of the science of hadith, its terminology and the principles of biographical evaluation.
5	Nukhbat Al-Fikar Fi mustalah Ahl Al-Athar (Arabic: نخبة الفكر في مصطلح أهل الأثر)	<b>Imam Al-Asqalani</b> Al-Hafidh ibn Hajar al-Asqalani (Arabic: الحافظ ابن حجر العسقلاني) (d. 1449 A.D. / 852 AH) Nukhbat Al-Fikar Fi mustalah Ahl Al-Athar is with the explanation in hadith terminology field.
6	Mozuat E Kabeer (Arabic: موضوعات كبير)	<b>Mulla Ali al-Qari</b> Nur ad-Din Abu al-Hasan Ali ibn Sultan Muhammad al-Hirawi al-Qari (Mulla Ali al-Qari) (Arabic: ملا علي القاري) known as Mulla Ali al-Qari (Nur al-Din Abu al-Hasan Ali ibn Sultan Muhammad al-Hirawi al-Qari) (d. 1605 A.D. / 1014 AH) Mozuat E Kabeer is the book by Mulla Ali al-Qari in science of Hadith field.

### 2.2.3 (Seerah or Seerat) Life of Beloved Muhammad Mustafa<sup>S.A.W</sup>

In the Arabic language, the word **sīra or sīrat (seerah or seerat)** (Arabic: سيرة) comes from the verb *sāra* (Present tense: *yasīru*), which means to travel or to be on a journey. A person's *sīra* is that person's journey through life, or biography, encompassing their birth, events in their life, manners and characteristics, and their end of life in this world. In Islam, *Al-sira al-Nabawiyya* (Arabic: السيرة النبوية ﷺ) (Prophetic biography), *Seerat Rasul Allah* (Arabic: سيرت رسول الله ﷺ) (Life of the Messenger of God "Allah"), or *Seerah* are the traditional Muslim biographies of Muhammad Mustafa<sup>S.A.W</sup> from which, in addition to the Quran and trustable (authentic) Hadiths, most vital information about his life and the early period of Islam is derived.

Beloved Muhammad Mustafa<sup>S.A.W</sup> is the final prophet of Allah<sup>S.W.T</sup> for all human being as in Quran Karim Allah<sup>S.W.T</sup> mentioned, in "Al-Ahzab':40"<sup>36</sup> [*Muhammad*<sup>S.A.W</sup> is

<sup>36</sup>Quran Karim: "Al-Ahzab':40" مَا كَانَ مُحَمَّدٌ أَبَا أَحَدٍ مِنْ رِجَالِكُمْ وَلَكِنْ رَسُولَ اللَّهِ وَخَاتَمَ النَّبِيِّينَ وَكَانَ اللَّهُ بِكُلِّ شَيْءٍ عَلِيمًا ﴿٤٠﴾

not the father of any man among you, but a messenger of God, and the seal of the prophets. God has knowledge of everything.]. Therefore, Seerat Rasul Allah<sup>S.A.W</sup> is essential for every human being. Allah<sup>S.W.T</sup> by himself mentioned about the great manner and character of Muhammad<sup>S.A.W</sup> through Quran Karim "Al-Qalam:1-4"<sup>37</sup> [Ya Muhammad<sup>S.A.W</sup>] For you are verily born of sublime nature. [You have the greatest character]. Therefore, Allah<sup>S.W.T</sup> ordered to all Muslim [who want Allah's will and pleasure], for coping the manner and character of Muhammad Rasul Allah<sup>S.A.W</sup> in his/her life through Quran Karim "Al-Ahzab':21"<sup>38</sup> [There has certainly been for you in the Messenger of Allah an excellent pattern for anyone whose hope is in Allah and the Last Day and [who] remembers Allah often].

In the field of Seerah or Seerat, beside of studying the whole life's events, manner and character, jobs, economy, family and friends and more, in every possible direction, the physical appearance or view of Muhammad<sup>S.A.W</sup> is an attractive and beautiful part as well which is called the Shamā'il Muhammadiyyah ("The Appearance of Muhammad") (Arabic: شمائل المحمدية ﷺ). Such information are scarce and rare, but well-known and accepted description are present from Hazrat Ali Murtaza<sup>R.T</sup> (Arabic: حضرت علي مرتضى رض) Muhammad's son-in-law and cousin [4<sup>th</sup> Khalifa of Islam] in Tirmidhi. Other descriptions are attributed for Hazrat bibi Aisha Sidiqa<sup>R.T</sup> (Arabic: حضرت بي بي عائشه صديقه رض) Muhammad's wife [Mother of Islam], 'Hazrat Abd Allah ibn 'Abbas<sup>R.T</sup> (Arabic: حضرت عبد الله ابن عباس رض), Hazrat Abu Hurairah<sup>R.T</sup> (Arabic: حضرت ابوهريره رض), Hazrat Anas<sup>R.T</sup> (Arabic: حضرت انس صاحب رض), Hazrat Hasan ibn Ali<sup>R.T</sup> (Arabic: حضرت حسن ابن علي رض) and other few Sahaba<sup>R.T</sup>. but a very beautiful description is attributed by a woman named Umm Ma'bad (Arabic: ام معبد)<sup>39</sup>.

<sup>37</sup>Quran Karim: "Al-Qalam:1-4"

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ  
ن وَالْقَلَمِ وَمَا يَسْطُرُونَ ﴿١﴾  
مَا أَنْتَ بِنِعْمَةِ رَبِّكَ بِمَجْنُونٍ ﴿٢﴾  
وَإِنَّ لَكَ لَأَجْرًا غَيْرَ مَمْنُونٍ ﴿٣﴾  
وَإِنَّكَ لَعَلَى خُلُقٍ عَظِيمٍ ﴿٤﴾

<sup>38</sup>Quran Karim: "Al-Ahzab':21" لَقَدْ كَانَ لَكُمْ فِي رَسُولِ اللَّهِ أُسْوَةٌ حَسَنَةٌ لِمَن كَانَ يَرْجُوا اللَّهَ وَالْيَوْمَ الْآخِرَ وَذَكَرَ اللَّهَ كَثِيرًا ﴿٢١﴾

<sup>39</sup>In his Book, "Uyunul-Athar," Ibn Sayyidin-Nas mentioned:

While immigrating to Madinah, Prophet Muhammad ﷺ was accompanied by Abu Bakr, Amir Ibn Fuhayrah, the slave of Abu Bakr, and the son of Urayqit, who guided them on their way. They passed by Umm Ma'bad from the tribe of Khuza'ah, who did not know them. The Prophet said to her: 'O Umm Ma'bad, do you have milk?' She said: 'No, by Allah.' He then saw a female sheep at the end of the house and asked her about it. She said that it was an old sheep and did not produce milk anymore. With the permission of Umm Ma'bad, the Prophet passed his hand over the back and udder of the sheep. Then he asked for a container. He milked the sheep and filled the container. Then he gave the milk to his Companions to drink. He milked the sheep again to fill the container for Umm Ma'bad and he left. Later, upon his return, Umm Ma'bad's husband asked her: O Umm Ma'bad, What is this milk when there is no milking sheep in the house and the rest of the sheep were away? She said: 'No, by Allah. However, there passed by us **A man with obvious beauty and cleanliness, a glowing countenance, and a good appearance/disposition; with no bulging stomach disgracing him, or a small head disparaging him; is overtly handsome and wholly beautiful; his eyes are wide and very white and black and eyelashes are long; whose voice is devoid of hoarseness, neck is long, and beard is full; the white part of whose**

Important books of Seerat Rasul Allah "S.A.W" (Arabic: سيرت رسول الله ﷺ) are named in Table.2.6.

Table 2.6: Important books of Seerat Rasul Allah "S.A.W" (Arabic: سيرت رسول الله ﷺ)

No	Book Name	Author / Brief Description
1	<b>Sirat Rasul Allah</b> (Arabic: سيرة رسول الله) "Life of the Messenger of God"	<b>Ibn Ishāq</b> Muḥammad ibn Ishāq ibn Yasār ibn Khiyār (Arabic: محمد بن إسماعيل بن إسحاق بن خييار, or simply <b>ibn Ishāq</b> , ابن إسحاق, meaning "the son of Isaac") (d. 767 A.D. / 150 AH) Ibn Ishāq collected oral traditions that formed the basis of an important biography of the Islamic prophet Muhammad. Alfred Guillaume's authoritative translation of the Sira of Ibn Ishāq presents in English the complete history of the life of Prophet Muhammad mentioned that  No book can compare in comprehensiveness, arrangement, or systematic treatment with Ibn Ishāq's work  The original versions and survival of Ibn Ishāq works are collected and cited in two main sources. firstly by his student <b>Ziyād al-Baqqā'i</b> (Arabic: زياد بن عبد الله بكائي), which was further edited by <b>ibn Hisham</b> (Arabic: ابن هشام). Second source is in book of <b>History of the Prophets and Kings</b> by Muhammad ibn Jarir al-Tabari (Arabic: محمد ابن جرير الطبري).
2	<b>As-Sīrah an-Nabawiyyah</b> (Arabic: السيرة النبوية) The Life of the Prophet	<b>Ibn Hisham</b> Abu Muhammad 'Abd al-Malik bin Hisham ibn Ayyub al-Himyari al-Mu'afiri al-Baṣri (Arabic: أبو محمد عبد الملك بن هشام ابن أيوب الحميري المعافري البصري) (d. 833 A.D. / 218 AH) As-Sīrah an-Nabawiyyah (السيرة النبوية), 'The Life of the Prophet'; is an edited recension of Ibn Ishāq's classic Sīratu Rasūli l-Lāh (سيرة رسول الله) 'The Life of God's Messenger'. Ibn Ishāq's now lost work survives only in <b>Ibn Hishām's</b> and <b>al-Tabari's</b> recensions, although fragments of several others survive, and Ibn Hishām and al-Tabarī share virtually the same material.
3	<b>Ash-Shama'il An-Nabawiyyah wa Al-Fada'il Al-Mustafawiyyah</b> (Arabic: الشمائل النبوية و فضائل المصطفوية) The Appearance of Muhammad, <b>Shamā'il al-Tirmidhi</b> or simply <b>Shamā'il</b>	<b>Imām al-Termezī/Tirmidhī</b> Abū Isa Muhammad ibn Isa as-Sulami ad-Darir al-Bughi at-Tirmidhi (Arabic: أبو عيسى محمد بن عيسى السلمي الضرير البوغي الترمذي) (d. 892 A.D. / 279 AH) In this book Imam Tirmidhi has recorded everything about the Holy Prophet "S.A.W" on the authority of the Companions, and collected <b>397 hadith</b> which are divided into <b>55 Chapters</b> . Drawing A pen picture of the Holy Prophet's "S.A.W" physical features manners and characteristics

( To be continued)

eyes is extremely white, and the black part of whose eyes is extremely black, as if his eyelids have kohl naturally; whose eyebrows arch longitudinally and thinly (as if they) meet; who has an extremely black hair; who is stately when silent and is gorgeous when speaking; who is the most beautiful and striking man from far and the best and most beautiful from close; whose speech is sweet, clear, and decisive, neither vaguely short, nor boringly and pointlessly long; whose words flow forth like a perfect string of pearls; of medium height that neither elicits contempt to avert him for shortness, nor aversion to him for excessive tallness; who is a branch between two branches ; he is the most radiant of the three and the most well-respected; whose companions surround him; when he speaks they listen attentively to his speech, and when he commands they vie with each other to fulfill his commands. who is well served and attended, who is neither a scowler nor a prattler.

No	Book Name	Author / Brief Description
4	<b>Dala'il al-Nubuwwah Wama'rifat Ahwal Sahib al-Shari'ah</b> (Arabic: دلائل النبوة (ومعرفة أحوال صاحب الشريعة) The Signs of Prophet-hood	<b>Imam al-Bayhaqi</b> Abū Bakr Aḥmad ibn Ḥusayn Ibn 'Alī ibn Mūsā al-Khosrojerdi al-Bayhaqi (Arabic: أحمد بن الحسين بن علي بن موسى الخراساني البيهقي المشهور بالبيهقي (d. 1066 A.D. / 458 AH) One of the earliest books written on the prophetic proof of Muhammad <sup>"S.A.W"</sup> is this magnificent work of Imam al-Bayhaqi. Book is arranged in chapters of topics which is followed by narrations related to each chapter. As the Imam was one of the few Hadith scholars relied upon in this field gives this book authoritative standing among the scholars however there is also extensive Tahqiq done by the editor as well.
5	<b>Al-Shifa bi Ta'rif Huquq al-Mustafa</b> ( الشفا بتعريف حقوق (المصطفى short title, ash-Shifa or al-Shifa ( الشفا ) (The Healing)	<b>Qadi Iyad</b> Qadi 'Iyad ibn Musa (Arabic: القاضي عياض بن موسى (d. 1149 A.D. / 544 AH) the most frequently used and commented upon handbook in which Muhammad's life, his qualities and his miracles are described in every detail. Ash-Shifa remains one of the most commentated books of Islam after the <b>Sahih's of Muhammad al-Bukhari and Muslim ibn al-Hajjaj</b> . Commentaries such as (Sharh al-Shifa' li-al-Qadi 'Ayyad (Arabic: الشفا شرح القاضي عياض) in 2 volumes by Ali al-Qari (ملا علي) Manahil as-safa fi takhrij Ahadith al-Shifa (Arabic: مناهل الصفا في تخریج احاديث الشفاء) by al-Suyuti (Arabic: جلال الدين السيوطي رح ( الشفاء
6	<b>Al-Sira Nabawiyya</b> (( السيرة النبوية )) Life of the Prophet Muhammad	<b>Ibn Kathir</b> Hafiz Imad Ad-Din Abu al-Fida Isma'il bin Kathir al-Qurashi Al-Damishqi Shafi' (Arabic: حافظ عماد الدين ابوالفدا اسماعيل ابن كثير قرشي دمشقي شافعي رح (d. 1373 A.D. / 774 AH) Extract from The Beginning and The End, Al-Bidāya wa-n-Nihāya (( البداية والنهاية )) of Ibn Kathir.
7	<b>Al-Khasais-ul-Kubra</b> ( القصص الكبرى )	<b>Imam al-Suyuti</b> Abd al-Raḥman ibn Abi Bakr ibn Muhammad Jalal al-Din al-Khuda'ri al-Suyuti (Arabic: جلال الدين عبد الرحمن بن أبي بكر بن محمد الخضيري السيوطي رح (d. 1505 A.D. / 911 AH) Al Khasais-ul-Kubra is a book written by Egyptian writer Jalaluddin Al-Suyuti (Arabic: جلال الدين السيوطي رح ) , a distinguished Islamic scholar. The book deals with the miracles attributed to our beloved prophet Muhammad <sup>"S.A.W"</sup> .
8	<b>Al-Muwahib al-Ladunniyyaha</b> ( مواهب لدني )	<b>Iman Qasṭallānī</b> Shihāb al-Dīn Abū'l-'Abbās Aḥmad ibn Muḥammad ibn Abī Bakr al-Qasṭallānī al-Qutaybī al-Shāfi'ī (Arabic: شهاب الدين عبدالباس احمد ابن محمد ابن ابوبكر قستلاني الشافعي رح (d. 1517 A.D. / 923 AH) The book was commented in Sharh al-Mawahib al-Ladunniyyah (8 volumes) by Muhammad al-Zurqani (1645–1710 A.D) (Arabic: محمد الزرقاني). It was abridged by Sheikh Imam al-Qadi Yusuf bin Ismail bin Yusuf bin Ismail bin Muhammad Nāsir al-Dīn an-Nabhani al-Naqshbandi (1849–1932 A.D) (Arabic: شيخ امام القاضي يوسف بن إسماعيل بن يوسف بن إسماعيل بن محمد ناصر الدين نباني نقشبندی).
9	<b>Madarij-un-Nabuwwah</b> ( مدارج النبوة )	<b>Abd al-Haqq al-Dehlawi</b> Abd al-Haqq al-Dehlawi (Persian: شیخ عبدالحق محدث دهلوی (d. 1642 A.D. / 1052 AH) Madarij un-Nabuwwah (Grades of Prophethood) - the famous biography (sira) of the Prophet Muhammad <sup>"S.A.W"</sup> , by the revered scholar, the master of Researchers' Shaykh al-Muhaqqiq, Shah 'Abd al-Haq Muhaddith ad-Dihlawi <sup>"R.T"</sup> .
10	<b>Hindi: A prophet you do not know</b> (Persian: محمد پیغمبر که شما نمی شناسید - محمد پیغمبری که (از تو باید شناخت	Constantin Virgil Gheorghiu (Persian: کنستین ویرژیل گئورگیو (d. 1992 A.D. / 1412 AH) Constantin Virgil Gheorghiu (Persian: کنستین ویرژیل گئورگیو) was a Romanian writer, best known for his 1949 novel. The original written was in France Language in by name of <b>La vie de Mahomet</b> (translated from the Romanian by Livia Lamoure), Éditions Plon, 1963. Éditions du Rocher, 1999, ISBN 2-268-03275-2. In this book the author analyze the life of our beloved prophet Muhammad <sup>"S.A.W"</sup> in various modern dimensions.

## 2.2.4 Muslims Believes: Haqaed or Aqidah (Creed)

Islam as the latest revelation and revolution of Allah<sup>(S.W.T)</sup> for human being, has the strongest logical and natural believes (Faith, Arabic: إيمان) standards with the fully support of Allah<sup>(S.W.T)</sup> (The God) direct or indirect speech (Quran Karim, Hadith of beloved prophet Muhammad<sup>S.A.W</sup>). The first step of entrance to Islam is the Shahada (Arabic: شهادة) means testimony: "I bear witness that there is no god but (the One) God (Allah), and I bear witness that Muhammad<sup>S.A.W</sup> is God's messenger" (Arabic: لا إله إلا الله لا محمد رسول الله). Indeed, this sentence is the building block of Islamic believes with the strong consequences to believe and obey every verses of Quran Karim and orders of Allah's final messenger Muhammad<sup>S.A.W</sup>.

According to Hadith of Gabriel or Jibril<sup>A.S</sup> (Arabic: حديث جبرئيل "ع") which narrated by al-Muslim [Number of Hadith:8], believe is Islam could be divided in to six fundamental articles as fallow:

1. **(The God):** Allah<sup>(S.W.T)</sup> mentioned in Quran Karim in the "Chapter:112" <sup>40</sup> [SAY: *"HE IS God the one the most unique, God the immanently indispensable. He has begotten no one, and is begotten of none. There is no one comparable to Him."*].

The one and only one God exist in the world who is Allah<sup>(S.W.T)</sup>. He is the creator of all creatures form first up to end. He is the master of all his creatures. He is the artist of all the world and in every form and color which he will, create a creature with just order of (Be, and it is)(Arabic: كن فيكون) as mentioned in Quran Karim in the "Al-Baqara:117" <sup>41</sup> [Creator of the heavens and the earth from nothingness, He has only to say when He wills a thing: "Be", and it is.]. Allah<sup>(S.W.T)</sup> self describe himself in Quran Karim "Ash-Shura:11" <sup>42</sup> [Originator of the heavens and the earth, He has made your consorts from among you, and made pairs of cattle. He multiplies you in this way. There is no other like Him. He is all-hearing and all-seeing.] and in "An-Nahl:60" <sup>43</sup> [The semblance of those who believe not in the life to come is that of the meanest; but the semblance of God is the most sublime, for He is all-mighty and all-wise.] Allah<sup>(S.W.T)</sup> mentioned in "Taha:8" <sup>44</sup> [God: There is no god but He. To Him belong the attributes most beautiful.], as wall as, according to the Hadiths of Sahih al-Bukhari (6410)Al-Bukhari et al. (1978) <sup>45</sup> and Sahih al-Bukhari (7392)Al-Bukhari

<sup>40</sup> Quran Karim: Al-Ikhlās:1-4 بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ قُلْ هُوَ اللَّهُ أَحَدٌ ﴿١﴾ اللَّهُ الصَّمَدُ ﴿٢﴾ لَمْ يَلِدْ وَلَمْ يُولَدْ ﴿٣﴾ وَلَمْ يَكُنْ لَهُ كُفُوًا أَحَدٌ ﴿٤﴾

﴿٤﴾

<sup>41</sup> Quran Karim: Al-Baqara:117 بَدِيعُ السَّمَوَاتِ وَالْأَرْضِ وَإِذَا قَضَىٰ أَمْرًا فَإِنَّمَا يَقُولُ لَهُ كُنْ فَيَكُونُ ﴿١١٧﴾

<sup>42</sup> Quran Karim: Ash-Shura:11 فَاطِرُ السَّمَوَاتِ وَالْأَرْضِ جَعَلَ لَكُم مِّنْ أَنفُسِكُمْ أَزْوَاجًا وَمِنَ الْأَنْعَامِ أَزْوَاجًا يَذُرُّكُمْ فِيهِ لَيْسَ كَمِثْلِهِ شَيْءٌ وَهُوَ السَّمِيعُ الْبَصِيرُ ﴿١١﴾

<sup>43</sup> Quran Karim: An-Nahl:60 لِلَّذِينَ لَا يُؤْمِنُونَ بِالْآخِرَةِ مَثَلُ السَّوِّ وَلِلَّهِ الْمَثَلُ الْأَعْلَىٰ وَهُوَ الْعَزِيزُ الْحَكِيمُ ﴿٦٠﴾

<sup>44</sup> Quran Karim: Taha:8 اللَّهُ لَا إِلَهَ إِلَّا هُوَ لَهُ الْأَسْمَاءُ الْحُسْنَىٰ ﴿٨﴾

<sup>45</sup> Sahih al-Bukhari (6410) عَنْ أَبِي هُرَيْرَةَ، رَوَايَةً قَالَ " لِلَّهِ تِسْعَةٌ وَتِسْعُونَ اسْمًا، مِائَةٌ إِلَّا وَاحِدًا، لَا يَحْفَظُهَا أَحَدٌ إِلَّا دَخَلَ الْجَنَّةَ، وَهُوَ وَتَرٌ " يُحِبُّ الْوَتَرَ. (Narrated Abu Huraira: Allah has ninety-nine Names, i.e., one hundred minus one, and whoever believes in their meanings and acts accordingly, will enter Paradise; and Allah is witr (one) and loves 'the witr' (i.e., odd numbers). <https://sunnah.com/bukhari/80/105>

et al. (1978) <sup>46</sup>, Allah<sup>(S.W.T)</sup> has 99 names of attributes which is called *asmā'u llāhi l-ḥusnā* (Arabic: أسماء الله الحسنى, Beautiful Names of God). These beautiful names of Allah<sup>(S.W.T)</sup> as shown in Table.2.7 mentioned in Quran Karim or in Hadith of beloved prophet Muhammad<sup>"S.A.W"</sup> or in both. Islam religion rejects all form of Shirk (Arabic: شرك) such as polytheism and idolatry, as well as the Christian doctrine of the Trinity as mentioned in "Al-Maeda':73" <sup>47</sup> [They have certainly disbelieved who say, "Allah is the third of three." And there is no god except one God. And if they do not desist from what they are saying, there will surely afflict the disbelievers among them a painful punishment].

Table 2.7: Beautiful Names of Allah<sup>(S.W.T)</sup>

No	Arabic	Transliteration	Meaning
1	الله	Allah	Aware of the divine self sacred
2	الرحمن	Ar-Rahman	Most Gracious/ The Beneficent/ All-Compassionate
3	الرحيم	Ar-Raḥīm	The Most Merciful/ Ever-Merciful/ Most Clement
4	المالك	Al-Mālik	The King/ Lord/ Sovereign/ Dominion/ Master
5	القدوس	Al-Quddūs	The Holy/ All-Holy/ All-Pure/ Sacred/ All-Sacred
6	السلام	As-Salām	The Giver of Peace/ Peace/ All-Calm/ Ever-Tranquil
7	المؤمن	Al-Mu'amin	he Granter of Security/ the Giver/ Faith/ Supreme Believer (of Belief)/ Giver of Belief/ All-Assurer
8	المهيمن	Al-Muhaymin	The Controller/ Absolute Authority Over All/ Guardian Over All/ Absolute Master/ Eternal Dominating
9	العزيز	Al-'Azīz	The Exalted in Might and Power/ Exalted/ Powerful/ Almighty/ Mighty
10	الجبار	Al-Jabbār	The Omnipotent/ Supreme Power/ Possessor of Having All Power/ Strong
11	المتكبر	Al-Mutakabbir	The Possessor of Greatness/ Supreme/ Justly Proud
12	الخالق	Al-Khāliq	The Creator/ Creator of the Universe/ Maker/ True Originator/ Absolute Author
13	البارئ	Al-Bārī	The Initiator/ Evolver/ Eternal Spirit Worshipped By All, Have Absolute Power Over All Matters, Nature and Events
14	المصور	Al-Muṣawwir	The Fashioner/ Shaper/ Designer/ Artist
15	الغفار	Al-Ghaḥfār	The Repeatedly Forgiving/ Absolute Forgiver/ Pardoner
16	القهار	Al-Qaḥḥār	Overcomer/ Conqueror/ Absolute Vanquisher/ The Subduer
17	الوهاب	Al-Waḥḥāb	The Absolute Bestower/ Giver/ Grantor/ Great Donor
18	الرزاق	Ar-Razzāq	The Provider/ Sustainer/ Bestower of Sustenance/ All-Provider
19	الفتاح	Al-Fattāḥ	The Opener/ Opener of the Gates of Profits/ Reliever/ The Victory Giver
20	العليم	Al-Alīm	The Knowing/ All-Knower/ Omniscient/ All-Knowledgeable/ Possessor of Knowing Much of Ever Thing/ All-Knowing
21	القابض	Al-Qābiḍ	The Restrainer/ Withholder/ Straightener/ Absolute Seizer
22	الباسط	Al-Bāsiṭ	The Extender/ Expander/ Generous Provider
23	الخافض	Al-Khāfiḍ	The Abaser/ Humiliator/ Downgrader [Possessor of Giving Comfort, Free from Pain Anxiety or Troubles]

( To be continued)

<sup>46</sup>Sahih al-Bukhari (7392) مَنْ أَحْصَاهَا مِنْ أَحْصَاهَا " إِنَّ لِلَّهِ تِسْعَةَ وَسْعِينَ اسْمًا مِائَةً إِلَّا وَاحِدًا، مَنْ أَحْصَاهَا دَخَلَ الْجَنَّةَ ". أَخْبَرَهُ حَفْظَانَهُ. (Narrated Abu Huraira: Allah's Messenger (ﷺ) said, "Allah has ninety-nine Names, one-hundred less one; and he who memorized them all by heart will enter Paradise." To count something means to know it by heart. <https://sunnah.com/bukhari/97/21>

<sup>47</sup>Quran Karim: "Al-Maeda':73" كَفَرُوا الَّذِينَ كَفَرُوا " إِنَّ اللَّهَ ثَلَاثُ ثَلَاثَةٍ وَمَا مِنْ إِلَهٍ إِلَّا إِلَهُ وَحْدٌ وَإِنْ لَمْ يَنْتَهُوا عَمَّا يَقُولُونَ لَيَمَسَّنَّ الَّذِينَ كَفَرُوا مِنْهُمْ عَذَابٌ أَلِيمٌ ﴿٧٣﴾

No	Arabic	Transliteration	Meaning
24	الرَّافِعُ	Ar-Rāfiʿ	The Exalter/ Upgrader [of Ranks]
25	المُعِزُّ	Al-Muʿizz	The Giver of Honor/ Bestower of Honor/ Empowerer
26	المُذِلُّ	Al-Mudhill	The Giver of Dishonor/ the Giver of Disgrace
27	السامِعُ	As-Samīʿ	The Hearing/ All-Hearing/ Hearer of Invocation
28	البَصِيرُ	Al-Baṣīr	The All-Seeing/ All-Seer/ Ever-Clairvoyant/ Clear-Sighted/ Clear-Seeing
29	الحَكَمُ	Al-Ḥakam	The Judge/ Arbitrator/ Arbiter/ All-Decree/ Possessor of Authority of Decisions and Judgment
30	العَدْلُ	Al-ʿAdl	The Just/ Authorized and Straightforward Judge of Dealing Justly
31	اللَّطِيفُ	Al-Laṭīf	The Gentle/ Benignant/ Subtly Kind/ All-Subtle
32	الخبِيرُ	Al-Khabīr	The All-Aware/ Well-Acquainted/ Ever-Adept
33	الحَلِيمُ	Al-Ḥalīm	The Forbearing/ Indulgent/ Oft Forbearing/ All-Enduring
34	العَظِيمُ	Al-ʿAẓīm	The Most Great/ Ever-Magnificent/ Most Supreme/ Exalted/ Absolute Dignified
35	العَفُورُ	Al-Ghafūr	The Ever-Forgiving/ Oft-Forgiving
36	الشَّكُورُ	Ash-Shakūr	The Grateful/ Appreciative/ Multiplier of Rewards
37	العَلِيُّ	Al-ʿAlī	The Sublime/ Ever-Exalted/ Supreme/ Most High/ Most Lofty
38	الكَبِيرُ	Al-Kabīr	The Great/ Ever-Great/ Grand/ Most Great/ Greatly Abundant of Extent, Capacity and Importance
39	الْحَفِیْظُ	Al-Ḥafīẓ	The Preserver/ Ever-Preserving/ All-Watching/ Protector/ Guardian/ Oft-Conservator
40	المُقِیْتُ	Al-Muqīt	The Nourisher/ Feeder
41	الحَسِیْبُ	Al-Ḥasīb	The Bringer of Judgment/ Ever-Reckoner [the One Who Takes Account of All Matters]
42	الْجَلِيلُ	Al-Jalīl	The Majestic/ Exalted/ Oft-Important/ Splendid
43	الْكَرِيمُ	Al-Karīm	The Noble/ Bountiful/ Generous/ Precious/ Honored/ Benefactor
44	الرَّقِیْبُ	Ar-Raqīb	The Watchful/ Observer/ Ever-Watchful/ Watcher
45	الْمُجِیْبُ	Al-Mujīb	The Responsive/ Answerer/ Supreme Answerer/ Acceptor of Invocation
46	الْوَاسِعُ	Al-Wāsi	The Vast/ All-Embracing/ Omnipresent/ Boundless/ All-Encompassing
47	الحَكِیْمُ	Al-Ḥakīm	The Wise/ Ever-Wise/ Endowed with Sound Judgment
48	الْوَدُودُ	Al-Wadūd	The Affectionate/ Ever-Affectionate/ Loving One/ Loving/ the Lover/ the One Who Tenders and Warm Hearts
49	الْمَجِیدُ	Al-Majīd	The All-Glorious/ Majestic/ Ever-Illustrious [Oft-Brilliant in Dignity, Achievements or Actions]
50	الْبَاعِثُ	Al-Bāʿith	The Resurrector/ Awakener/ Arouser/ Dispatcher
51	الشَّهِیدُ	Ash-Shahīd	The Witness/ Testifier/ Ever-Witnessing
52	الْحَقُّ	Al-Ḥaqq	The Truth/ Reality/ the Only One Certainly Sound and Genuine in Truth
53	الْوَكِیْلُ	Al-Wakīl	The Trustee, The Dependable, The Advocate
54	القَوِیُّ	Al-Qawīyy	The Strong
55	الْمَتِیْنُ	Al-Matīn	The Firm, The Steadfast
56	الْوَلِیُّ	Al-Walīyy	The Friend, Helper
57	الْمَحْمِدُ	Al-Ḥamīd	The All Praiseworthy
58	الْمُحْصِیُّ	Al-Muḥṣī	The Accounter, The Numberer of All
59	المُبْدِیُّ	Al-Mubdi	The Originator, The Producer, The Initiator
60	المُعِیْدُ	Al-Muʿīd	The Restorer, The Reinstater Who Brings Back All
61	الْمُحِیُّ	Al-Muḥ · yiy	The Giver of Life
62	المُمِیْتُ	Al-Mumīt	The Bringer of Death

( To be continued)

No	Arabic	Transliteration	Meaning
63	الحي	Al-Ḥayy	The Living
64	القيوم	Al-Qayyūm	The Subsisting, The Independent, The Self-Subsisting
65	الواجد	Al-Wājid	The Perceiver, The Finder, The Unfailing
66	الماجد	Al-Mājid	The Illustrious, The Magnificent
67	الواحد	Al-Wāḥid	The Unique, The Single
68	الأحد	Al-ʿAḥad	The One, The Indivisible
69	الصمد	Aṣ-Ṣamad	The Eternal, The Absolute, The Self-Sufficient
70	القادر	Al-Qādir	The All-Powerful, He Who is able to do Everything
71	المقتدر	Al-Muqtadir	The Determiner, The Dominant
72	المقدم	Al-Muqaddim	The Expediter, He Who Brings Forward
73	المؤخر	Al-Muʿakh · khir	The Delayer, He Who Puts Far Away
74	الأول	Al-ʿAwwal	The First, The Beginning-less
75	الآخر	Al-ʿĀkhir	The Last, The Endless
76	الظاهر	Aẓ-Ẓāhir	The Manifest, The Evident, The Outer
77	الباطن	Al-Bāṭin	The Hidden, The Unmanifest, The Inner
78	الوالي	Al-Wālī	The Patron, The Protecting Friend, The Friendly Lord
79	المتعال	Al-Mutaʿālī	The Supremely Exalted, The Most High
80	البر	Al-Barr	The Good, The Beneficent
81	التواب	At-Tawwāb	The Ever-Returning, Ever-Relenting
82	المنتقم	Al-Muntaqim	The Avenger
83	العفو	Al-ʿAfūw	The Pardoner, The Effacer, The Forgiver
84	الرؤوف	Ar-Raʿūf	The Kind, The Pitying
85	مالك الملك	Māliku l-Mulk	The Owner of all Sovereignty
86	ذوالجلال والإكرام	Dhu l-Jalālī wa l-Ikrām	The Owner, Lord of Majesty and Honour
87	المقسط	Al-Muqsiṭ	The Equitable, The Requiter
88	الجامع	Al-Jāmi	The Gatherer, The Unifier
89	الغني	Al-Ghānī	The Rich, The Independent
90	المغني	Al-Mugh · nī	The Enricher, The Emancipator
91	المانع	Al-Mānīʿ	The Preventer, The Withholder, The Shielder, The Defender
92	الضار	Aḍ-Ḍārr	The Distressor, The Harmer, The Afflictor
93	النافع	An-Nāfiʿ	The Propitious, The Benefactor, The Source of Good
94	النور	An-Nūr	The Light
95	الهادي	Al-Hādī	The Guide, The Way
96	البدیع	Al-Badīʿ	The Originator, The Incomparable, The Unattainable, The Beautiful
97	الباقی	Al-Bāqī	The Immutable, The Infinite, The Everlasting
98	الوارث	Al-Wārith	The Heir, The Inheritor of All
99	الرشيد	Ar-Rashīd	The Guide to the Right Path
100	الصبور	Aṣ-Ṣabūr	The Timeless, The Patient

2. **Angels:** are also one creature of our creator (Allah<sup>(S.W.T)</sup>). The Quranic word for angel (Arabic: ملك malak), derives from Malaka, meaning "he controlled", due to their power to govern different affairs assigned to them. The Quran Karim is the main source for the Islamic concept of angels Burge (2015). Some of angels are mentioned

by name in the Quran Karim such as Gabriel and Michael, others are only referred just by their function. Duties assigned to angels include, communicating revelations from Allah<sup>(S.W.T)</sup>, glorifying Allah<sup>(S.W.T)</sup>, recording every person's actions, and taking a person's soul at the time of death. Allah<sup>(S.W.T)</sup> describe in Quran Karim "Fatir:1" <sup>48</sup> [ALL PRAISE BE to God, the originator of the heavens and the earth, who appointed angels as His messengers, with wings, two, three and four. He adds what He pleases to His creation. He has certainly power over everything.]

3. **Revelations or Holy Books:** in Islam religion we believe that Allah<sup>(S.W.T)</sup> sent for guidance of human being, four holy books and one hundred small chapters (Arabic: صحيفه sahefa) for his various prophets.

- **Zabūr also Zaboor** (Arabic: زَبُورٌ) was the holy book of Dawud<sup>(A.S)</sup> (David) (Arabic: داود ع) as Allah<sup>(S.W.T)</sup> mentioned in Quran Karim "An-Nisa:163" <sup>49</sup> [And We gave David the Psalms].
- **Tawrat also Tawrah or Taurat** (Arabic: تَوْرَة) was the holy book of Musa<sup>(A.S)</sup> (Moses) (Arabic: موسى ع) as Allah<sup>(S.W.T)</sup> mentioned in Quran Karim "Aal-e-Imran:3" <sup>50</sup> [He sent down to you the Book with the Truth, confirming what came before it; and He sent down the Torah and the Gospel.]
- **Injil** (Arabic: إِنْجِيل) was the holy book of Isa<sup>(A.S)</sup> (Jesus) (Arabic: عيسى ع) as Allah<sup>(S.W.T)</sup> mentioned in Quran Karim "Al-Hadid:27" <sup>51</sup> [Then We sent following their footsteps Our messengers and followed [them] with Jesus, the son of Mary, and gave him the Gospel. And We placed in the hearts of those who followed him compassion and mercy and monasticism, which they innovated; We did not prescribe it for them except [that they did so] seeking the approval of Allah . But they did not observe it with due observance. So We gave the ones who believed among them their reward, but many of them are defiantly disobedient.]
- **Quran Karim or Quran** (Arabic: قُرْآنِكْرِيم) is the last, complete and final revelation and holy book for all mankind upto end of the world. Quran Karim is the biggest miracle of beloved Muhammad Rasollullah<sup>"S.A.W"</sup>, that Allah<sup>"S.W.T"</sup> secure it form any changes, as Quran Karim mentioned in "Al-Hijr':9" <sup>52</sup> [Indeed, it is We who sent down the Qur'an and indeed, We will be its guardian.]. For more information about Quran Karim (see Sect. 2.2.1) of this research.

Muslims believe that parts of the previously revealed scriptures (holy books), the Tawrat (Torah) and the Injil (Gospel), had become distorted either in interpretation

<sup>48</sup>Quran Karim: Fatir:1 الْحَمْدُ لِلَّهِ فَاطِرِ السَّمَوَاتِ وَالْأَرْضِ جَاعِلِ الْمَلَكَةِ رُسُلًا أُولَىٰ أَجْنَحَةٍ مَّتَنًى وَثَلَّثَ وَرَبَعَ يَزِيدُ فِي الْخَلْقِ مَا يَشَاءُ إِنَّ اللَّهَ عَلَىٰ كُلِّ شَيْءٍ قَدِيرٌ ﴿١﴾

<sup>49</sup>Quran Karim: An-Nisa:163 \*\*\* وَأَتَيْنَا دَاوُدَ زَبُورًا ﴿١٦٣﴾ \*\*\*

<sup>50</sup>Quran Karim: Aal-e-Imran:3 نَزَّلَ عَلَيْكَ الْكِتَابَ بِالْحَقِّ مُصَدِّقًا لِّمَا بَيْنَ يَدَيْهِ وَأَنزَلَ التَّوْرَةَ وَالْإِنْجِيلَ ﴿٣﴾

<sup>51</sup>Quran Karim: Al-Hadid:27 ثُمَّ قَفَّيْنَا عَلَىٰ آثَرِهِمْ بِرُسُلِنَا وَقَفَّيْنَا بِعِيسَى ابْنِ مَرْيَمَ وَآتَيْنَاهُ الْإِنْجِيلَ وَجَعَلْنَا فِي قُلُوبِ الَّذِينَ اتَّبَعُوهُ رَأْفَةً وَرَحْمَةً وَرَهْبَانِيَّةً ابْتَدَعُوهَا مَا كَتَبْنَاهَا عَلَيْهِمْ إِلَّا ابْتِغَاءَ رِضْوَانِ اللَّهِ فَمَا رَعَوْهَا حَقَّ رِعَايَتِهَا فَآتَيْنَا الَّذِينَ ءَامَنُوا مِنْهُمْ أَجْرَهُمْ وَكَثِيرٌ مِنْهُمْ فَسِقُونَ ﴿٢٧﴾

<sup>52</sup>Quran Karim: "Al-Hijr':9" إِنَّا نَحْنُ نَزَّلْنَا الذِّكْرَ وَإِنَّا لَهُ لَحَافِظُونَ ﴿٩﴾

or in text, or even in both. This fact is mentioned in Quran Karim in several places such as in "Al-Baqara':75"<sup>53</sup> [Do you covet [the hope, O believers], that they would believe for you while a party of them used to hear the words of Allah and then distort the Torah after they had understood it while they were knowing?], in "Al-Baqara':79"<sup>54</sup> So woe to those who write the "scripture" with their own hands, then say, "This is from Allah," in order to exchange it for a small price. Woe to them for what their hands have written and woe to them for what they earn]. There is also an Hadith in Sahih al-Bukhari (7362) Al-Bukhari et al. (1978)<sup>55</sup> [Narrated Abu Huraira: The people of the Book used to read the Torah in Hebrew and then explain it in Arabic to the Muslims. Allah's Messenger (ﷺ) said (to the Muslims). "Do not believe the people of the Book, nor disbelieve them, but say, 'We believe in Allah and whatever is revealed to us, and whatever is revealed to you.'"].

4. **Prophets:** (Arabic: أنبياء , anbiyā') are those humans chosen by Allah<sup>"S.W.T"</sup> at different times in the past, to convey his messages (warnings and glad tidings), teachings (way of personal life) and legislation (public life) to people while being in contact with Allah<sup>"S.W.T"</sup> mostly through revelation. The prophets were instructed by Allah<sup>"S.W.T"</sup> to bring the "will of Allah<sup>"S.W.T"</sup>" to the peoples of the nations. Muslims believe that prophets are human and not divine, though some are able to perform miracles to prove their claim. Allah<sup>"S.W.T"</sup> says in Quran Karim in "Al-Baqara':285"<sup>56</sup> The Messenger has believed in what was revealed to him from his Lord, as did the believers. They all have believed in Allah, and His angels, and His scriptures, and His messengers: "We make no distinction between any of His messengers." And they say, "We hear and we obey. Your forgiveness, our Lord. To you is the destiny.". The Quran Karim mentions the names of several prophets in Islam, including Adam<sup>"A.S"</sup> (Arabic: آدم ع), Noah<sup>"A.S"</sup> (Arabic: نوح ع), Abraham<sup>"A.S"</sup> (Arabic: ابراهيم ع), Ismail<sup>"A.S"</sup> (Arabic: يعقوب ,اسرائيل ع), Isaac<sup>"A.S"</sup> (Arabic: اسحاق ع), Yaqub<sup>"A.S"</sup> or Israel (Arabic: يوسف ع), Yusuf<sup>"A.S"</sup> (Arabic: موسى ع), Moses<sup>"A.S"</sup> (Arabic: عيسى ع), among others. Muslims believe that Allah<sup>"S.W.T"</sup> finally sent Muhammad Rasollullah<sup>"S.A.W"</sup> as the last law-bearing prophet (Seal of the prophets (Arabic: خاتم الأنبياء)) to convey the divine message to the whole world (to sum up and to finalize the word of Allah<sup>"S.W.T"</sup>).

5. **Resurrection and judgment:** Belief in the "Day of Resurrection" or Yawm al-Qiyāmah (Arabic: يوم القيامة), is also vital for Muslims. The time of Qiyāmah is pre-

<sup>53</sup> Quran Karim: "Al-Baqara':75" أَفَتَطْمَعُونَ أَنْ يُؤْمِنُوا لَكُمْ وَقَدْ كَانَ فَرِيقٌ مِنْهُمْ يَسْمَعُونَ كَلِمَ اللَّهِ ثُمَّ يَحْرِفُونَهُ مِنْ بَعْدِ مَا عَقَلُوهُ وَهُمْ يَعْلَمُونَ ﴿٧٥﴾

<sup>54</sup> Quran Karim: "Al-Baqara':79" قَوْلٍ لِلَّذِينَ يَكْتُبُونَ الْكِتَابَ بِأَيْدِيهِمْ ثُمَّ يَقُولُونَ هَذَا مِنْ عِنْدِ اللَّهِ لِيَشْتَرُوا بِهِ ثَمَنًا قَلِيلًا قَوْلٍ لَهُمْ مِمَّا كَتَبَتْ أَيْدِيهِمْ وَوَيْلٌ لَهُمْ مِمَّا يَكْسِبُونَ ﴿٧٩﴾

<sup>55</sup> Sahih al-Bukhari (7362) عَنْ أَبِي هُرَيْرَةَ، قَالَ كَانَ أَهْلُ الْكِتَابِ يَقْرَأُونَ التَّوْرَةَ بِالْعِبْرَانِيَّةِ وَيُفَسِّرُونَهَا بِالْعَرَبِيَّةِ لِأَهْلِ الْإِسْلَامِ فَقَالَ رَسُولُ اللَّهِ (ﷺ) "لَا تَصْدُقُوا أَهْلَ الْكِتَابِ، وَلَا تَكْذِبُوهُمْ وَقُولُوا (أَمَّا بِاللَّهِ وَمَا أُنْزِلَ إِلَيْنَا وَمَا أُنْزِلَ إِلَيْكُمْ) ". الآية.

<sup>56</sup> Quran Karim: "Al-Baqara':285" ءَامَنَ الرَّسُولُ بِمَا أُنْزِلَ إِلَيْهِ مِنْ رَبِّهِ وَالْمُؤْمِنُونَ كُلٌّ ءَامَنَ بِاللَّهِ وَمَلَكِهِ وَكِتَابِهِ وَرُسُلِهِ لَا تَفْرِقُ بَيْنَ أَحَدٍ مِنْ رُسُلِهِ وَقَالُوا سَمِعْنَا وَأَطَعْنَا غُفْرَانَكَ رَبَّنَا وَإِلَيْكَ الْمَصِيرُ ﴿٢٨٥﴾

ordained by Allah<sup>"S.W.T"</sup> but unknown to humankind. The trials and tribulations preceding and during the Qiyāmah are described in the Quran Karim and the Hadith, as well as in the commentaries of Islamic scholars. On Yawm al-Qiyāmah, all humankind will be judged by their good and bad deeds and consigned to Jannah (Arabic: جنت) (paradise) or Jahannam (Arabic: جهنم) (hell). Yawm al-Qiyāmah is also identified in the Quran Karim as Yawm ad-Dīn (Arabic: يوم الدين, Day of Religion); as-Sā'ah (Arabic: الساعة, 'the Last Hour'); and al-Qāri'ah (Arabic: القارعة, 'The Clatterer').

6. **Divine will:** The concept of divine will is referred to as al-qadā' wa l-qadar (Arabic: قضا وقدر), which literally derives from a root that means 'to measure'. Everything, good and bad, is believed to have been decreed. Imam Abū Ḥanīfa in Al-Fiqh al-Akbar said that:

"The acts of obedience no matter what they entail are due by the Order of Allah, the Exalted, His Love, Acceptance, Knowledge, Will, Creating and Destining. All the sins are by His Knowledge, Creating, Destining and Will but not by His Love, Acceptance and Order."<sup>57</sup>

Actually, believe in Islam religion is not limited in the above six articles. Believe in Islam include all Quran Karim verses subjects and all authentic Sunnah and Hadith of Muhammad Rasollullah<sup>"S.A.W"</sup>. Table.2.8 shown important books in Haqead part.

Table 2.8: Books of Haqead or Aqidah (Creed) that are used in Islamic Nation

No	Book Name	Author
1	<b>Al-Fiqh al-Akbar</b> (فقه اكبر)	<b>Imam al-Azam ("The Greatest Imam")</b> Imam Abū Ḥanīfa al-Nu'mān b. Thābit b. Zū'ā b. Marzubān (Arabic: أبو حنيفة نعمان بن ثابت بن زوطا بن مرزبان; (d. 767 A.D. / 150 AH
2	<b>Al-Risala, Kitab ar-Risāla fī Uṣūl al-Fiqh</b> (كتاب الرسالة في أصول الفقه) "book of the communication on the foundations of comprehension"	(Imam Shafi) Abū 'Abdillāh Muhammad ibn Idrīs al-Shāfi'ī (Arabic: أبو عبد الله محمد بن إدريس الشافعي; (d. 820 A.D. / 204 AH)
3	<b>Khalq Afaalul-Ibaad</b> (خلق أفعال العباد)	(Imam al-Bukhari) Abu Abd Allah Muhammad ibn Isma'il ibn Ibrahim ibn al-Mughirah ibn Bardizbah al-Ju'fi al-Bukhari (Arabic: أبو عبد الله محمد بن إسماعيل بن إبراهيم بن المغيرة بن بردزبه الجعفي البخاري; (d. 870 A.D. / 256 AH)
4	<b>Al-Aqidah al-Tahawiyyah</b> (العقيدة الطحاوية)	Abu Ja'far al-Tahawi (Arabic: أبو جعفر الطحاوي; (d. 933 A.D. / 321 AH)
5	<b>Maqalat al-Islamiyyin wa Ikhtilaf al-Musallin</b> (مقالات الاسلاميين واختلاف المصلين)	(Imam Al-Ash'ari) Abū al-Ḥasan 'Alī ibn Ismā'īl ibn Ishāq al-Ash'arī (Arabic: ابوالحسن علي بن اسماعيل بن اسحاق اشعري; (d. 936 A.D. / 324 AH)
6	<b>Kitab al-Tawhid</b> (Arabic: كتاب التوحيد, lit. 'The Book of Monotheism')	(Imam al-Maturidi) Abū Maṣṣūr Muḥammad b. Muḥammad b. Maḥmūd al-Samarqandī, (Arabic: أبو منصور محمد بن محمد بن محمود الماتريدي السمرقندي الحنفي; (d. 944 A.D. / 332 AH)

( To be continued)

<sup>57</sup>[https://www.aicp.org/SupportingDocs/Al\\_Fiqh\\_Akbar\\_English.pdf](https://www.aicp.org/SupportingDocs/Al_Fiqh_Akbar_English.pdf)

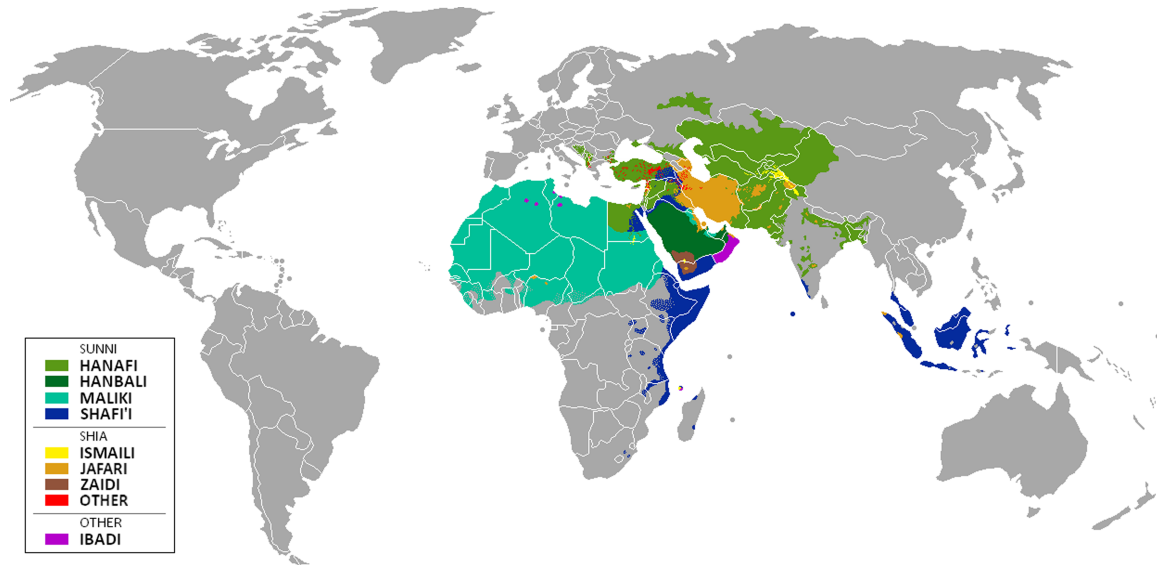


Figure 2.7: Different Madhhab (schools of jurisprudence or schools of law) in the world. Source: Miller (2009)

No	Book Name	Author
7	<b>Ihya' Ulum al-Dint</b> (The Revival of the Religious Sciences) (احياء علوم الدين)	(Imam Al-Ghazali) Abū Ḥāmid Muḥammad ibn Muḥammad al-Ghazali (Arabic: أَبُو حَامِدٍ مُحَمَّدُ بْنُ مُحَمَّدٍ الطُّوسِيُّ الْغَزَالِيُّ) (d. 1111 A.D. / 505 AH)
8	<b>Al-Iqtisād fī al-i'tiqād</b> The Moderation in Belief (الاقتصاد في الاعتقاد)	(Imam Al-Ghazali) Abū Ḥāmid Muḥammad ibn Muḥammad al-Ghazali (Arabic: أَبُو حَامِدٍ مُحَمَّدُ بْنُ مُحَمَّدٍ الطُّوسِيُّ الْغَزَالِيُّ) (d. 1111 A.D. / 505 AH)
9	<b>Takmeel-Ul-Iman</b> (تكميل الايمان)	Shik Abd al-Haqq Mohadith al-Dehlawi (Arabic: شيخ عبدالحق محدث دهلوی رح) (d. 1642 A.D. / 1051 AH)
10	<b>Al-Aqidah Al-Hasanah</b> (حسن العقيدة, العقيدة الحسنة)	Syah Waliyullah al-Dehlawi (Persian: شاه ولی الله دهلوی رح شيخ الإسلام) (d. 1762 A.D. / 1176 AH)

## 2.2.5 Orders and Ways of Doing Actions: Feeqia

In Islam religion the must valuable source of information is firstly **Quran Karim**, as the root and main source, and secondly, respected **Sunnah** of Mohammad Rasolullah<sup>"S.A.W"</sup>. For third and fourth fundamental source of Sharia law, if a topic has no clear commands or sentences in both Quran Karim and respected Sunnah, then every Madhhab (Arabic: مذهب, Schools of jurisprudence, Schools of law) select different methodologies. Fig. 2.7 show the different Madhhab (schools of jurisprudence or schools of law) in the world. Sunni Muslims or Ahl as-Sunnah ull Jamahat (Arabic: أهل السنة والجماعة), which makes up 87–90% of all Muslims according the research of Pew Research Center, Miller (2009), for extracting the laws in third and fourth position go for **Ijma** (Arabic: إجماع) referring to the *consensus or agreement* of Islamic scholars on a point of Islamic law) and **Qiyas** (Arabic: قياس) is the process of *deductive analogy* in which the teachings of the hadith are compared and contrasted with those of the **Quran**, in order to apply a known injunction (nass) to a new circumstance and create a new injunction. Here the ruling of the **Sunnah** and the **Quran** is used as a means to solve or provide a response to a new problem that may arise.

Quran Karim mentioned in "An-Nisa':59"<sup>58</sup> [O you who believe! Obey Allah and obey the Messenger and those in authority among you].

The hadith of Muhammad<sup>S.A.W</sup>, "**My ummah will never agree upon an error**" Narrated by al-Tirmidhi (2167)<sup>59</sup> Al-Tirmidhi (2007); Ibn Majah (2007); Dawood and bin Ashath (1981) and others with slightly different wordings are often cited as a proof for the validity of **Ijma**. Ijma of the first three generations of Muslims (Sahaba "respected Companions" of beloved Muhammad<sup>S.A.W</sup>, Student of Sahaba (Tah'bin) and Student of Tahibin (Tab Tah'bin) "may Allah bless upon all of them") has more value among all Muslims according to the Hadiths of Rasollullah<sup>S.A.W</sup> Jami' at-Tirmidhi(2641)<sup>60</sup> Al-Tirmidhi (2007).

**Qiyas** is a form of reasoning (*ijtihad*) which the Prophet<sup>S.A.W</sup> expressly validates in the famous *Hadith of Muaz bin Jabal when he was sent to Yemen Sunan Abi Dawud (3592) Dawood and bin Ashath (1981)*. A woman came to the Prophet<sup>S.A.W</sup> and said that her father had died without performing the hajj. Will it benefit him if she perform the hajj on the father's behalf? The Prophet told her: "Supposing your father had a debt to pay and you pay it on his behalf, would this benefit him?" To this her reply was affirmative and the Prophet said, "The debt owed to Allah merits even greater consideration" Sunan An-Nasa'i Al-Shuyuthiy (1995). The companions of the Prophet<sup>S.A.W</sup> also utilized qiyas in deducing the rulings of Fiqh For example; Abu Bakr drew an analogy between the father and the grandfather in respect to their entitlement in inheritance. Fundamental sources of information in Islamic laws and orders according to Sunni Muslims is shown in Fig. 2.8.

### 2.2.5.1 Five Pillars of Islam

Islam has five core beliefs and practices according to Hadith of Sahih Muslim<sup>61</sup> Siddiqui (1976). These are also called (arkān al-Islām, Arabic: أركان الإسلام; also arkān ad-dīn Arabic: أركان الدين "pillars of the religion") which are as follow:

1. Shahada (Testimony) which is the basic creed (Believe) of Islam, must be recited

<sup>58</sup> Quran Karim: "An-Nisa':59" \*\*\*يَأْتِيهَا الَّذِينَ ءَامَنُوا أَطِيعُوا اللَّهَ وَأَطِيعُوا الرَّسُولَ وَأُولَى الْأَمْرِ مِنْكُمْ\*\*\*

<sup>59</sup> Jami' at-Tirmidhi (2167) عَنْ عَبْدِ اللَّهِ بْنِ دِينَارٍ، عَنِ ابْنِ عُمَرَ، أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ "إِنَّ اللَّهَ لَا يَجْمَعُ أُمَّتِي - أَوْ قَالَ أُمَّةً - عَلَى ضَلَالَةٍ وَيَدُ اللَّهِ مَعَ الْجَمَاعَةِ وَمَنْ شَذَّ شَذَّ إِلَى النَّارِ" مُحَمَّدٌ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ - عَلَى ضَلَالَةٍ وَيَدُ اللَّهِ مَعَ الْجَمَاعَةِ وَمَنْ شَذَّ شَذَّ إِلَى النَّارِ "

[Ibn 'Umar narrated that the Messenger of Allah<sup>S.A.W</sup> said: 'Indeed Allah will not gather my Ummah " or he said: "[Muhammad's]Ummah upon deviation, and Allah's Hand is over the Jama'ah, and whoever deviates, he deviates to the Fire."]

<sup>60</sup> Jami' at-Tirmidhi (2641) عَنْ عَبْدِ اللَّهِ بْنِ يَزِيدَ، عَنْ عَبْدِ اللَّهِ بْنِ عَمْرٍو، قَالَ قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ "لَيَأْتِيَنَّ عَلَى أُمَّتِي مَا أَتَى عَلَى بَنِي إِسْرَائِيلَ حَدَوُ النَّعْلِ بِالنَّعْلِ حَتَّىٰ إِنْ كَانَ مِنْهُمْ مَنْ أَتَى أُمَّةً عَلَانِيَةً لَّكَانَ فِي أُمَّتِي مَنْ يَضَعُ ذَلِكَ وَإِنْ بَنِي إِسْرَائِيلَ تَفَرَّقَتْ عَلَى ثَلَاثِينَ وَسَبْعِينَ مِلَّةً وَتَفْتَرِقُ أُمَّتِي عَلَى ثَلَاثٍ وَسَبْعِينَ مِلَّةً كُلُّهُمْ فِي النَّارِ إِلَّا مِلَّةً وَاحِدَةً قَالُوا وَمَنْ هِيَ يَا رَسُولَ اللَّهِ قَالَ مَا أَنَا عَلَيْهِ وَأَصْحَابِي "

[Narrated 'Abdullah bin 'Amr: that the Messenger of Allah (ﷺ) said: "Indeed the children of Isra'il split into seventy-two sects, and my Ummah will split into seventy-three sects. All of them are in the Fire Except one sect." He said: "And which is it O Messenger of Allah?" He said: "What I am upon and my Companions."]

<sup>61</sup> Sahih Muslim Book 1, Hadith 21 عَنْ أَبِيهِ، قَالَ قَالَ عَبْدُ اللَّهِ قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ "بُنِيَ الْإِسْلَامُ عَلَى خَمْسٍ شَهَادَةٍ أَنَّ لَا إِلَهَ إِلَّا اللَّهُ وَأَنَّ مُحَمَّدًا عَبْدُهُ وَرَسُولُهُ وَأَقَامَ الصَّلَاةَ وَآتَى الزَّكَاةَ وَحَجَّ الْبَيْتِ وَصَوْمَ رَمَضَانَ .

[It is narrated on the authority of 'Abdullah son of 'Umar that the Messenger of Allah (ﷺ) said: (The superstructure of) al-Islam is raised on five (pillars), testifying (the fact) that there is no god but Allah, that Muhammad is His bondsman and messenger, and the establishment of prayer, payment of Zakat, Pilgrimage to the House (Ka'ba) and the fast of Ramadan.]

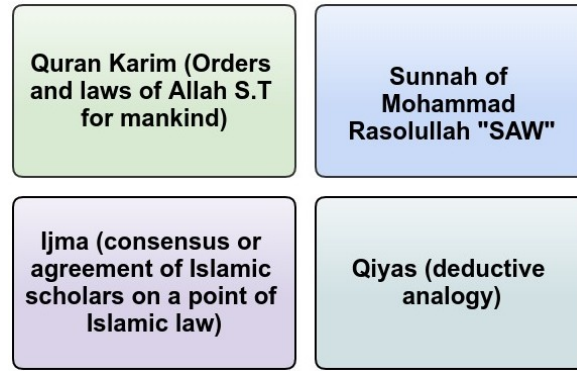


Figure 2.8: Fundamental sources of information in Islamic laws and orders

under oath with the specific statement: "ʾašhadu ʾal-lā ʾilāha ʾillā-llāhu wa ʾašhadu ʾanna muḥammadan rasūlu-llāh" Arabic: أشهد أن لا إله إلا الله وأن محمدا رسول الله, or, "I testify that there is no god but Allah and I testify that Muhammad is the messenger of God;". Mohammad (1985)

2. Salat (Prayer) five daily ritual prayers are called ṣalāh or ṣalāt (Arabic: صلاة). Salat is intended to focus the mind on God, and is seen as a personal communication with him that expresses gratitude and worship.
3. Zakat (Charity) is a type of welfare and support in a Muslim society, characterized by the giving of a fixed portion (2.5% annually) from wealthy people to poor once. Powell (2009); Cordes et al. (2005)
4. Sawm (Fasting) from food and drink, sexual intercourse, or smoking. Fast must be performed from dawn to dusk during the month of Ramadan (The holy month in Islam). Crotty and Lovat (2016)
5. Hajj (Pilgrimage) has to be performed during the first weeks of the twelfth Islamic month of Dhu al-Hijjah in the city of Mecca. Every able Muslim who can afford it must make the pilgrimage to Mecca at least once in his or her lifetime. Davids (2006)

Three of the pillars are obligatory upon all Muslims, while Zakat and Hajj are obligatory only upon able Muslims. Table.2.9 shown important books in Feeqia part.

Table 2.9: Books of Feeqia (jurisprudence, Schools of law) that are used in Islamic Nation

No	Book Name	Author
1	<b>uṣūl al-fiqh</b> <i>Principles of Islamic jurisprudence</i> (أصول الفقه)	(Abu Yusuf) Yaqub ibn Ibrahim al-Ansari (Arabic: يعقوب بن إبراهيم الأنصاري) (d. 798 A.D. / 181 AH)
2	<b>zahir al-riwaya</b> (ظاهر الرواية)	(Muhammad al-Shaybani) Abu 'Abdullah Muḥammad ibnu-l-Ḥasan Ibn Farqad ash-Shaybānī (Arabic: محمد بن الحسن الشيباني) (d. 805 A.D. / 189 AH)

( To be continued)

No	Book Name	Author
3	<b>Kitab ar-Risāla fī Uṣūl al-Fiqh</b> (Arabic: كتاب الرسالة في أصول الفقه)	(Imam al-Shafi) Abū ʿAbdillāh Muhammad ibn Idrīs al-Shāfiʿī , (Arabic: أَبُو عَبْدِ اللَّهِ مُحَمَّدُ بْنُ إِدْرِيسَ الشَّافِعِيُّ) (d. 820 A.D. / 204 AH)
4	<b>Kitāb al-Umm</b> (Arabic: كتاب الأم "the exemplar.")	(Imam al-Shafi) Abū ʿAbdillāh Muhammad ibn Idrīs al-Shāfiʿī , (Arabic: أَبُو عَبْدِ اللَّهِ مُحَمَّدُ بْنُ إِدْرِيسَ الشَّافِعِيُّ) (d. 820 A.D. / 204 AH)
5	<b>Al-Hidayah</b> "the guidance" ( الهداية في شرح بداية المبتدي )	Burhan al-Din al-Marghinani (Arabic: برهان الدين المرغيناني) (d. 1197 A.D. / 593 AH)
6	<b>Fatawa 'Alamgiri</b> (Arabic: الفتاوى العالمية , <b>Al-Fatawa al-Hindiyya</b> (Arabic: الفتاوى الهندية )	Was the work of many prominent scholars from different parts of the world, including Hejaz, principally from the Hanafi school. In order to compile Fatawa-e-Alamgiri, emperor Aurangzeb gathered 500 experts in Islamic jurisprudence (Fiqh), 300 from South Asia, 100 from Iraq and 100 from the Hejaz (Saudi Arabia). Their work over years, resulted in an Islamic code of law for South Asia, in late Mughal Era. It consists of legal code on personal, family, slaves, war, property, inter-religious relations, transaction, taxation, economic and other law for a range of possible situations and their juristic rulings by the Faqih of the time.
7	<b>Fatawa Aziz</b> ( الفتاوى عزيز )	Shah Abdul Aziz Dehlavi (Arabic: المحدث شاه عبد العزيز دهلوي رح ) (d. 1824 A.D. / 1239 AH)

## 2.2.6 Allah's Love, Will, Pleasure and Relationship: Horfan

Tasawwuf basically consists of dedication to worship, total dedication to Allah<sup>"S.W.T"</sup>, disregard for the finery and ornament of the world, doing Islamic orders with sincerity, purity and inner cleanness. Indeed, power, pleasure, wealth, and prestige of this world has no value in front of Allah<sup>"S.W.T"</sup> and his all orders.

The historian Ibn Khaldun notes in his Muqaddima: This knowledge is a branch of the sciences of Sacred Law that originated within the Umma. From the first, the way of such people had also been considered the path of truth and guidance by the early Muslim community and its notables, of the Companions of the Prophet<sup>"S.A.W"</sup>, those who were taught by them, and those who came after them. So if the word did not exist in the earliest times, we should not forget that this is also the case with many other Islamic disciplines, such as tafsir, 'Qur'anic exegesis,' or 'ilm al-jarh wa ta'dil, 'the science of the positive and negative factors that affect hadith narrators acceptability,' or 'ilm al-tawhid, the science of belief in Islamic tenets of faith,' all of which proved to be of the utmost importance to the correct preservation and transmission of the religion.

Allah<sup>"S.W.T"</sup> says in one Hadith Qudssi: *"He who is hostile to a friend of Mine I declare war against. My slave approaches Me with nothing more beloved to Me than what I have made obligatory upon him, and My slave keeps drawing nearer to Me with voluntary works until I love him. And when I love him, I am his hearing with which he hears, his sight with which he sees, his hand with which he seizes, and his foot with which he walks. If he asks me, I will surely give to him, and if he seeks refuge in Me, I will surely protect him"*<sup>62</sup>. It discloses the central reality of Tasawwuf.

As Allah<sup>"S.W.T"</sup> says in Quran Karim "Al-Hijr:9"<sup>63</sup> *"Surely We have revealed the Remembrance, and surely We shall preserve it"*. Imam Nawawi described: The level of Islam (Arabic: اسلام) has been preserved and conveyed to us by the Imams of Shari'a or 'Sacred

<sup>62</sup>Fath al-Bari, hadith 6502 [This hadith was related by Imam Bukhari, Ahmad ibn Hanbal, al-Bayhaqi, and others with multiple contiguous chains of transmission, and is sahih.]

<sup>63</sup>Quran Karim: "Al-Hijr:9"

إِنَّا نَحْنُ نَزَّلْنَا الذِّكْرَ وَإِنَّا لَهُ لَحَافِظُونَ ﴿٩﴾

Law or Feeqa' and its disciplines; the level of Iman (Arabic:إيمان), by the Imams of 'Aqida or 'tenets of faith'; and the level of Ihsan (Arabic:احسان), "to worship Allah as though you see Him," by the Imams of Tasawwuf.

Prophet Mohammad "S.A.W" sunnah which Muslims have been commanded to follow is not just the words and actions of the Mohammad "S.A.W", but also his states, states of the heart such as taqwa 'godfearingness,' ikhlas 'sincerity,' tawakkul 'reliance on Allah,' rahma 'mercy,' tawadu' 'humility,' and so on Keller (2017). Here we list some states of the heart that Quran Karim and Sunnah plain for us:

- Love of Allah: Quran Karim "Al-Baqara:165"<sup>64</sup> *"And those who believe are greater in love for Allah"*.
- Love of the Prophet "S.A.W": *"None of you believes until I am more beloved to him than his father, his son, and all people"* <sup>65</sup>.
- Mercy: *"Whomever is not merciful to people, Allah will show no mercy"* <sup>66</sup>.
- Love of each other: *"By Him in whose hand is my soul, none of you shall enter paradise until you believe, and none of you shall believe until you love one another . . ."* <sup>67</sup>.
- Presence of mind in the prayer (salat): *"Truly, a man leaves, and none of his prayer has been recorded for him except a tenth of it, a ninth of it, eighth of it, seventh of it, sixth of it, fifth of it, fourth of it, third of it, a half of it"* <sup>68</sup>. — meaning that none of a person's prayer counts for him except that in which he is present in his heart with Allah.

And examples of states that are haram or unlawful:

- Fear of anyone besides Allah: Quran Karim "Al-Baqara:40"<sup>69</sup> *"And fulfill My covenant: I will fulfill your covenant—And fear Me alone"*.
- Despair: Quran Karim "Az-Zumar:53"<sup>70</sup> *"should not be disheartened of the mercy of Allah"* "S.W.T" .
- Showing off in acts of worship: *"The slightest bit of showing off in good works is as if worshipping others with Allah . . ."* <sup>71</sup>.
- Arrogance: *"No one shall enter paradise who has a particle of arrogance in his heart"* <sup>72</sup>.
- Envy: *"Beware of envy, for envy consumes good works as flames consume firewood"* <sup>73</sup>.

<sup>64</sup> Quran Karim: "Al-Baqara:165" \*\*\* وَالَّذِينَ آمَنُوا أَشَدُّ حُبًّا لِلَّهِ \*\*\*

<sup>65</sup> Fath al-Bari, hadith 15

<sup>66</sup> Sahih Muslim, hadith 2319

<sup>67</sup> Sahih Muslim, hadith 54

<sup>68</sup> Sunan Abi Dawud, hadith 796

<sup>69</sup> Quran Karim: "Al-Baqara:40" وَأَوْفُوا بِعَهْدِي أُوفِ بِعَهْدِكُمْ وَإِنِّي فَأَرْحَمُونَ ﴿٤٠﴾

<sup>70</sup> Quran Karim: "Az-Zumar:53" لَا تَقْنَطُوا مِن رَّحْمَةِ اللَّهِ

<sup>71</sup> (al-Mustadrak 'ala al-Sahihayn, 1.4)

<sup>72</sup> (Sahih Muslim, hadith 91)

<sup>73</sup> (Sunan Abi Dawud, 4.276: hadith 4903)

In Tasawwuf every sufi must have a complete and valid chain or series of Sullock (Persian: سلسله سلوک) which must be reach Hazrat Muhammad Mustafa <sup>"S.A.W"</sup>, e.g. "Fig. 2.9 shown my chain of sullock in Tasawwuf". Table.2.10 shown important books in Tasawwuf part.

Table 2.10: Some Books of Tasawwuf that are used in Islamic Nation

No	Book Name	Author
1	Sharh Maktobat Qudsi Ayat ( شرح مکتوبات قدسی آیات )	(Imam Rabani <sup>"R.T"</sup> ) Imam Rabani, Mojadid Alif Sani, Hazrat Shaikh Ahmad Farooqi Sarindi Kabuli <sup>"R.T"</sup> (Persian: محبوب سبحانی ) ( شرح مولوی نصر اللہ ) (امام ربانی مجدد الف ثانی صاحب (رح) )
2	Qudisa - Kalamat Bahu-l-deen Naqshband ( قدسیہ کلمات بہاؤ الدین ) (نقشبند)	(khowaja Bahu-l-deen Naqshband <sup>"R.T"</sup> ) Khowaja Khowaja kan Hazrat khowaja Bahulhaq wul deen Naqshband <sup>"R.T"</sup> (Persian: خواجه خواجگان حضرت خواجہ بہاءالحق والدین نقشبند صاحب (رح) )
3	Adab ul Sullock (Arabic: آداب السلوک (عربی)	(Shaikh Abdul Qahdir Jellani Saheb <sup>"R.T"</sup> ) Shaikh Abu Muhammad Hazrat Abdul Qahdir Jellani Saheb <sup>"R.T"</sup> , (Persian: شیخ عبدالقادر) (جیلانی صاحب (رح) )
4	Kasheful Mahboob ( کشف المحجوب )	(Ali Ajweeri <sup>"R.T"</sup> ) Dahta Ali bni Hesman Ajweeri Saheb <sup>"R.T"</sup> (Persian: (داتا علی بن عثمان فجوری صاحب (رح) )
5	Tareeqa ul Rashideen ( طریقہ الراشدین ) (وہجت المسترشدين)	Mullana Qhues Muhammad Saheb Naqshbandi <sup>"R.T"</sup> (Arabic: مولانا) (غوث محمد صاحب نقشبندی مجددی (رح) )
6	Tazkerat ul Awlwa ( تذکرۃ الأولیاء )	Hazrat Khowaja (Farid uldeen) Alludeen Ataar <sup>"R.T"</sup> (Arabic: شیخ فرید) (الدین عطار صاحب نیشاپوری (رح) )
7	Kashf al-Asrar (Persian: کشف اسرار) Sad Mawedaan (Persian: صد میدان) Zahd ul Arefeen (Persian: زاد العارفین)	Khawaja Abdullah Ansari <sup>"R.T"</sup> (Persian: (خواجہ عبداللہ انصاری صاحب (رح) )
8	Kemya Sahatad ( کیمیای سعادت ) Ihya' Ulum al-Dint (The Revival of the Religious Sciences) ( احیاء علوم الدین )	(Imam Al-Ghazali <sup>"R.T"</sup> ) Abū Ḥāmid Muḥammad ibn Muḥammad al-Ghazali <sup>"R.T"</sup> (Arabic: (أَبُو حَامِدٍ مُحَمَّدُ بْنُ مُحَمَّدٍ الطُّوسِيُّ الْغَزَالِيُّ )
9	Bayaat Ke Zaroorat wa Fazerat ( بیعت کی ضرورت و فزلیت (اردو)	(Imam Al-Ghazali <sup>"R.T"</sup> ) Muwllana Hassan ul Karim Malanq Naqshbandi <sup>"R.T"</sup> (Arabic: (مولانا احسان الکریم ملنگ نقشبندی )
10	Muqammat Bahadoura ( مقامات ) (بہادرہ)	(Peer Bahadour Jan Agha <sup>"R.T"</sup> ) Hazrat Khowaja Abdulwakeel Bahadour Jan Agha <sup>"R.T"</sup> (Arabic: (حضرت خواجہ عبدالوکیل بہادر جان آغا (رح) )
11	Bustaan Hurfaan - Prove of Tasawwuf and Tareqat in Quran Karim and Sunnah and Quote of Great Scholars ( بوستان عرفان - اثبات تصوف و طریقت در قرآن و سنت و اقوال علما اہل سنت والجماعت )	(Ustad Fazli Saheb Mubarak <sup>"R.T"</sup> ) Hazrat Morshidna Alhaj Ustad Powhand Farid Ahmad Fazli Saheb <sup>"R.T"</sup> (Arabic: (حضرت مرشدنا الحاج استاد) (پوهاند فرید احمد فضلی صاحب (رح) )

## 2.2.7 Summary of Islamic Information Context

Islam religion with the complete and correct information in all part of life, is also open for all type of researches for researchers (Muslims and non-Muslims). Researches in specific topics such as (Philosophy of humanity, goals of creation, human rights, woman rights, effects of Islam in knowledge through history, life in Islam and etc), are interesting and desirable to fine the facts of Islam. Therefore, our main purpose in Islamic information context section was to explore the core information zones, their importance, positions in Islam. History of Islam and information about respected characters in Islam are also separate zones of information. Mind map of this study is show in Fig.2.10.



Figure 2.9: Example of Chain/Series of Sullock which reached Hazrat Muhammad Mustafa "S.A.W"

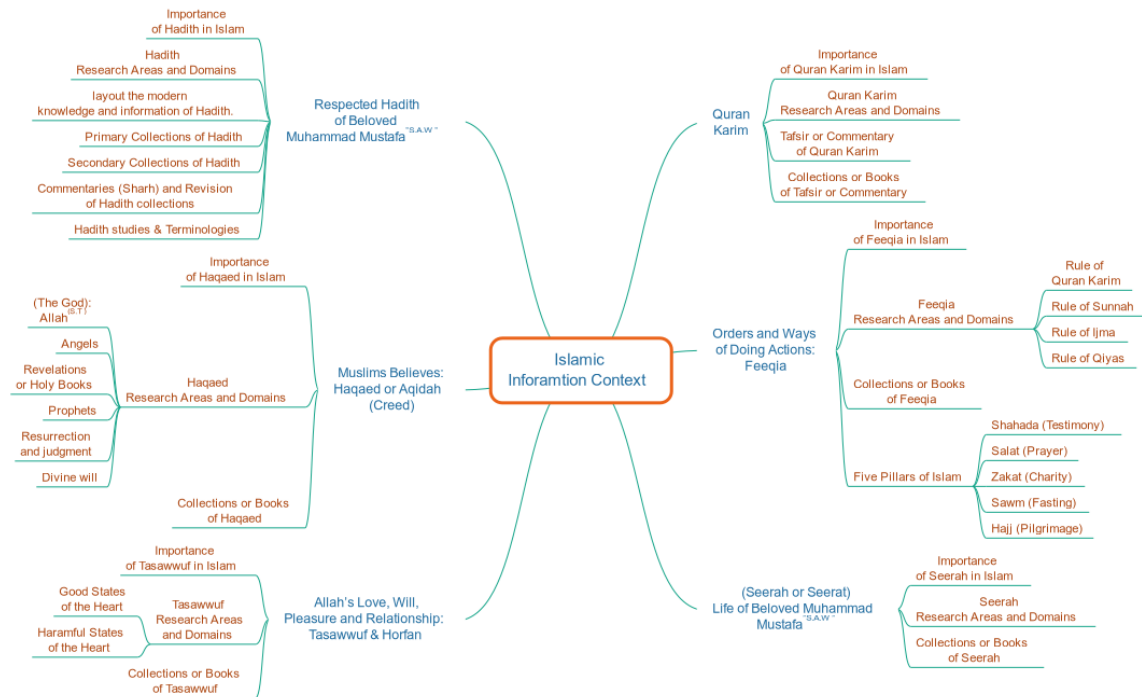


Figure 2.10: Summary of Islamic Information Context in This Research

## 2.3 What We Have for Processing of Information in Current Century?

In the section we have an overview of some most used models (client-servers architecture) services and techniques in processing of data and information in current century (21th century).

### 2.3.1 Client - Servers Architecture

Client - server model is a distributed application structure that partitions tasks or workloads between the providers of a resource or service, called servers, and service requester, called clients as shown in Fig. 2.11. As Sun Microsystem (2011) demonstrated the client server architecture, Often clients and servers communicate over a computer network on separate hardware.

#### 2.3.1.1 Client

Client can be:

- Personal Computer: multi-purpose computer whose size, capabilities, and price make it feasible for individual use. dictionary.com (2020a)
- Smart phone: a class of mobile phones and of multi-purpose mobile computing devices. They are distinguished from feature phones by their stronger hardware capabilities and extensive mobile operating systems, which facilitate wider software, internet (including web browsing over mobile broadband), and multimedia functionality (including

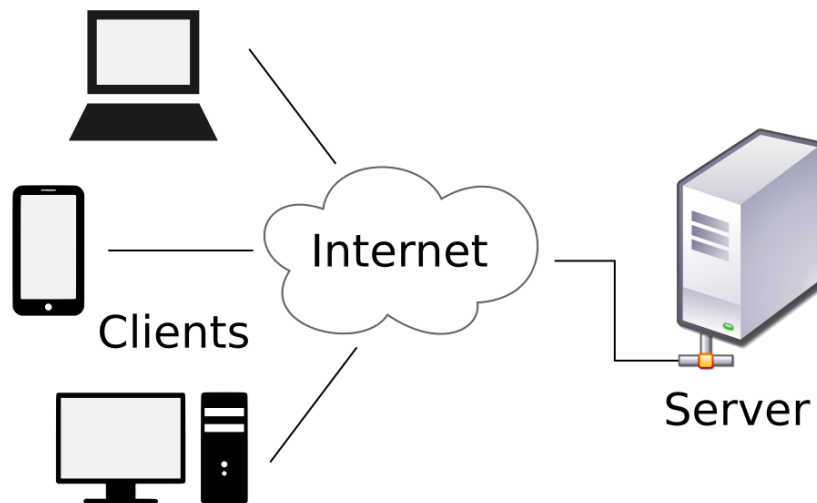


Figure 2.11: Client Server Model. Source: Wikimedia Commons (2019)

music, video, cameras, and gaming), alongside core phone functions such as voice calls and text messaging. dictionary.com (2020c); Wikipedia contributors (2020b)

- tablet: is a mobile device, typically with a mobile operating system and touchscreen display processing circuitry, and a rechargeable battery in a single, thin and flat package. Tablets, being computers, do what other personal computers do, but lack some input/output (I/O) abilities that others have. Modern tablets largely resemble modern smartphones, the only differences being that tablets are relatively larger than smartphones. dictionary.com (2020d); Editors PC Magazine (2020); Wikipedia contributors (2020c)
- Printer: is a peripheral device which makes a persistent representation of graphics or text, usually on paper. While most output is human-readable, bar code printers are an example of an expanded use for printers. dictionary.com (2020b); United State Forest Service (2020); Wikipedia contributors (2020a)
- etc

### 2.3.1.2 Server

As Sons (2011) define, a server is a computer program or a device that can provides functionality for other programs or devices, often called clients. This architecture is called the client-server model as shown in Fig. 2.11, and a single overall computation is distributed across multiple processes or devices. Servers can provide various functionalities, often called "services", such as sharing data or resources among multiple clients, or performing computation for a client.

The purpose of a server is to share data as well as to share resources and distribute work. A server has been categorized depending on different scenarios and Purpose which is exist, for instance Table.2.11 shown some servers in different purpose.

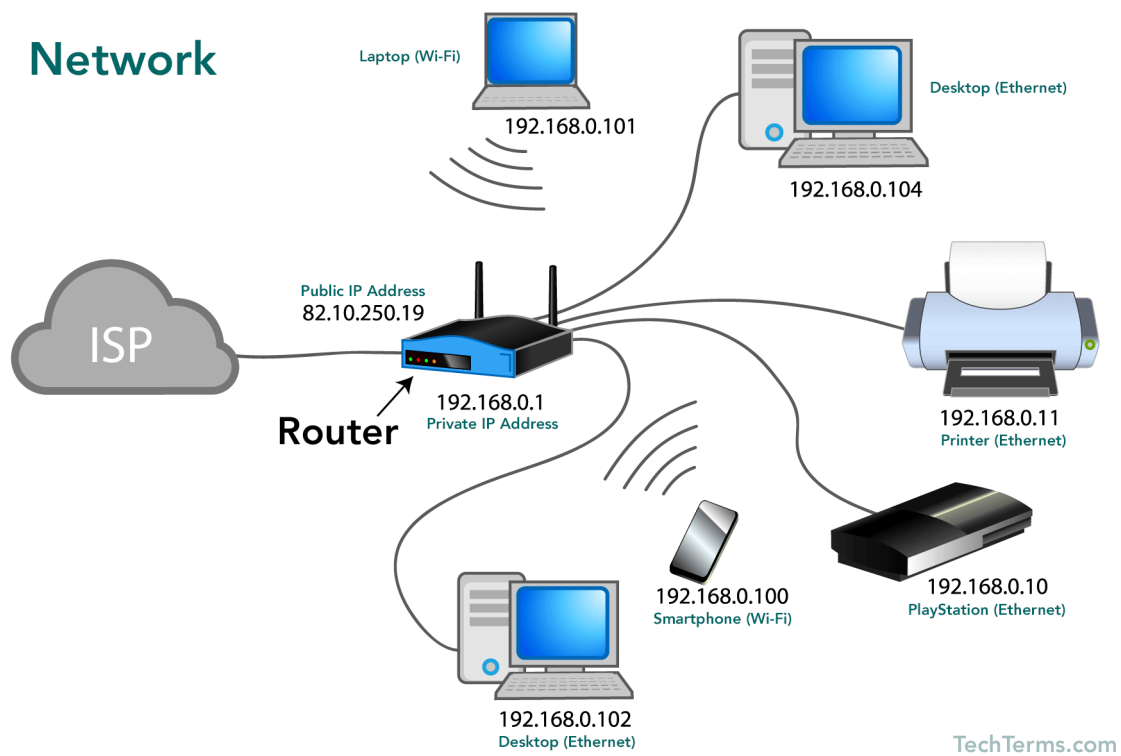


Figure 2.12: Network. Source: TechTerms (2020)

Table 2.11: Some Servers in Different Scenarios and Purpose

Server Name	Scenarios and Purpose	Client
Application server	Hosts web apps (computer programs that run inside a web browser) allowing users in the network to run and use them, without having to install a copy on their own computers.	Computers with a web browser
Computing server	Shares vast amounts of computing resources, especially CPU and random-access memory, over a network.	Any computer program that needs more CPU power and RAM than a personal computer can probably afford.
Database server	Maintains and shares any form of a database ( organized collection of data, generally stored and accessed electronically from a computer system. Where databases are more complex they are often developed using formal design and modeling techniques) over a network.	Spreadsheets, accounting software, asset management software or virtually any computer program that consumes well-organized data, especially in large volumes
File server	Shares files and folders, storage space to hold files and folders, or both, over a network	Networked computers are the intended clients, even though local programs can be clients

### 2.3.1.3 Network and Internet

As Computer Hope (2020b) define, A network is a collection of computers, servers, main-frames, network devices, peripherals, or other devices connected to one another to allow the sharing of data.

Computer networks support many applications and services, such as access to the World Wide Web, digital video, digital audio, shared use of application and storage servers, print-

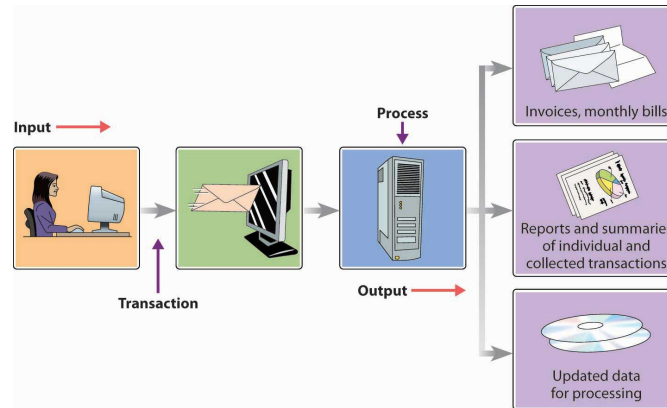


Figure 2.13: Sample of a Transaction Processing System. Source: Saylor.org (2020)

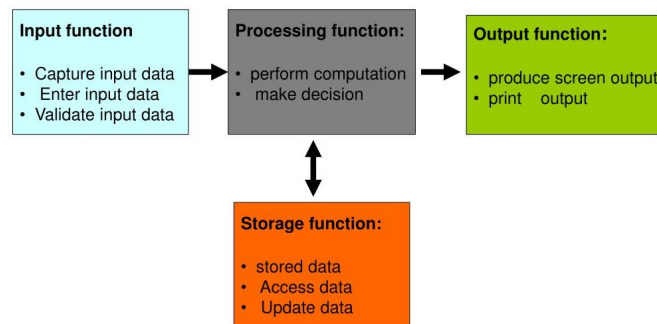


Figure 2.14: Transaction Processing System Functions

ers, and fax machines, and use of email and instant messaging applications as shown in Fig. 2.12.

An excellent example of a network is the Internet, which connects millions of people all over the world. Computer Hope (2020a) introduce the internet, Alternatively referred to as the net or web, the Internet (interconnected network) was initially developed to aid in the progress of computing technology by linking academic computer centers. The Internet we use today started being developed in the late 1960s with the start of ARPANET and transmitted its first message on Friday, October 29, 1969. In 1993, the Internet experienced one of its largest growths to date and today is accessible by people all over the world.

## 2.3.2 Services and Systems

### 2.3.2.1 Information Systems

D'Atri et al. (2008); businessdictionary.com (2020) described computer-based information system, as a system, composed of people and computers that processes or interprets information. Furthermore, computer-based information system is an IS using computer technology to carry out some or all of its planned tasks. Rainer and Cegielski (2012) emphasizes the basic components of computer-based information systems, which are:

**Hardware** these are the devices like the monitor, processor, printer and keyboard, all of

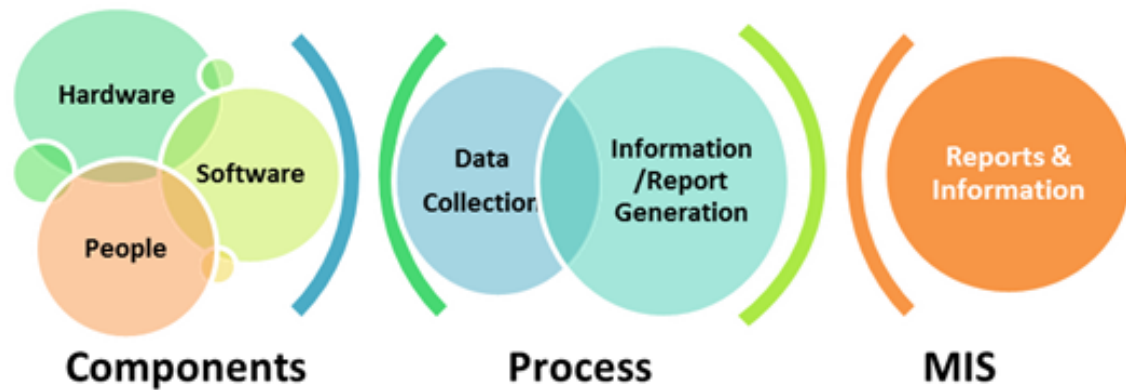


Figure 2.15: Management Information System Components. Source: whatissixsigma.net (2020)

which work together to accept, process, show data and information.

**Software** are the programs that allow the hardware to process the data.

**Databases** are the gathering of associated files or tables containing related data.

**Networks** are a connecting system that allows diverse computers to distribute resources.

**Procedures** are the commands for combining the components above to process information and produce the preferred output.

The first four components (hardware, software, database, and network) make up what is known as the information technology platform. Information technology workers could then use these components to create information systems that watch over safety measures, risk and the management of data. These actions are known as information technology services.

#### 2.3.2.1.1 Types of information system

Nowadays, Information system can be categorize in various forms:

- **Transaction Processing Systems (TPS):** is a software system, or software/hardware combination, that supports transaction processing (a way of computing that divides work into individual, indivisible operations which called transactions), as described by Rayns et al. (2011). Fig. 2.13 has been showing a example of TPS system and Fig. 2.14 are showing the input, process, storage and output functions of a TPS system.
- **Management Information Systems (MIS):** Bourgeois (2018) demonstrated MIS as, an information system used for decision-making, and for the coordination, control, analysis, and visualization of information in an organization as shown in Fig. 2.15 and Fig. 2.16 are showing the high level view of a MIS system. Mays Business School (2020); Saunders College of Business, Rochester Institute of Technology (2020); University of Massachusetts Dartmouth (2020) shows, the study of the management information systems testing people, processes and technology in an organizational context.

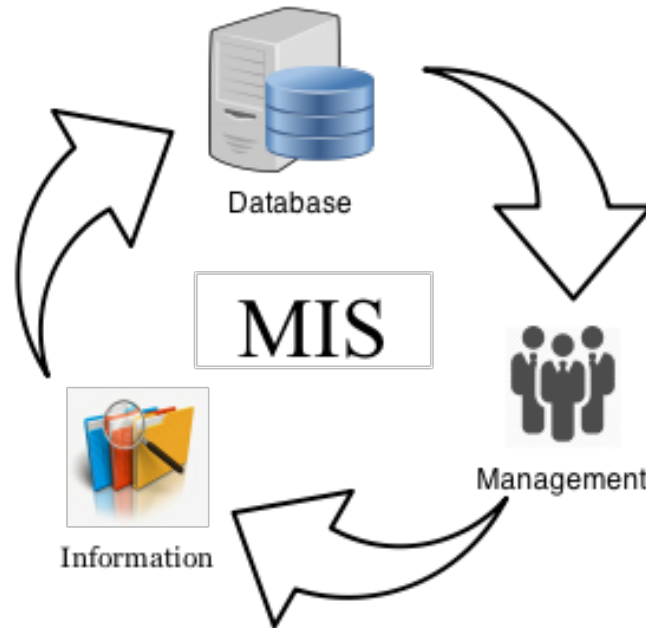


Figure 2.16: High Level View of a Management Information Systems. Source: Aristotle Consultancy (2020)

- **Decision Support Systems (DSS):** Keen (1980); Sol et al. (2013) both source mentioned a DSS as, an information system that supports business or organizational decision-making activities as shown in Fig. 2.17. DSS systems serve the management, operations and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance —i.e. unstructured and semi-structured decision problems. Decision support systems can be either fully computerized or human-powered, or a combination of both. An instance of decision support system with input, tools and output is shown in Fig. 2.18.
- **Executive Information Systems (EIS):** Power (2002); Walstrom and Wilson (1997); Salmeron and Herrero (2005) described executive information systems, that, facilitates and supports senior executive information and decision-making needs. It provides easy access to internal and external information relevant to organizational goals. It is commonly considered a specialized form of decision support system (DSS). EIS emphasizes graphical displays and easy-to-use user interfaces. They offer strong reporting and drill-down capabilities as shown in Fig 2.19.
- **Data Warehouses (DW-DWH):** Dedić and Stanier (2016) described a data warehouses as, a system used for reporting and data analysis, and is considered a core component of business intelligence as shown in Fig 2.20.
- **Enterprise Resource Planning (ERP):** Almajali et al. (2016); Rubina et al. (2011) described a enterprise resource planning as, a category of business management software — typically a suite of integrated applications—that an organization can use to collect, store, manage, and interpret data from many business activities as shown in Fig 2.21.

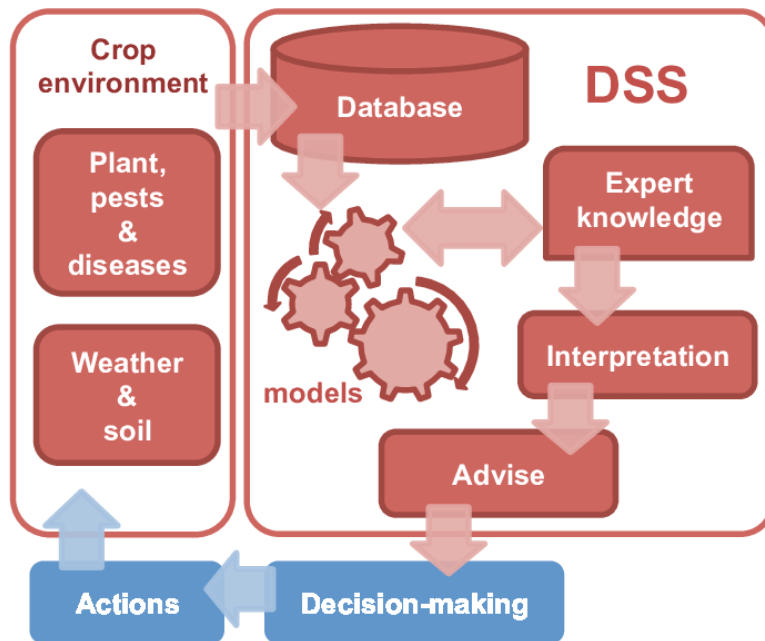


Figure 2.17: Instance of a Decision Support Systems. Source: Rossi et al. (2012)

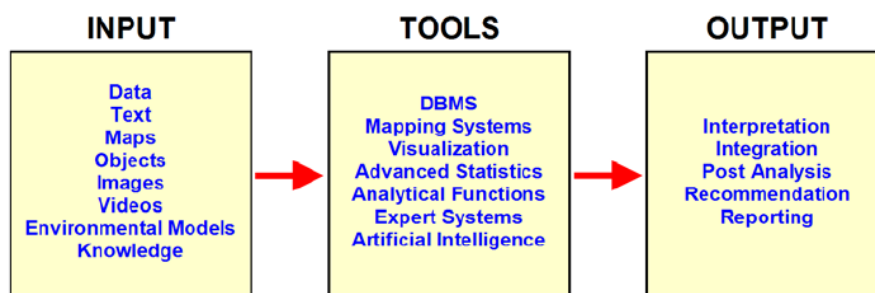


Figure 2.18: Decision Support Systems Input, Tools and Output. Source: Jao (2010)

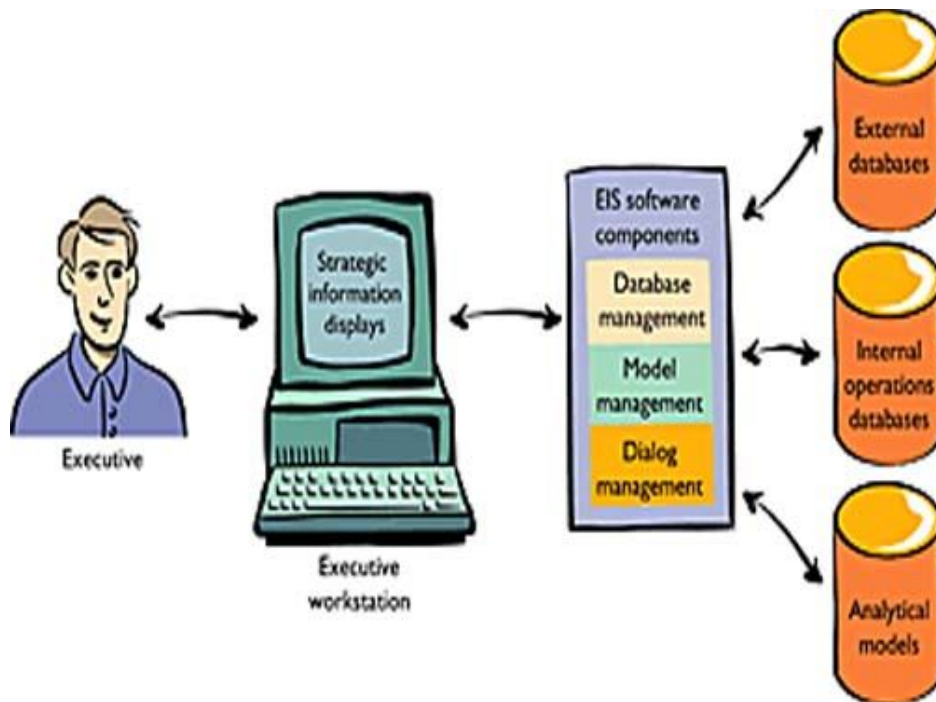


Figure 2.19: Executive Information System Architecture



Figure 2.20: Data Warehouses Architecture. Source: Ossak Info Tech (2020)



Figure 2.21: Enterprise Resource Planning. Source: Share Codex (2020)

- **Enterprise Systems (ES):** Yogl (2004); Fowler (2002); Daniel (2016) emphasized enterprise system as a large-scale enterprise software packages that support business processes, information flows, reporting, and data analytics in complex organizations as shown in Fig 2.22.
- **Expert Systems:** Jackson (1998); Leondes (2001) demonstrated the expert system as a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if-then rules rather than through conventional procedural code as shown in Fig 2.23.
- **Geographic Information System:** Clarke (1986); Maliene et al. (2011) described geographic information system as a system, designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data. GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data in maps, and present the results of all these operations as shown in Fig 2.24.
- **Office Automation:** Webster (1990) explained office automation system, that refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks. Raw data storage, electronic transfer, and the management of electronic business information comprise the basic activities of an office automation system. Office automation helps in optimizing or automating existing office procedures as shown in Fig 2.25.

### 2.3.2.2 Database Systems

Elmasri (2008); Atzeni et al. (1999) demonstrated database which is an organized collection of data, generally stored and accessed electronically from a computer system. Where databases are more complex they are often developed using formal design and modeling techniques.

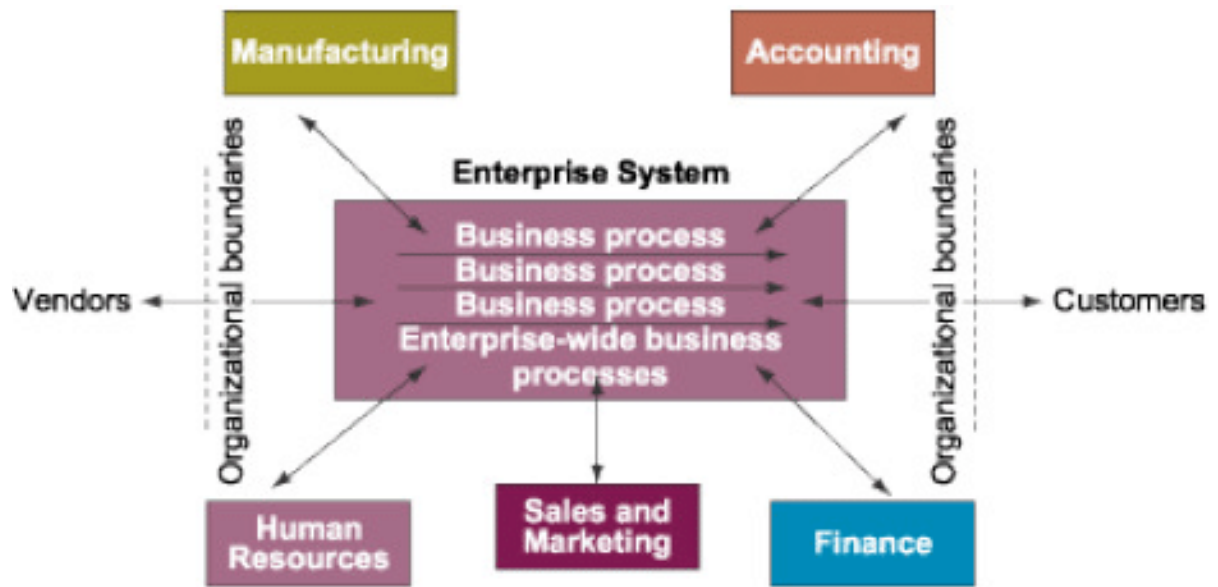


Figure 2.22: Enterprise Systems. Source: Daniel (2016)

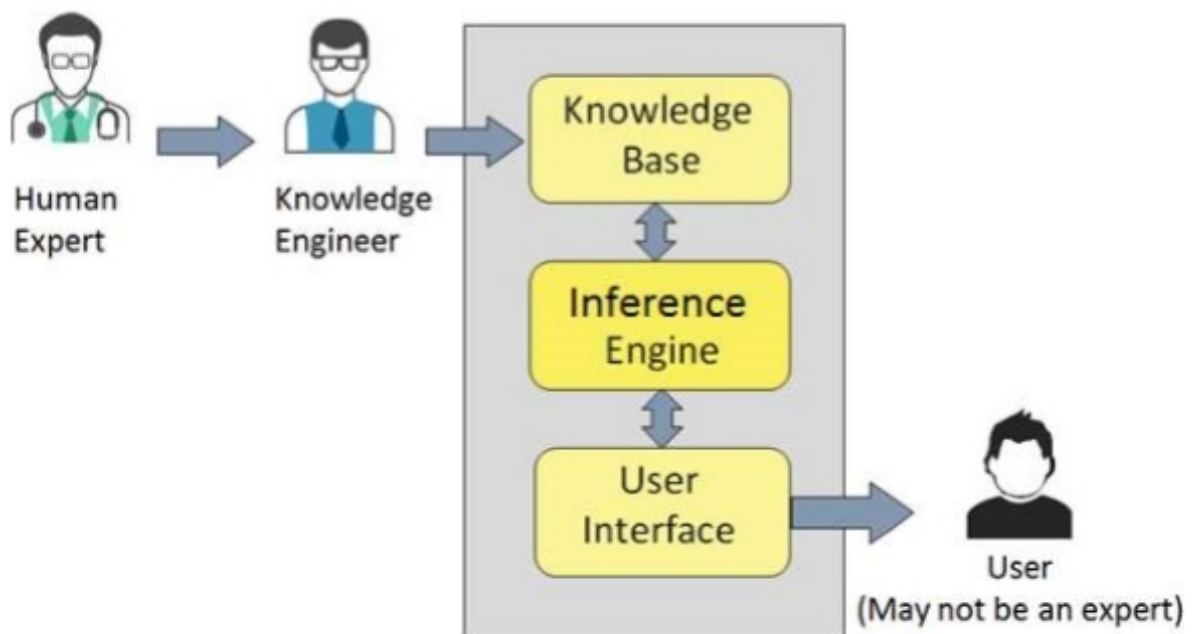


Figure 2.23: Expert Systems. Source: Tutorials Point (2020b)

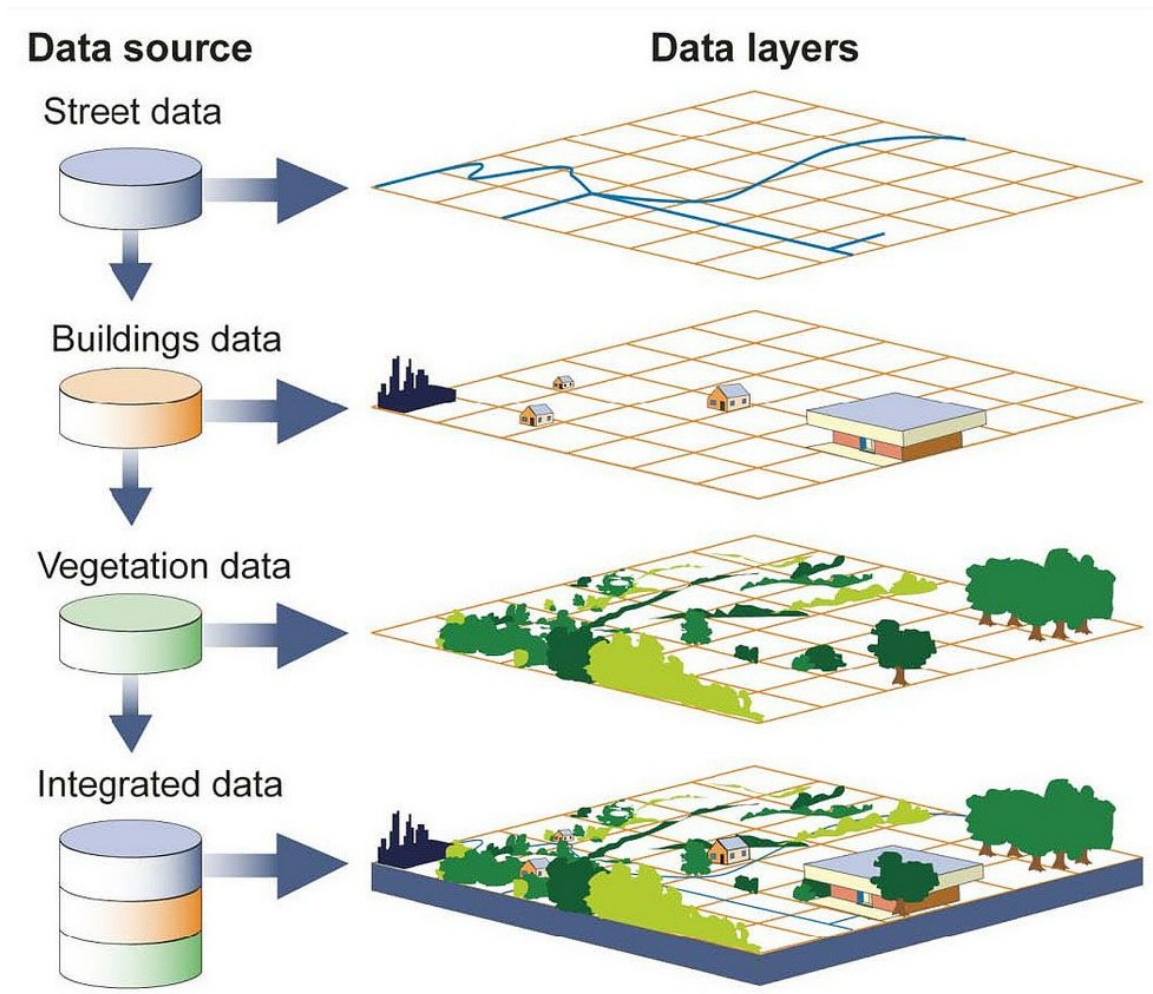


Figure 2.24: Geographic Information System. Source: National Geographic (2020)



Figure 2.25: Office Automation System. Source: on il4Syrians (2019)

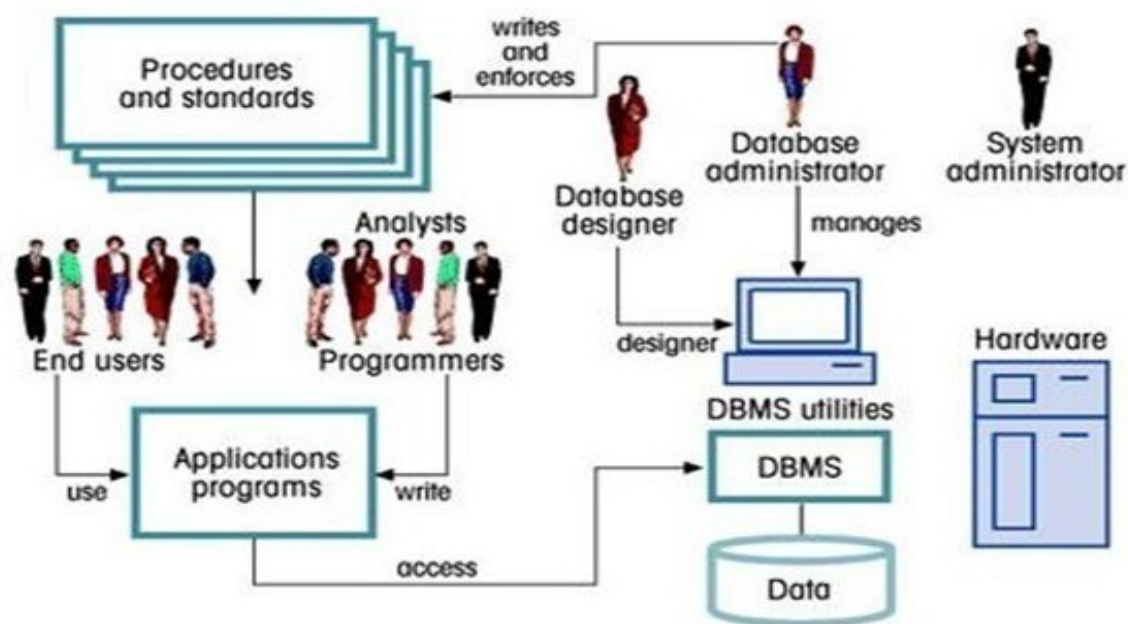


Figure 2.26: DBMS components and its environment. Source: Prabhjot (2017)

### 2.3.2.2.1 Database Management System (DBMS)

Connolly and Begg (2005) explained the database management system (DBMS) which is the software that interacts with end users, applications, and the database itself to capture and analyze the data. The DBMS software additionally encompasses the core facilities provided to administer the database. The DBMS and the associated applications can be referred to as a "database system". Fig 2.26 are showing the DBMS components and its environment.

Database management systems (DBMS) can be classify according to the database models that they support. Relational databases became dominant in the 1980s. These model data as rows and columns in a series of tables, and the vast majority use SQL for writing and querying data. In the 2000s, non-relational databases became popular, referred to as NoSQL because they use different query languages.

### 2.3.2.3 Web Applications

Chaffee (2000) demonstrated that a web application or web app is a client-server computer program that the client (including the user interface and client-side logic) runs in a web browser as shown in Fig 2.27. By other words, a web application is a computer program that utilizes web browsers and web technology to perform tasks over the Internet. Web applications environment are shown by Fig 2.28.

There are basically two main types of web application or web pages - static and dynamic.

**Static Web Page** McDunnigan (2017) demonstrated that a static web page is one that is usually written in (plain HTML, CSS, JavaScript) and what is in the code of the page is what is displayed to the user as shown in Fig 2.29.

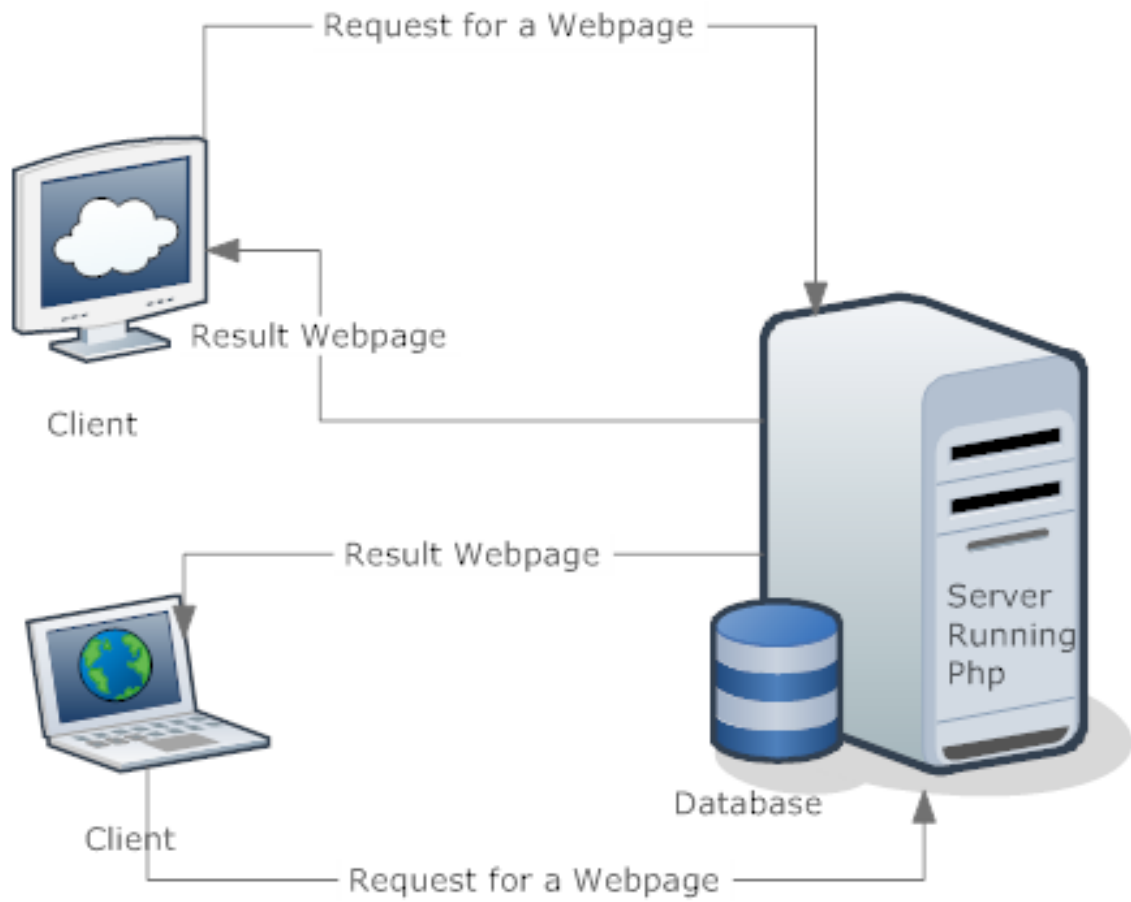


Figure 2.27: Client - Server Model for a Web Application. Source: Secure Web Apps (2020)

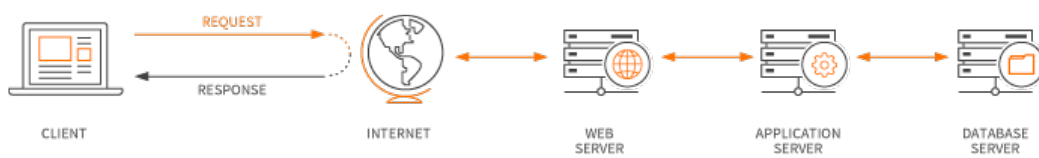


Figure 2.28: Web Applications Environment. Source: Bundle (2020)

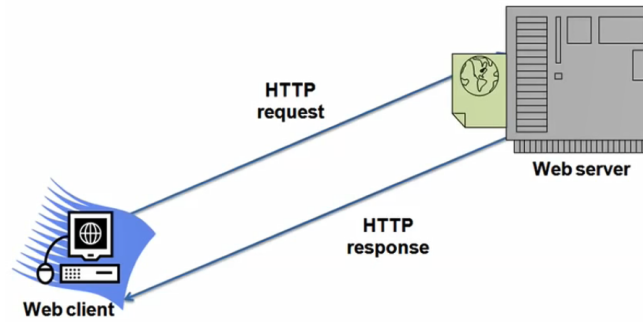


Figure 2.29: Static Web Page Environment

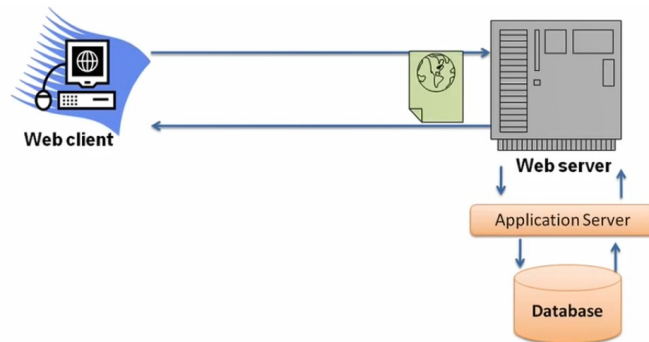


Figure 2.30: Dynamic Web Page Environment

**Dynamic Web Page** A dynamic web page is one that is written using a server-side scripting language such as PHP, ASP, JSP, or Python. In such a web app the content is called in by the scripting language from other files or from a database depending on actions taken by the user as shown in Fig 2.30.

The difference between static & dynamic web pages is that static web pages is delivered to the user's web browser exactly as stored, in contrast to dynamic web pages which are generated by a web application. McDunnigan (2017)

#### 2.3.2.4 RESTful-API

As Fielding and Taylor (2000) firstly mentioned, Representational state transfer (REST) is a software architectural style that defines a set of constraints to be used for creating Web services. Web services that conform to the REST architectural style, called RESTful Web services, provide interoperability between computer systems on the Internet. RESTful Web services allow the requesting systems to access and manipulate textual representations of Web resources by using a uniform and predefined set of stateless operations.

"Web resources" were first defined on the World Wide Web as documents or files identified by their URLs. However, today they have a much more generic and abstract definition that encompasses every thing or entity that can be identified, named, addressed, or handled, in any way whatsoever, on the Web. In a RESTful Web service, requests made to a resource's URI will create a response with a payload formatted in HTML, XML, JSON, or

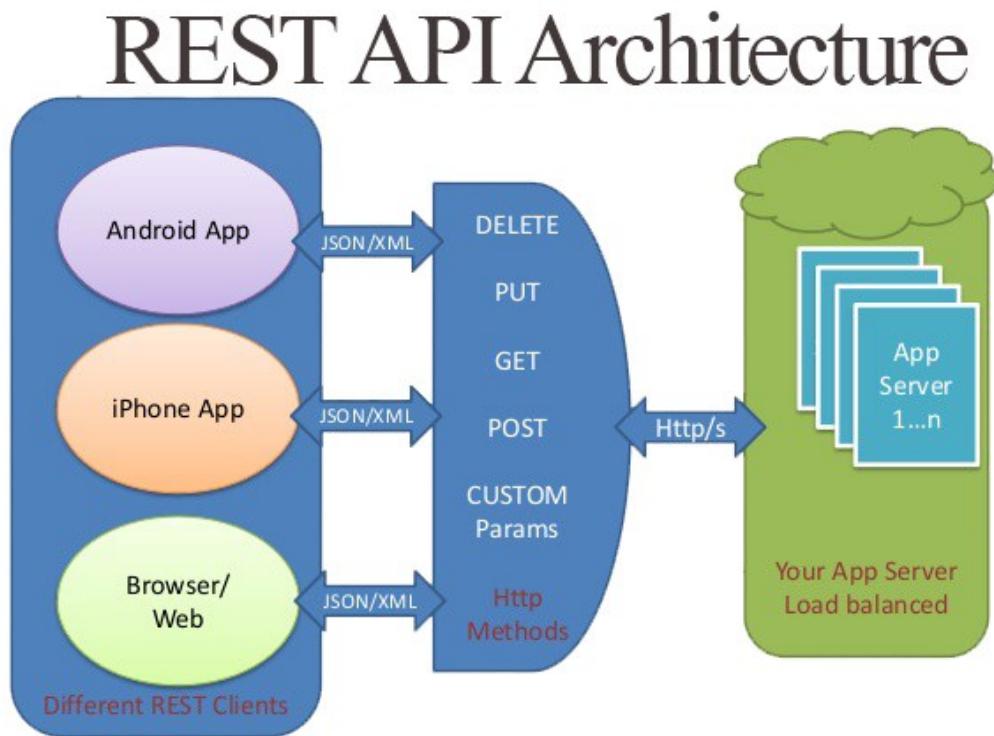


Figure 2.31: RESTful-API Architecture

some other format. The response can confirm that some alteration has been made to the stored resource, and the response can provide hypertext links to other related resources or collections of resources. When HTTP is used, as is most common, the operations (HTTP methods) available are GET, HEAD, POST, PUT, PATCH, DELETE, CONNECT, OPTIONS and TRACE as shown in table.2.12. An example of RESTful-API architecture is shown in Fig.2.31.

REST is architectural style for distributed hypermedia systems and was first presented by Roy Fielding in 2000 in his famous dissertation. Like any other architectural style, REST also does have it's own 6 guiding constraints which must be satisfied if an interface needs to be referred as RESTful. These principles are listed below.

- **Client - Server:** By separating the user interface concerns from the data storage concerns, we improve the portability of the user interface across multiple platforms and improve scalability by simplifying the server components.
- **Stateless:** Each request from client to server must contain all of the information necessary to understand the request, and cannot take advantage of any stored context on the server. Session state is therefore kept entirely on the client.
- **Cacheable:** Cache constraints require that the data within a response to a request be implicitly or explicitly labeled as cacheable or non-cacheable. If a response is

cacheable, then a client cache is given the right to reuse that response data for later, equivalent requests.

- **Uniform interface:** By applying the software engineering principle of generality to the component interface, the overall system architecture is simplified and the visibility of interactions is improved. In order to obtain a uniform interface, multiple architectural constraints are needed to guide the behavior of components. REST is defined by four interface constraints: identification of resources; manipulation of resources through representations; self-descriptive messages; and, hypermedia as the engine of application state.
- **Layered system:** The layered system style allows an architecture to be composed of hierarchical layers by constraining component behavior such that each component cannot “see” beyond the immediate layer with which they are interacting.
- **Code on demand (optional):** REST allows client functionality to be extended by downloading and executing code in the form of applets or scripts. This simplifies clients by reducing the number of features required to be pre-implemented.

Table 2.12: Common HTTP Methods

Method	Description
<b>GET</b>	Transfer a current representation of the target resource.
<b>HEAD</b>	Same as GET, but only transfer the status line and header section.
<b>POST</b>	Perform resource-specific processing on the request payload.
<b>PUT</b>	Replace all current representations of the target resource with the request payload.
<b>DELETE</b>	Remove all current representations of the target resource.
<b>CONNECT</b>	Establish a tunnel to the server identified by the target resource.
<b>OPTIONS</b>	Describe the communication options for the target resource.
<b>TRACE</b>	Perform a message loop-back test along the path to the target resource.

### 2.3.2.5 Mobile Applications

A mobile application, also referred to as a mobile app or simply an app, is a computer program or software application designed to run on a mobile device such as a phone, tablet, or watch. Apps were originally intended for productivity assistance such as email, calendar, and contact databases, but the public demand for apps caused rapid expansion into other areas such as mobile games, factory automation, GPS and location-based services, order-tracking, and ticket purchases, so that there are now millions of apps available. Apps are generally downloaded from application distribution platforms which are operated by the owner of the mobile operating system, such as the App Store (iOS) or Google Play Store. Some apps are free, and others have a price, with the profit being split between the application’s creator and the distribution platform. Mobile applications often stand in contrast to desktop applications which are designed to run on desktop computers, and web applications which run in mobile web browsers rather than directly on the mobile device.

Pogue (2009) stated, that smartphones could be nicknamed “app phones” to distinguish them from earlier less-sophisticated smartphones. American Dialect Society (2011) demonstrated term “app” as *Word of the Year*, short for “software application”, since become very

popular; in 2010.

#### 2.3.2.5.1 Types of Mobile Applications

Mobile applications may be classified by numerous methods. A common scheme is to distinguish native, hybrid, and web-based apps.

**Native App** All apps targeted toward a particular mobile platform are known as native apps. Therefore, an app intended for Apple device do not run in Android devices. As a result, most businesses develop apps for multiple platforms. While developing native apps, professionals incorporate best-in-class user interface modules. This accounts for better performance, consistency and good user experience. Users also benefit from wider access to application programming interfaces and make limitless use of all apps from the particular device. Further, they also switch over from one app to another effortlessly. The main purpose for creating such apps is to ensure best performance for a specific mobile operating system.

**Hybrid App** The concept of the hybrid app is a mix of native and web-based apps. Apps developed using React Native, Flutter, Apache Cordova, Xamarin, Sencha Touch and other similar technology fall into this category. These are made to support web and native technologies across multiple platforms. Moreover, these apps are easier and faster to develop. It involves use of single code base which works in multiple mobile operating systems.

**Web-based App** A web-based app is coded in HTML5, CSS or JavaScript. Internet access is required for proper behavior and user-experience of this group of apps. These apps may capture minimum memory space in user devices compared to native and hybrid apps. Since all the personal databases are saved on the Internet servers, users can fetch their desired data from any device through the Internet.

#### 2.3.2.6 Search Engines

A web search engine or Internet search engine is a software system that is designed to carry out web search (Internet search), which means to search the World Wide Web in a systematic way for particular information specified in a textual web search query. The search results are generally presented in a line of results, often referred to as search engine results pages (SERPs). The information may be a mix of links to web pages, images, videos, infographics, articles, research papers, and other types of files. Some search engines also mine data available in databases or open directories. Unlike web directories, which are maintained only by human editors, search engines also maintain real-time information by running an algorithm on a web crawler. Internet content that is not capable of being searched by a web search engine is generally described as the deep web.

##### 2.3.2.6.1 Approach of Search Engines

Jawadekar (2010) stated that, a search engine maintains the following processes in near real time:

1. Web crawling
2. Indexing

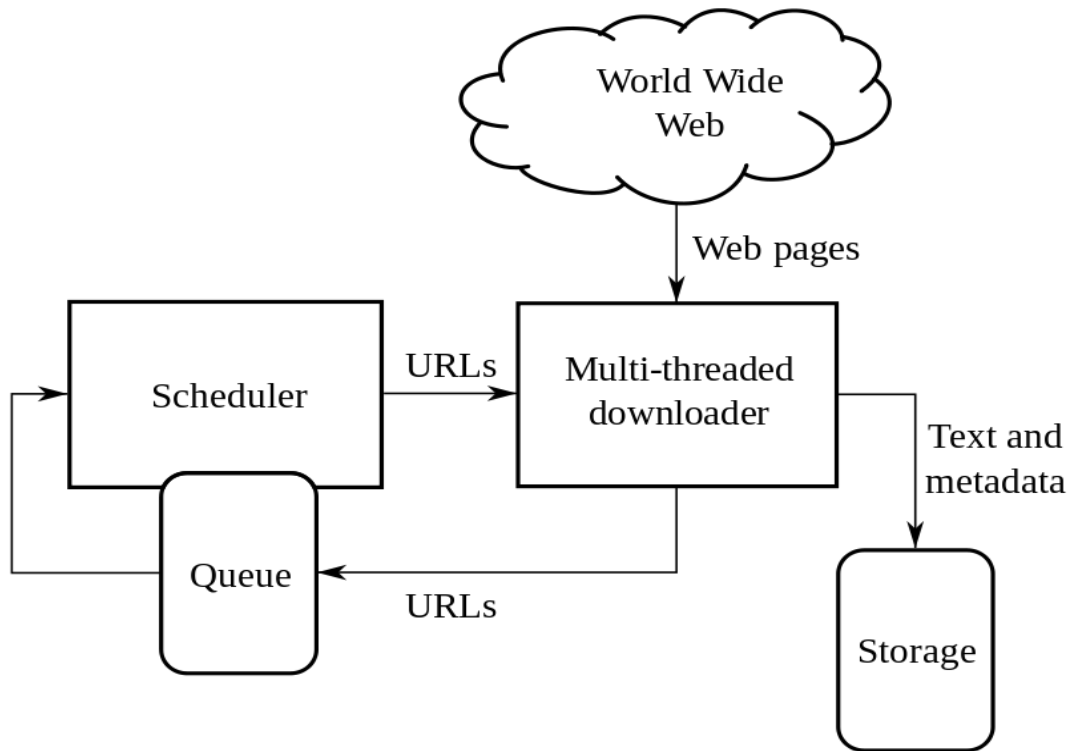


Figure 2.32: Architecture of a Web Crawler. Source: Castillo (2004)

### 3. Searching

**Web crawling** Dasgupta et al. (2007) demonstrated that, search engines get their information by web crawling from site to site. The "spider" checks for the standard filename robotS.W.Txt, addressed to it. The robotS.W.Txt file contains directives for search spiders, telling it which pages to crawl. After checking for robotS.W.Txt and either finding it or not, the spider sends certain information back to be indexed depending on many factors, such as the titles, page content, JavaScript, Cascading Style Sheets (CSS), headings, or its metadata in HTML meta tags. After a certain number of pages crawled, amount of data indexed, or time spent on the website, the spider stops crawling and moves on. Architecture of a Web crawler is shown in Fig 2.32.

**Indexing** Jawadekar (2010) described that, indexing means associating words and other definable tokens found on web pages to their domain names and HTML-based fields. The associations are made in a public database, made available for web search queries. A query from a user can be a single word, multiple words or a sentence. The index helps find information relating to the query as quickly as possible.

**Searching** Jansen et al. (2000) stated that, typically when a user enters a query into a search engine it is a few keywords. The index already has the names of the sites containing the keywords, and these are instantly obtained from the index. The real processing load is in generating the web pages that are the search results list: Every page in the entire list must be weighted according to information in the indexes as stated in Jawadekar (2010). Then the top search result item requires the lookup,

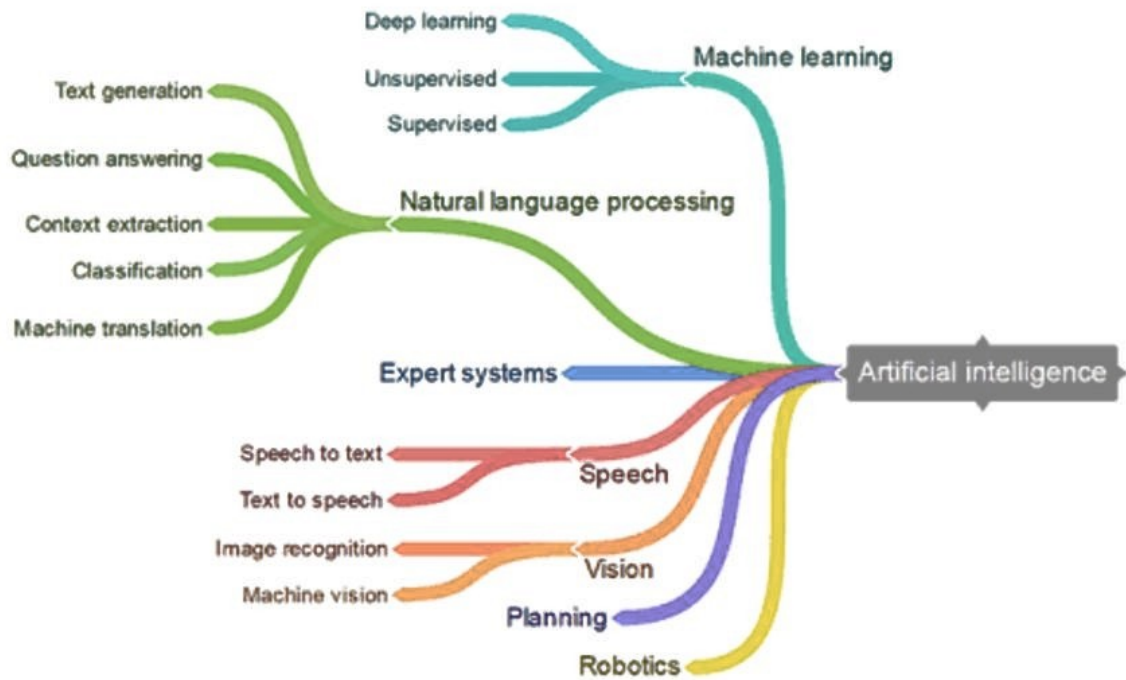


Figure 2.33: Artificial Intelligence (AI) Application Area and Branches. Source: Institute (2020)

reconstruction, and markup of the snippets showing the context of the keywords matched. These are only part of the processing each search results web page requires, and further pages (next to the top) require more of this post processing.

## 2.3.3 Techniques

### 2.3.3.1 Artificial Intelligence (AI)

Lounge (2019) stated that, Artificial Intelligence (AI) is the replication of human intelligence in computers. In the words of the person who coined the term artificial intelligence, McCarthy (1989), “It is the science and engineering of making intelligent machines”.

Nilsson (1998); Poole et al. (1998) stated, artificial intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans.

Everitt and Hutter (2018); Grewal (2014) as leading AI textbooks define the field as the study of “intelligent agents”: any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. Colloquially, the term “artificial intelligence” is often used to describe machines (or computers) that mimic “cognitive” functions that humans associate with the human mind, such as “learning” and “problem solving”. Artificial Intelligence (AI) application area and branches is shown in Fig 2.33.

#### 2.3.3.1.1 Artificial Intelligence Examples

builtin.com (2020); Towards Data Science (2020) stated the following artificial intelligence instance of today (2020):

- **Smart assistants** (like Siri on Apple devices and Amazon Alexa)
- **Disease mapping and prediction tools**
- **Manufacturing robots**
- **Optimized, personalized healthcare treatment recommendations**
- **Conversational bots for marketing and customer service**
- **Robo-advisors for stock trading**
- **Spam filters on email** (Gmail.com)
- **Social media monitoring tools for dangerous content or false news**
- **Song or TV show recommendations** (YouTube, Spotify and Netflix)
- **Recommendation of products to users** (Amazon.com)
- **Ranking search results** (Google search)
- **Displaying targeted ads to users** (Google Ads)
- **Self-driving cars** (Mercedes-Benz, General Motors, Continental Automotive Systems, Autoliv Inc., Bosch, Nissan, Toyota, Audi, Volvo, Vislab from University of Parma, Oxford University and Google)

### 2.3.3.2 Machine Learning (ML)

Lounge (2019) stated that, Machine Learning referred to the ability of a machine to learn using data sets instead of hard coded rules. In addition, Machine Learning allows computers to learn by themselves. This type of learning takes advantage of the processing power of modern computers, which can easily process large data sets.

Bishop (2006); Koza et al. (1996) demonstrated, the machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to perform the task.

In other sentence, which Han et al. (2011) stated, Machine learning investigates how computers can learn (or improve their performance) based on data. A main research area is for computer programs to automatically learn to recognize complex patterns and make intelligent decisions based on data.

#### 2.3.3.2.1 Types of learning algorithms in machine learning

The types of machine learning algorithms differ in their approach, the type of data they input and output, and the type of task or problem that they are intended to solve.

**Supervised learning** Han et al. (2011); Russell and Norvig (2016) stated, supervised learning algorithms build a mathematical model of a set of data that contains both the inputs and the desired outputs. The data is known as training data, and consists of a set of training examples. Each training example has one or more inputs and the desired output, also known as a supervisory signal. Supervised learning algorithms include classification which is the problem of identifying to which of a set of categories a new observation belongs; and regression which is estimating the relationships between a dependent variable and one or more independent variables.

**Unsupervised learning** Han et al. (2011); Russell and Norvig (2016) stated, unsupervised learning algorithms take a set of data that contains only inputs, and find structure in the data, like grouping or clustering of data points. The algorithms, therefore, learn from test data that has not been labeled, classified or categorized.

**Semi-supervised learning** Han et al. (2011); Russell and Norvig (2016) stated, semi-supervised learning is a class of machine learning techniques that make use of both labeled and unlabeled examples when learning a model. In one approach, labeled examples are used to learn class models and unlabeled examples are used to refine the boundaries between classes. In other word, Semi-supervised learning falls between unsupervised learning (without any labeled training data) and supervised learning (with completely labeled training data). Many machine-learning researchers have found that unlabeled data, when used in conjunction with a small amount of labeled data, can produce a considerable improvement in learning accuracy.

**Reinforcement learning (RL)** Van Otterlo and Wiering (2012) stated, reinforcement learning is an area of machine learning concerned with how software agents ought to take actions in an environment in order to maximize some notion of cumulative reward. Reinforcement learning is one of three basic machine learning paradigms, alongside supervised learning and unsupervised learning.

**Active learning** Han et al. (2011); Russell and Norvig (2016) stated, active learning is a machine learning approach that lets users play an active role in the learning process. An active learning approach can ask a user (e.g., a domain expert) to label an example, which may be from a set of unlabeled examples or synthesized by the learning program. The goal is to optimize the model quality by actively acquiring knowledge from human users, given a constraint on how many examples they can be asked to label.

Some Common type of learning in machine learning (ML) is shown in Fig 2.34.

### 2.3.3.3 Deep Learning

Lounge (2019) stated that, Deep Learning subset of machine learning based on artificial neural networks. Neural Networks can be used in unsupervised, supervised, or reinforcement learning. For example, reinforcement learning that uses neural networks as function approximators can be referred to as 'deep reinforcement learning'.

Deep is a technical term. It refers to the number of layers in a neural network. A shallow network has one hidden layer, and a deep network has more than one. Multiple hidden layers allow deep neural networks to learn features of the data in a feature hierarchy. The difference between simple neural networks and deep neural networks is shown in Fig 2.35 and a classification task through machine learning and deep learning is shown in Fig 2.36.

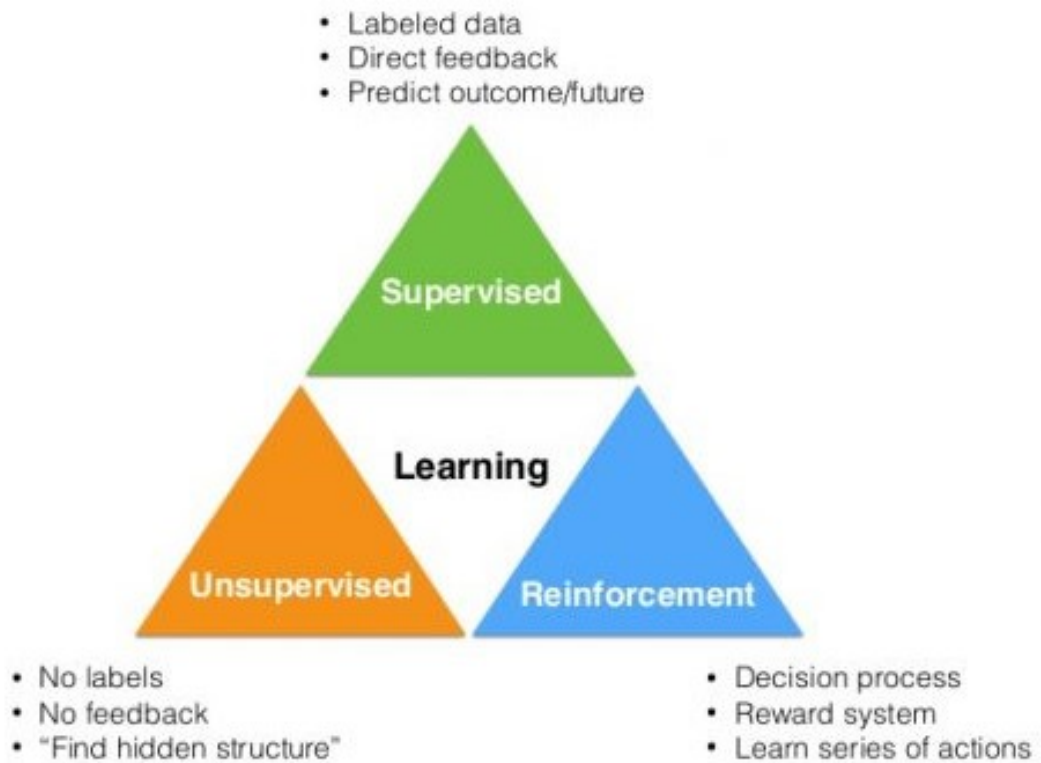


Figure 2.34: Machine Learning (ML) learning type. Source: Raschka (2020)

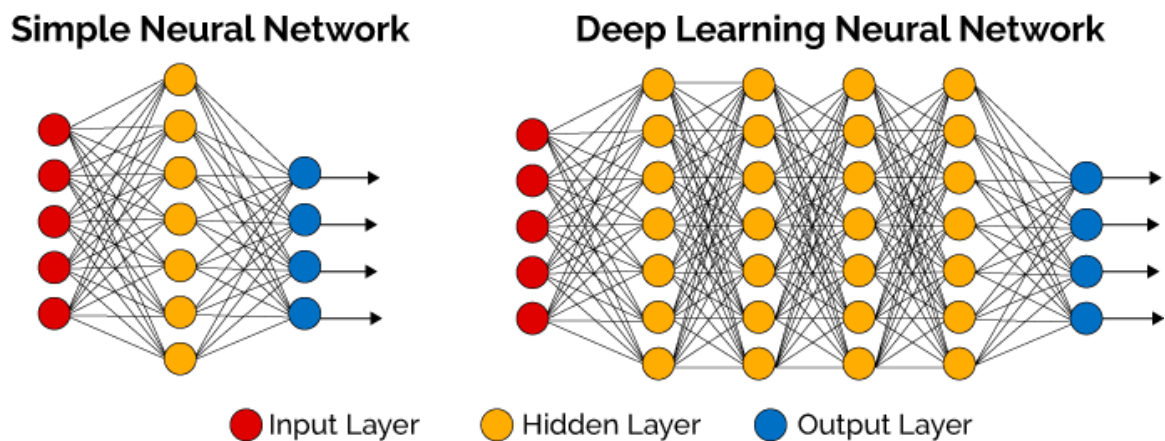


Figure 2.35: Difference Between Simple Neural Networks and Deep Neural Networks. Source: Gill (2018)

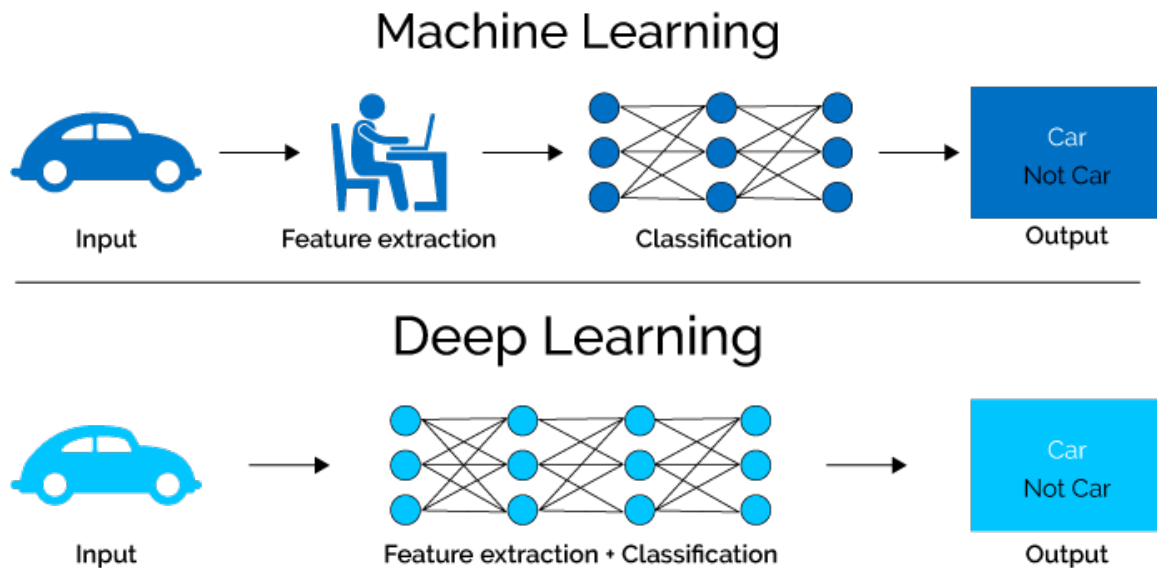


Figure 2.36: Machine Learning (ML) and Deep Learning Classification Task. Source: Gill (2018)

Difference between artificial intelligence (AI), machine learning, and deep learning is shown in Fig 2.37.

#### 2.3.3.4 Data Mining (DM)

Chakrabarti et al. (2006) demonstrated the data mining which is the process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems. Hastie et al. (2009); Han et al. (2011) stated other definition: Data mining is an interdisciplinary subfield of computer science and statistics with an overall goal to extract information (with intelligent methods) from a data set and transform the information into a comprehensible structure for further use. Fig 2.38a and Fig 2.38b have been showing the rule of data mining.

In addition, many other terms have a similar meaning to data mining—for example, knowledge mining from data, knowledge extraction, data/pattern analysis, data archaeology, and data dredging.

Data mining is the analysis step of the "knowledge discovery in databases" process or KDD. The knowledge discovery process is shown in Fig 2.39 as an iterative sequence of the following steps:

1. **Data cleaning** (to remove noise and inconsistent data)
2. **Data integration** (where multiple data sources may be combined)
3. **Data selection** (where data relevant to the analysis task are retrieved from the database)
4. **Data transformation** (where data are transformed and consolidated into forms appropriate for mining by performing summary or aggregation operations)
5. **Data mining** (an essential process where intelligent methods are applied to extract data patterns)

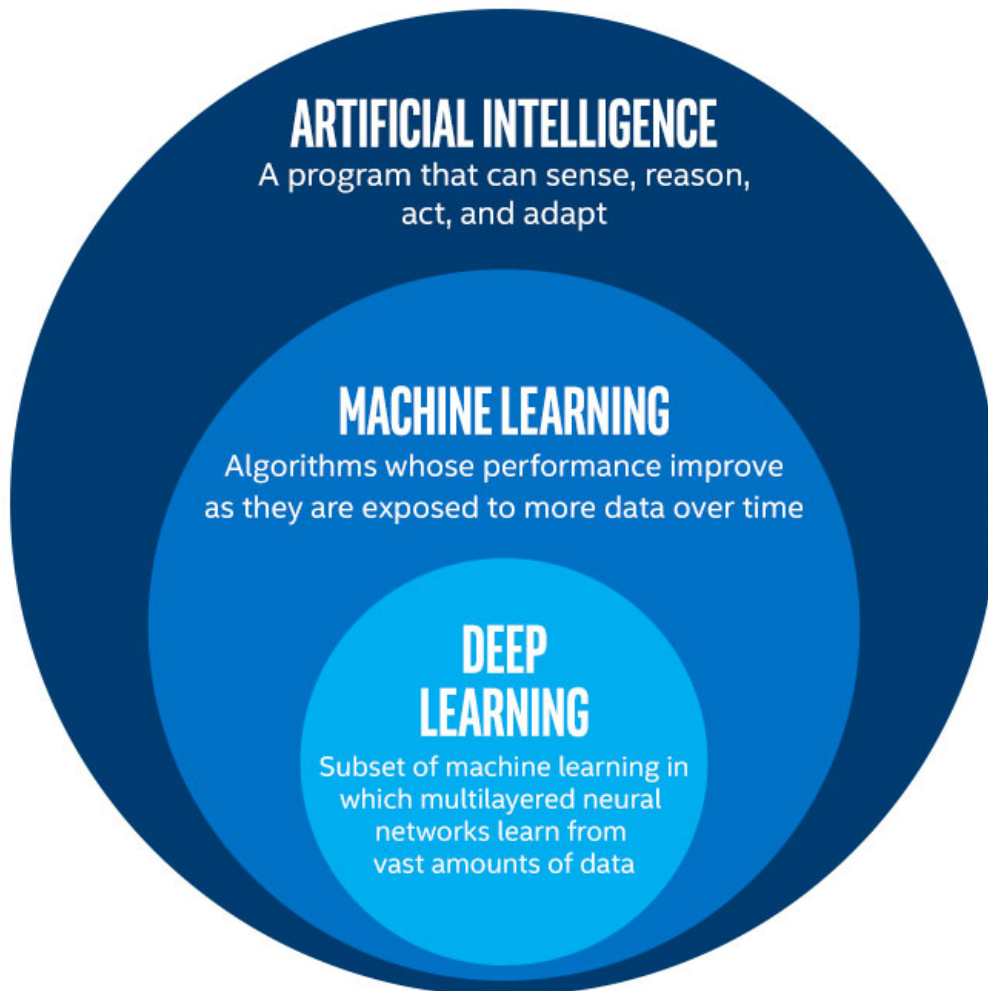


Figure 2.37: Difference Between Artificial Intelligence (AI), Machine Learning, and Deep Learning. Source: Singh (2019)

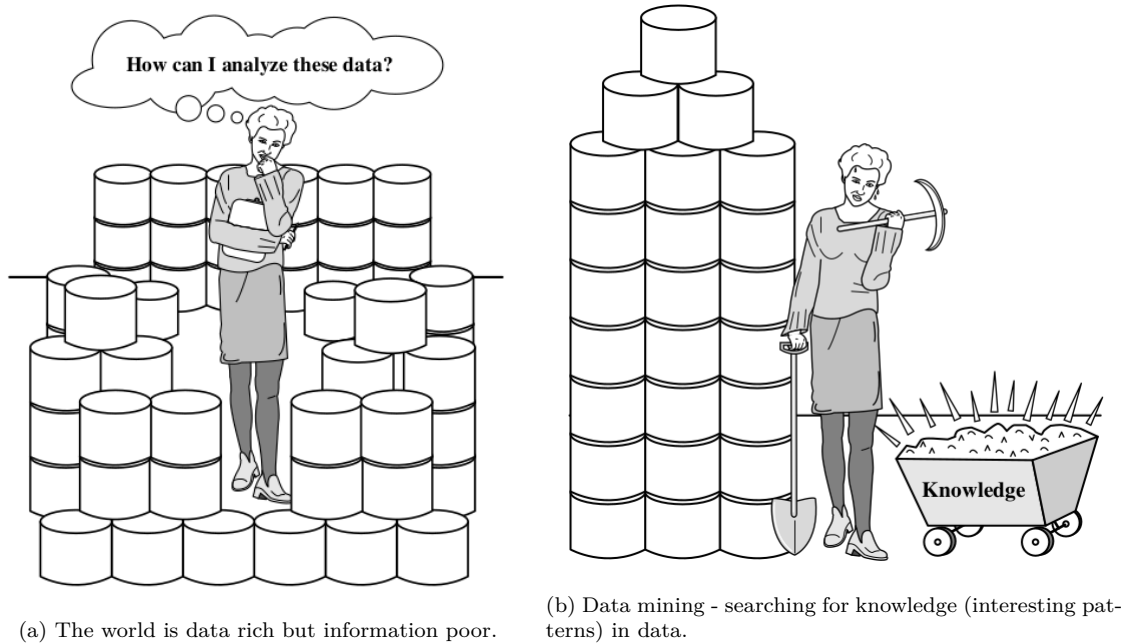


Figure 2.38: Rule of data mining. Source: Han et al. (2011)

6. **Pattern evaluation** (to identify the truly interesting patterns representing knowledge based on interestingness measures)
7. **Knowledge presentation** (where visualization and knowledge representation techniques are used to present mined knowledge to users)

### 2.3.3.5 Text Mining

Lokesh Kumar (2013) stated, text mining: extraction of useful and interesting information from this large amount of textual data. In other word by Hearst (2003), text mining is "the discovery by computer of new, previously unknown information, by automatically extracting information from different written resources. Written resources can be websites, books, emails, reviews, articles. Text mining, also referred to as text data mining, roughly equivalent to text analytics, is the process of deriving high-quality information from text. The process of text mining is shown in Fig 2.40

#### 2.3.3.5.1 Process of Text Mining

- **Text Pre-processing:** It involves the following series of steps.
  - **Text Cleanup:** means removing of any unnecessary or unwanted information such as remove ads from web pages, normalize text converted from binary formats, deal with tables, figures and formulas.
  - **Tokenization:** is simply achieved by splitting the text on white spaces and at punctuation marks that do not belong to abbreviations identified in the preceding step.

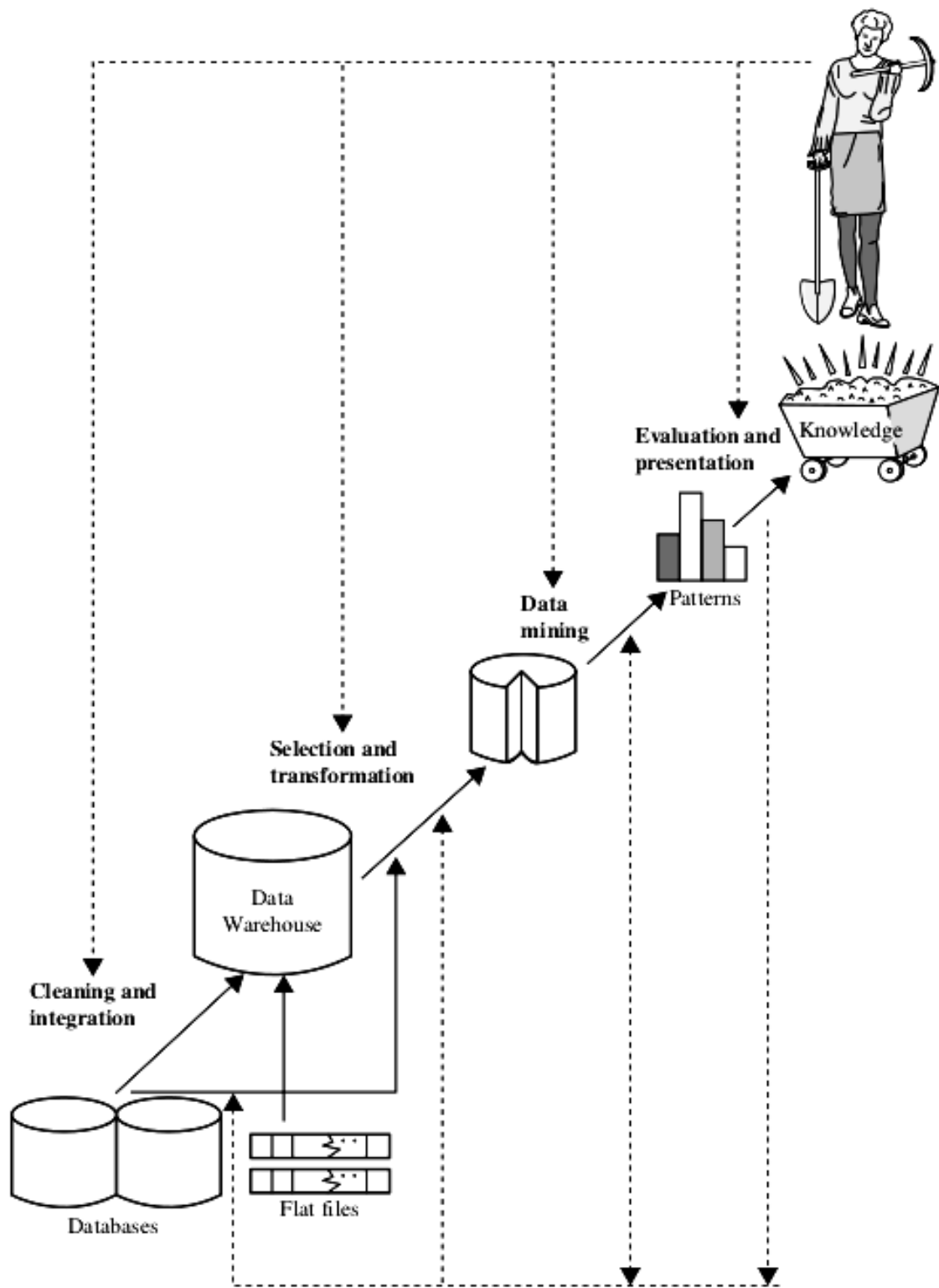


Figure 2.39: Data mining as a step in the process of knowledge discovery. Source: Han et al. (2011)

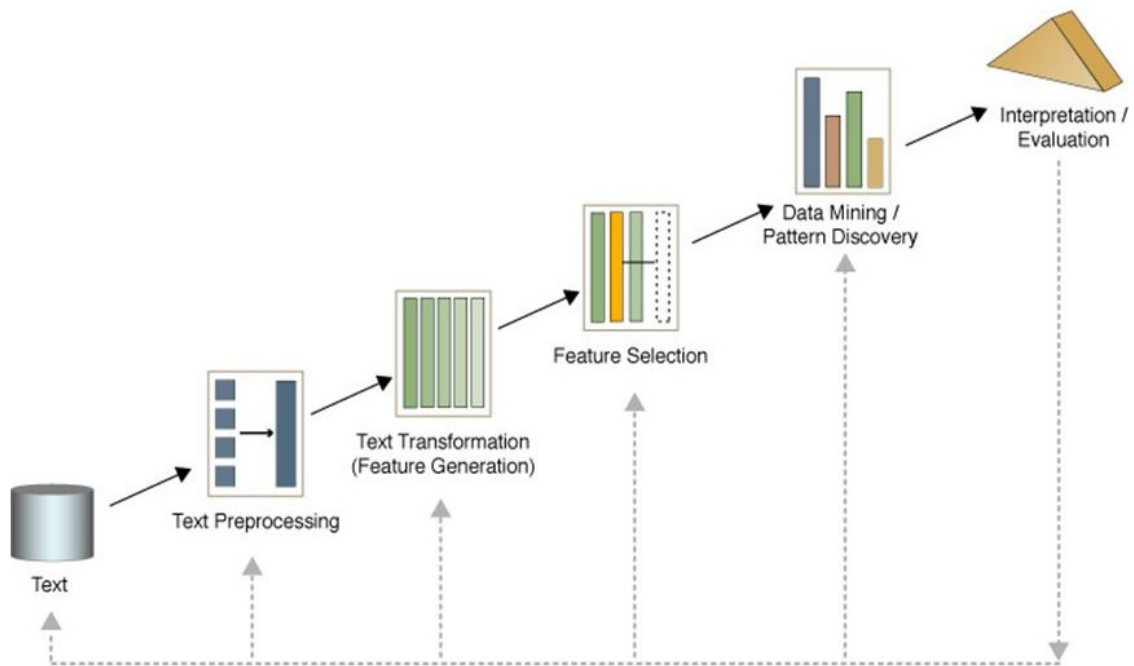


Figure 2.40: Activities / Process of Text Mining.

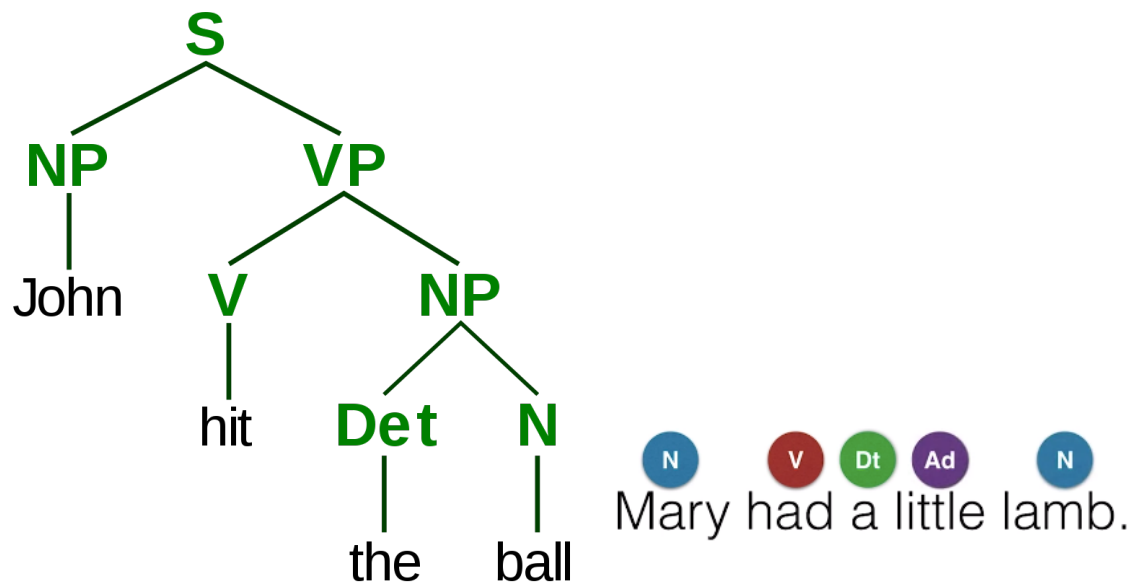


Figure 2.41: Part of Speech Tagging

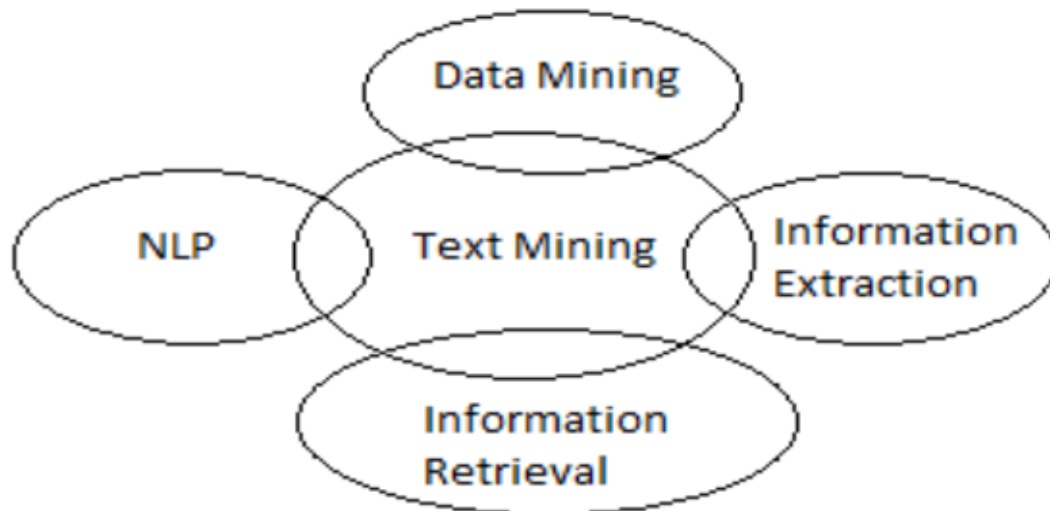


Figure 2.42: Text Mining Areas

- **Part of Speech Tagging:** means word class assignment to each token as shown in Fig 2.41.
- **Text Transformation (Feature Generation):** A text document is represented by the words (features) it contains and their occurrences. Two main approaches of document representation are (Bag of words, Vector Space)
- **Feature Selection:** is the process of selecting a subset of important features for use in model creation. The main assumption when using a feature selection technique is that the data contain many redundant or irrelevant features. Redundant features are the one which provides no extra information. Irrelevant features provide no useful or relevant information in any context. Feature selection technique is a subset of the more general field of feature extraction.
- **Data Mining:** At this point the Text mining process merges with the traditional Data Mining process.
- **Evaluate:** Evaluate the result, after evaluation the result can be discarded or the generated result can be used as an input for the next set of sequence such as (*translation, text-to-speech, visualization, searching, auto-completion, recommendation data pipeline or any other application that we want*)

#### 2.3.3.5.2 Areas of Text Mining

Lokesh Kumar (2013) stated that text analysis or text mining involves information retrieval, information extraction, data mining techniques including association and link analysis, visualization and predictive analytics. The goal is, essentially to turn text (unstructured data) into data (structured format) for analysis, via the use of natural language processing (NLP) methods.

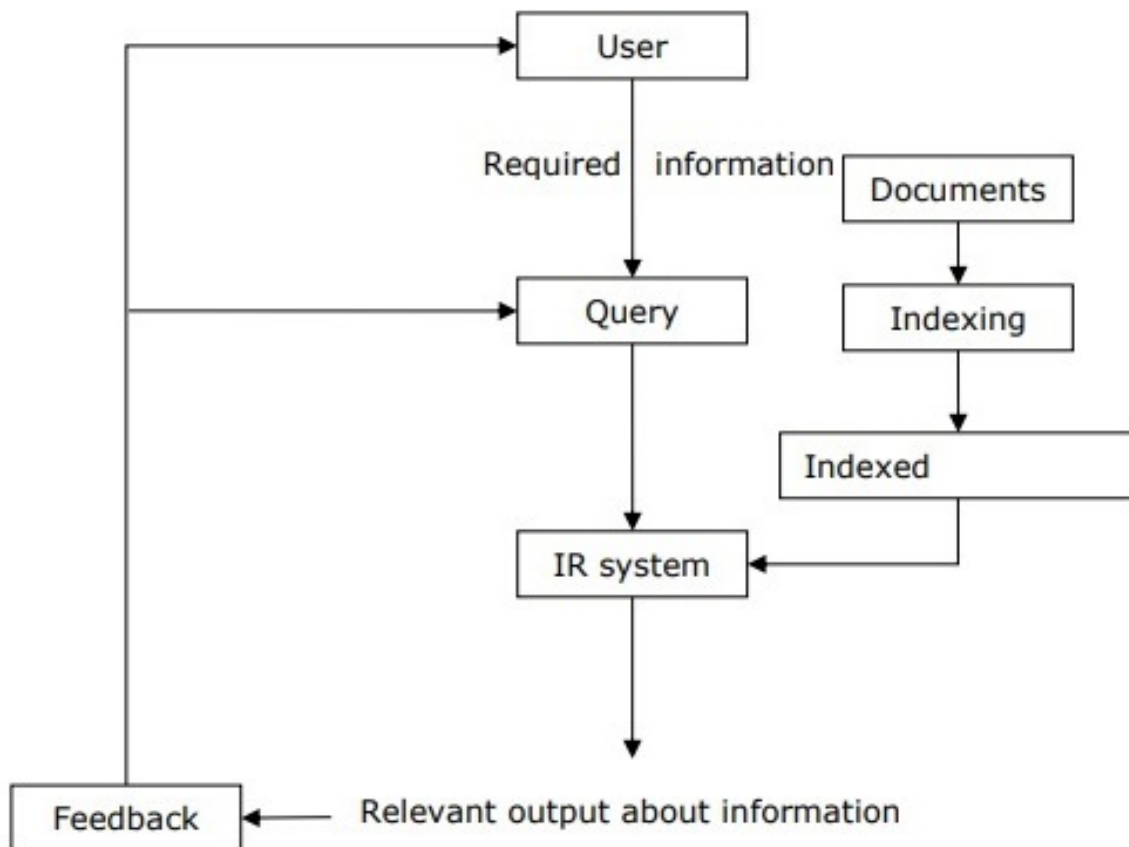


Figure 2.43: Process of Information Retrieval System. Source: Tutorials Point (2020c)

### 2.3.3.6 Information Retrieval (IR)

assists users in finding the information they require but it does not explicitly return the answers of the questions. IR system obtain information about resources that are relevant to an information collection resources, and use those information for searching. Searches can be based on full-text or other content-based indexing. Therefore, Information retrieval is the science of searching for information in a document, searching for documents themselves, and also searching for the metadata that describes data, and for databases of texts, images or sounds.

Automated information retrieval systems are used to reduce what has been called information overload. An IR system is a software system that provides access to books, journals and other documents; stores and manages those documents. Web search engines are the most visible IR applications. The process of a information retrieval system is shown in Fig 2.43

### 2.3.3.7 Natural Language Processing (NLP)

Lokesh Kumar (2013) demonstrated that Natural Language Processing (NLP) is the study of human language so that computers can understand natural languages as humans do. By

other definition, Natural Language Processing (NLP) is a subfield of linguistics, computer science, information engineering, and artificial intelligence concerned with the interactions between computers and human (natural) languages, in particular how to program computers to process and analyze large amounts of natural language data. NLP in text mining (is the process of deriving high quality information from the text) is as a method to carry out text mining job.

Challenges in Natural Language Processing more frequently involve speech recognition, natural language understanding, and natural language generation.

NLP research pursues to answer the following questions:

- How we understand the meaning of a sentence or a document?
- What are the indications we use to understand who did what to whom?
- What are the indications we use to understand when something happened?
- How we understand what is fact and what is supposition or prediction?
- etc

The building blocks of a meaning are the words (*nouns, verbs, adverbs and adjectives*), their correlation to each other within the structure of a sentence in a document, and within the context of what we already know about the world, that provides the true meaning of a text.

#### 2.3.3.7.1 Steps in NLP

As Tutorials Point (2020a) stated, there are general five steps:

1. **Lexical Analysis** — It involves identifying and analyzing the structure of words. Lexicon of a language means the collection of words and phrases in a language. Lexical analysis is dividing the whole chunk of text into paragraphs, sentences, and words.
2. **Syntactic Analysis** — Also called parsing, it involves analyzing words in sentences for grammar and rearranging them to determine how they relate to each other. It rejects sentences like “The apple eats the girl”.
3. **Semantic Analysis**
  - It draws the exact meaning or the dictionary meaning from the text. The text is checked for meaningfulness. It is done by mapping syntactic structures and objects in the task domain. The semantic analyzer disregards sentence such as “hot ice-cream”.
4. **Discourse Integration** — It analyzes the previous sentence to guess the meaning of the current sentence and the one after it.
5. **Pragmatic Analysis** — This reinterprets the statement to ensure it determines correctly what the statement means. It tries to retrieve aspects of the language that requires knowledge of the real world.

The NLP steps are shown in Fig 2.44

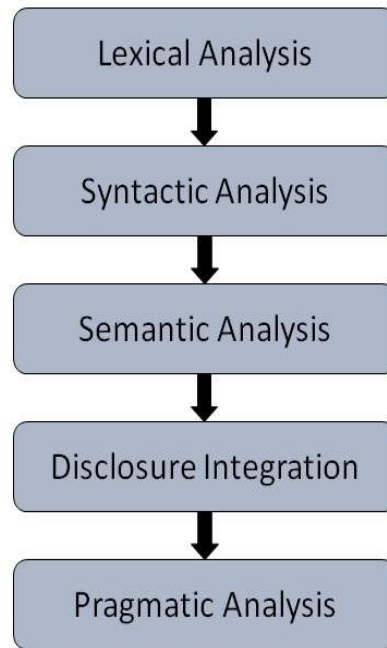


Figure 2.44: The Natural Language Processing General Steps. Source: Tutorials Point (2020a)

#### 2.3.3.7.2 Tasks and Applications of NLP?

These are sample of NLP tasks:

- Automatic Summarization
- Translation
- Named Entity Recognition
- Relationship Extraction
- Sentiment Analysis
- Speech Recognition
- Topic Segmentation
- etc

These are sample of NLP application area:

- Spell Checking
- Keyword Search
- Advertisement Matching
- Summarizing blocks of text
- Creating chatbots

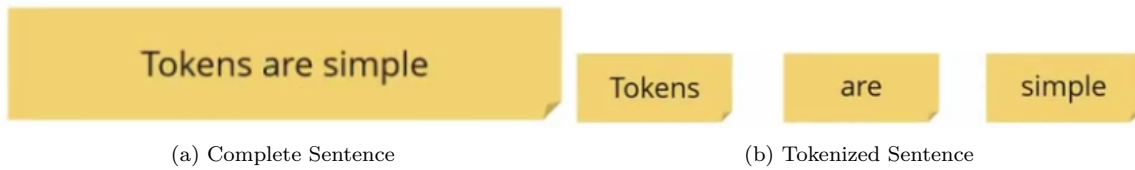


Figure 2.45: Tokenization

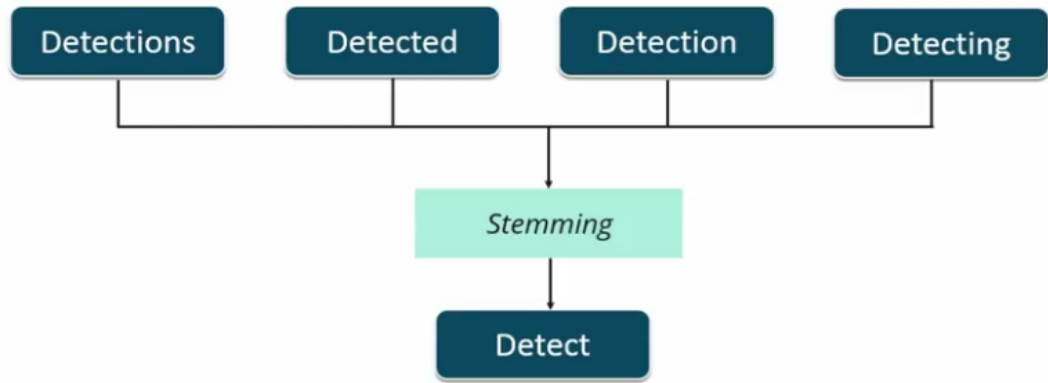


Figure 2.46: Stemming Example

- Machine translation
- Fighting spam
- Extracting information
- Automatically generating keyword tags
- Identifying types of entities extracted
- Identifying the sentiment of a string with sentiment analysis
- Reducing words to their roots
- Question-answering
- Customer service
- Market analysis

### 2.3.3.7.3 Important Terminologies of Text Mining and NLP

- **Tokenization:** The process of splitting the whole data(corpus: structured dataset) into smaller chunks as shown in Fig 2.45.
- **Stemming:** Normalize words into its base form or root from as shown in Fig 2.46.
- **Lemmatization:** Groups together different inflected forms of a word, called Lemma. Somehow similar to Stemming, as it maps several words into one common root. Output of Lemmatization is a proper word. For example, a lemmatiser should map *gone*, *going* and *went* into *go*.

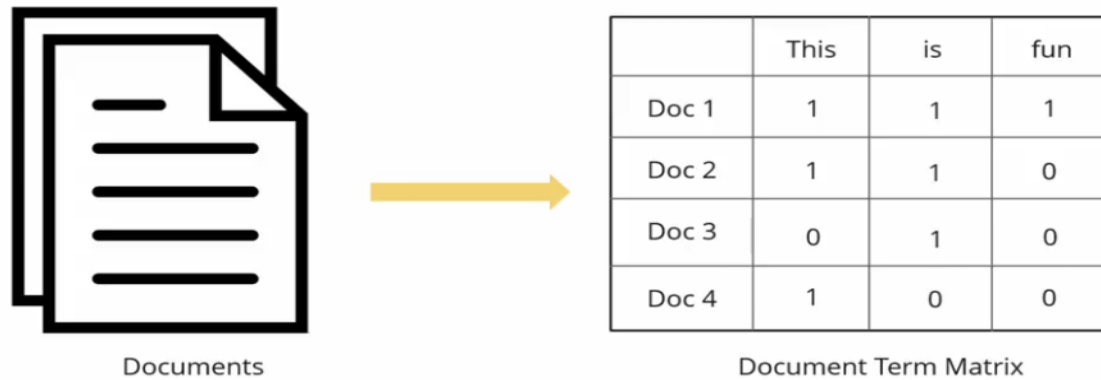


Figure 2.47: Document Term Matrix (DTM)

- **Stop Words:** are set common word in any language and by removing stop words our application in text mining can focus more in keywords or important words and retrieve more relevant information or documents. For example, *the, a, an, in, all, begin, and, before, really, however, who, if, sometimes, do*
- **Document Term Matrix (DTM):** is a matrix that show the frequency of words in documents as show in Fig 2.47.

### 2.3.3.8 Information Extraction (IE)

Lokesh Kumar (2013) demonstrated that, Information Extraction is the task of automatically extracting structured information from unstructured and/or semi- structured machine-readable documents. In more cases, this activity includes processing human language texts by means of natural language processing (NLP). Live example of IE is Google Search Engine. Applying information extraction to text is linked to the problem of text simplification in order to create a structured view of the information present in free text. Typical IE tasks and subtasks include:

- **Template filling:** Extracting a fixed set of fields from a document.
- **Knowledge Base Population:** Fill a database of facts by given a set of documents.
- **Relationship extraction:** as Nguyen and Verspoor (2019) work shows, identification of relations between entities, such as:
  - **PERSON works for ORGANIZATION** (extracted from the sentence "Mojeeb Rahman works for ITCC.")
  - **PERSON located in LOCATION** (extracted from the sentence "Mojeeb Rahman is in Kabul.")
- **Table information extraction:** as Milosevic et al. (2019, 2016) works show, extracting information in structured manner from the tables.
- **Terminology extraction:** (Language and vocabulary analysis) finding the relevant terms for a given corpus.

- **Audio extraction:** as Zils et al. (2002) work shows, finding relevant characteristic in an audio signal taken from a given repertoire.

### 2.3.3.9 Information Filtering (IF)

as Hanani et al. (2001) demonstrated that, Information filtering (IF) is one of the methods that is rapidly evolving to manage large amount of information flows. Its main goal is the management of the information overload and expose users to only information that is relevant to them. To do this the user's profile is compared to some reference characteristics. These characteristics may originate from the information item (the content-based approach) or the user's social environment (the collaborative filtering approach) or other ways. Recommender systems and content discovery platforms are active information filtering systems that attempt to present to the user information items such as (books, web pages, products, videos, news) that user is interested in. These systems add information items to the information flowing towards the user, as opposed to removing information items from the information flow towards the user. Some examples of filtering applications are:

- Filtering of search results on the internet search engines.
- Personal e-mail filtering based on personal profiles.
- Newsgroups filtering for groups or individuals.
- Browser filtering that block non-valuable information.
- Filtering application to give children access them only to suitable pages.
- Filtering applications for e-commerce that address products and promotions to potential customers only.
- and many more

### 2.3.3.10 Recommendation System

Ricci et al. (2011) stated that, Recommender Systems (RSs) are software tools and techniques providing suggestions for items to be use by a user.

Charu C (2016) said, A recommender system, or a recommendation system (sometimes replacing 'system' with a synonym such as platform or engine), is a subclass of information filtering system that seeks to predict the "rating" or "preference" a user would give to an item. They are primarily used in commercial applications.

Ricci et al. (2011); Charu C (2016); Gupta et al. (2013) demonstrated the utilization of recommendation systems in a variety of areas and most are commonly recognized as playlist generators for video and music services like Netflix, YouTube and Spotify, product recommenders for services such as Amazon, or content recommenders for social media platforms such as Facebook and Twitter. These systems can operate using a single input, like music, or multiple inputs within and across platforms like news, books, and search queries. There are also popular recommender systems for specific topics like restaurants. Recommender systems have also been developed to explore research articles and experts as stated by Chen et al. (2015), collaborators as defined by Chen et al. (2011) and financial services as mentioned by Felfernig et al. (2007).

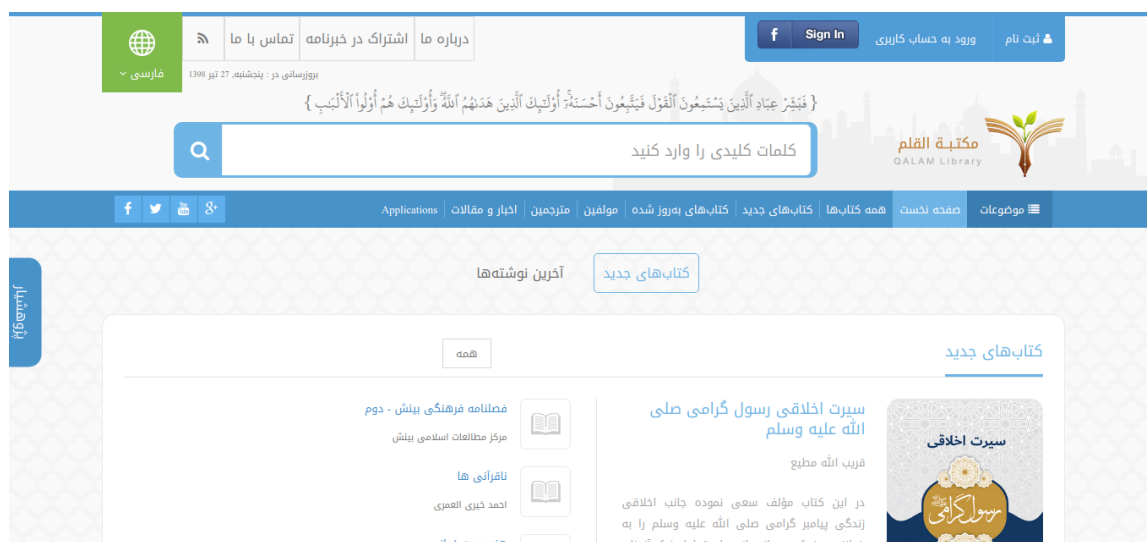


Figure 2.48: Aqeedeh.com - Qalam Library; an Islamic organization

We had studied real world implemented examples of recommendation systems in *Study of Recommendation Systems Real World Applications* section, and allocate a dedicated chapter for studying of *Recommendation Systems in Deep Level*.

## 2.4 Study of Available Islamic Systems for Dari or Persian Language

Analyze and review of related works in every research and development of a system has vital value. we can use strength points and improve weaknesses in our task. Therefore, in this research five Islamic technological organization analyzed and reviewed as shown in Table.2.13. Selected organizations are as followed:

- Aqeedeh.com as well known as Qalam Library is an Islamic organization <sup>74</sup>, that has big pool of Islamic books in PDF formats in different languages as shown in Fig. 2.48.
- Islamicity.org is an Islamic organization <sup>75</sup> in the world wide web in English language and different parts as shown in Fig. 2.49.
- Islamichouse.com is another organization <sup>76</sup> in the online world of data as shown in Fig. 2.50.
- Islamqa.info is an organization <sup>77</sup> that answers Islamic questions and store them to use in the future as shown in Fig. 2.51.
- Islamreligion.com is another organization <sup>78</sup> in the world with different contents as shown in Fig. 2.52.

<sup>74</sup><https://aqeedeh.com/>

<sup>75</sup><https://www.islamicity.org/>

<sup>76</sup><https://islamhouse.com/>

<sup>77</sup><https://islamqa.info>

<sup>78</sup><https://www.islamreligion.com/>



Figure 2.49: IslamiCity.org - an Islamic organization



Figure 2.50: Islamichouse.com - an Islamic organization



Figure 2.51: Islamqa.info - an Islamic organization

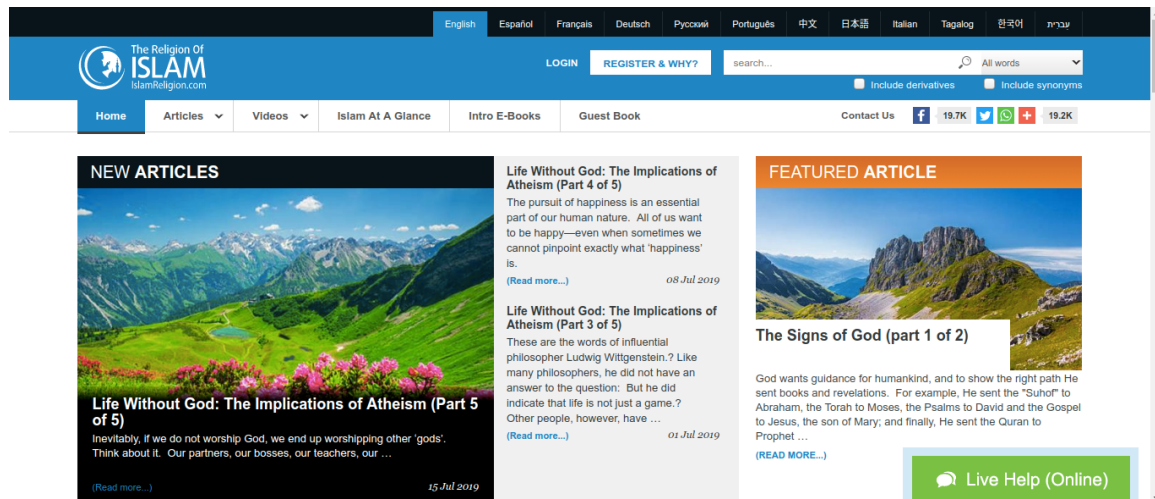


Figure 2.52: Islamreligion.com - an Islamic organization

Table 2.13: Study of Available Islamic Systems for Dari or Persian Language

No	System Name	Brief Description	Persian Language Support	Recommendation System Implemented
1	Aqeedeh.com	Aqeedeh.com as well known as Qalam Library is an Islamic organization , that has big pool of <b>Islamic books in PDF formats</b> in different languages. No Textual books exist for online reading. Only PDF of Books exist for download.	Yes	No Recommendation System (RS) Implemented.
2	Islamicity.org	Islamicity.org is an Islamic organization in the world wide web in English language in different parts. More of its contents are form other website feed and news feeds.	No	No Recommendation System (RS) Implemented.
3	Islamichouse.com	Islamichouse.com is another organization in the online world of data. This site store different <b>topics about Islam in about 114 world language.</b>	Yes	No Recommendation System (RS) Implemented.
4	Islamqa.info	Islamqa.info is an organization that <b>answers Islamic questions</b> and store them to use in the future. Has support of many languages of the world. Textual questions and answers are exist.	Yes	No Recommendation System (RS) Implemented. Important Topic are list. Most Read Topic also is there.
5	Islamreligion.com	Islamreligion.com is another organization in the world with different contents specially in <b>video formats and articles.</b>	No	Rating are Implemented. Most Read Topic also is there. Contents are in category vise.

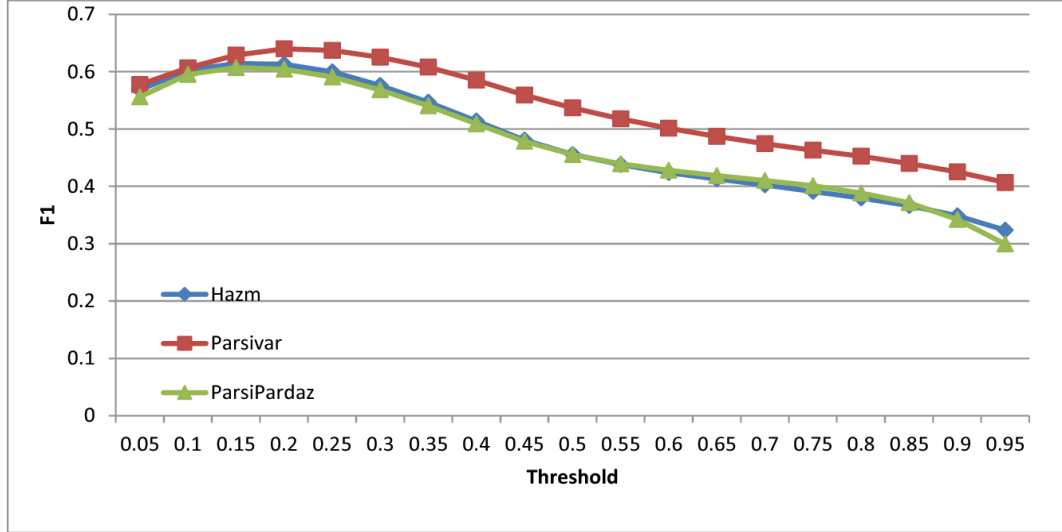


Figure 2.53: Parsivar - A language processing toolkit for Persian

## 2.5 Study of Natural Language Processing (NLP) in Dari or Persian Language

Natural Language Processing (NLP) is a prerequisite technique for developing of information systems that text is their main data. NLP processes and models are different through language per language and objective per objective, and for each language their should be a completely antithetic toolkit that follow their lexical or linguistic patterns and grammars structure. Dari and Persian language both are form same family and root, and we have some NLP toolkit or corpus that should by considered for farther tasks. Indeed, Comparison of common NLP toolkit for Persian language are shown in Table.2.14. The following are some instance of NLP toolkit for Persian language:

- **Persica corpus:** by Eghbalzadeh et al. (2012), a multipurpose text mining and Natural Language Processing toolkit that specialty use in News classification in Persian language.
- **Parsivar:** by Mohtaj et al. (2018) “A language processing toolkit for Persian”. Performance of this toolkit are shown in Fig. 2.53.
- **ParsiPardaz:** by Sarabi et al. (2013): “A language processing toolkit for Persian”.
- **Hazm:** by sobhe.ir (2014): “Python library for digesting Persian text”.

Table 2.14: NLP Toolkit for Persian Language

Name	Year	Source	Features
Persica corpus	2012	persica.csv is available for use	<ul style="list-style-type: none"> <li>• 1500000 categorized NEWS</li> <li>• Used for News (Content) Classification</li> </ul>
Parsivar	2018	Has Public github repository (ICTRC/Parsivar)	<p>According to the github documentation has:</p> <ul style="list-style-type: none"> <li>• Text Normalizing</li> <li>• Half space correction in Persian text</li> <li>• Word and sentence tokenizer (splitting words and sentences)</li> <li>• Word stemming</li> <li>• POS tagger</li> <li>• Shallow parser (Chunker)</li> <li>• NLTK compatible</li> <li>• Python 2.7 support</li> </ul>
ParsiPardaz	2013	<ul style="list-style-type: none"> <li>• Research Base (Has Publications)</li> <li>• Has no public github repository</li> </ul>	
Hazm	2014	Has Public github repository (sobhe/hazm), Hazm Used the (Persica corpus, ParsiPardaz) functionalities and techniques.	<p>According to the github documentation has:</p> <ul style="list-style-type: none"> <li>• Text cleaning</li> <li>• Sentence and word tokenizer</li> <li>• Word lemmatizer</li> <li>• POS tagger</li> <li>• Shallow parser</li> <li>• Dependency parser</li> <li>• Interfaces for Persian corpora</li> <li>• NLTK compatible</li> <li>• Python 2.7, 3.4, 3.5 and 3.6</li> </ul>

## 2.6 Study of Recommendation Systems Real World Applications

Here we list some real world recommendation system application form Charu C (2016) textbook.

## 2.6.1 Amazon.com Recommender System

Amazon.com is one of the pioneers in recommender systems, especially in the commercial setting. During the early years, it was one of the few retailers that had the chance to realize the usefulness of this technology. Originally founded as a book e-retailer, the business expanded to virtually all forms of products. Consequently, Amazon.com now sells virtually all categories of products such as *books, CDs, software, electronics, and so on*. The recommendations in Amazon.com are provided on the basis of explicitly provided ratings, buying behavior, and browsing behavior. The ratings in Amazon.com are specified on a 5-point scale, with lowest rating being 1-star, and the highest rating being 5-star. The customer-specific buying and browsing data can be easily collected when users are logged in with an account authentication mechanism supported by Amazon. Recommendations are also provided to users on the main Web page of the site, whenever they log into their accounts. In many cases, explanations for recommendations are provided. For example, the relationship of a recommended item to previously purchased items may be included in the recommender system interface. The purchase or browsing behavior of a user can be viewed as a type of implicit rating, as opposed to an explicit rating, which is specified by the user.

## 2.6.2 Netflix Movie Recommender System

Netflix was founded as a mail-order digital video disc (DVD) rental company of movies and television shows, which was eventually expanded to streaming delivery. At the present time, the primary business of Netflix is that of providing streaming delivery of movies and television shows on a subscription basis. Netflix provides users the ability to rate the movies and television shows on a 5-point scale. Furthermore, the user actions in terms of watching various items are also stored by Netflix. These ratings and actions are then used by Netflix to make recommendations. Netflix does an excellent job of providing explanations for the recommended items. It explicitly provides examples of recommendations based on specific items that were watched by the user. Such information provides the user with additional information to decide whether or not to watch a specific movie. Presenting meaningful explanations is important to provide the user with an understanding of why they might find a particular movie interesting. This approach also makes it more likely for the user to act on the recommendation and truly improves the user experience. This type of interesting approach can also help improve customer loyalty and retention.

### 2.6.2.1 Netflix Prize Contest

Netflix has contributed significantly to the research community as a result of the Netflix Prize contest. This contest was designed to provide a forum for competition among various collaborative filtering algorithms contributed by contestants. A data set of Netflix movie ratings was released, and the task was to predict ratings of particular user-item combinations. For this purpose, Netflix provided both a training data set, and a qualifying data set. The training data set contained **100,480,507** ratings that **480,189** users gave to **17,770** movies. The training set included a smaller probe set containing **1,408,395** ratings. The probe set was based on more recent ratings than the remaining training data, and it was statistically similar to the portion of the data set with hidden ratings. This portion of the data set was referred to as the qualifying data set, and it contained over **2,817,131** triplets of the form *User, Movie, GradeDate*. Note that the triplet did not contain the actual rating, which was known only to the judges. Users needed to predict the ratings in the qualifying

data set based on models of the training data. This prediction was scored by the judges (or an equivalent automated system), and the users were (continuously) informed of the prediction results on only half the qualifying data set on the leader-board. This half of the qualifying data set was referred to as the quiz set. The remaining half was used as the test set for computing the final score and determining the prize-winners. The scores of the remaining half were never revealed to the users until the very end. Furthermore, it was not revealed to the contestants which of the triplets in the qualifying set belonged to the quiz set, and which belonged to the test set. The reason for this unusual arrangement on the test set was to ensure that the users did not leverage the scores on the leader-board to overfit their algorithms to the test set. Issues related to overfitting on evaluation algorithms. Indeed, Netflix's framework for handling the contestant entries is an excellent example of proper evaluation design of recommendation algorithms. The probe set, quiz set, and test set were designed to have similar statistical characteristics. Prizes were given based on improvement of Netflix's own recommendation algorithm, known as Cinematch, or by improvement of the previous best score by a certain threshold. Many well-known recommendation algorithms, such as latent factor models, were popularized by the Netflix contest. The Netflix Prize contest is notable for its numerous contributions to recommendation research.

The Netflix Prize was an open competition for the best collaborative filtering algorithm to predict user ratings for films, based on previous ratings without any other information about the users or films, i.e. without the users or the films being identified except by numbers assigned for the contest.

According to the ([www.netflixprize.com](http://www.netflixprize.com)), the competition was held by Netflix, and was open to anyone who is neither connected with Netflix (current and former employees, agents, close relatives of Netflix employees, etc.) nor a resident of certain blocked countries (such as Cuba or North Korea). On *September 21, 2009*, the grand prize of **US\$1,000,000** was given to the *BellKor's Pragmatic Chaos team* which bested Netflix's own algorithm for predicting ratings by **10.06%** and **RMSE of 0.8567**.

### 2.6.3 Google News Personalization System

The Google News personalization system is able to recommend news to users based on their history of clicks. The clicks are associated with specific users based on identification mechanisms enabled by Gmail accounts. In this case, news articles are treated as items. The act of a user clicking on a news article can be viewed as a positive rating for that article. Such ratings can be viewed as unary ratings, in which a mechanism exists for a user to express their affinity for an item, but no mechanism exists for them to show their dislike. Furthermore, the ratings are implicit, because they are inferred from user actions rather than being explicitly specified by the user. Nevertheless, variations of the approach can also be applied to cases where ratings are explicitly specified. Collaborative recommendation algorithms are applied to the collected ratings, so that inferences can be made about the personalized articles for specific users.

### 2.6.4 Facebook Friend Recommendations

Social networking sites often recommend potential friends to users in order to increase the number of social connections at the site. Facebook is one such example of a social networking Web site. This kind of recommendation has slightly different goals than a product recommendation. While a product recommendation directly increases the profit of

Table 2.15: Examples of products recommended by various real-world recommender systems. Source: Charu C (2016)

System	Product Goal
Amazon.com	Books and other products
Netflix	DVDs, Streaming Video
Google News	News
Google Search	Websites, Advertisements
Facebook	Friends, Advertisements
Pandora	Music
YouTube	Online videos
Tripadvisor	Travel products
IMDb	Movies
Jester	Jokes
GroupLens	News
MovieLens	Movies
last.fm	Music

an organization by facilitating product sales, an increase in the number of social connections improves the experience of a user at a social network. This, in turn, encourages the growth of the social network. Social networks are heavily dependent on the growth of the network to increase their advertising revenues. Therefore, the recommendation of potential friends (or links) enables better growth and connectivity of the network. This problem is also referred to as link prediction in the field of social network analysis. Such forms of recommendations are based on structural relationships rather than ratings data. Therefore, the nature of the underlying algorithms is completely different.

Products that have recommended by various real-world recommender systems are show in Table.2.15.

## Chapter 3

# Methodology

The present research, is a scientific study and applied science research type. The main purpose is to find a technological way to store, view, search and recommend the Islamic textual information to people. Therefore, the prefer methods which I choose are the mix of documentary analysis, literature review and practically applying the findings, throughout the current (21<sup>th</sup>) century available information processing services and techniques.

The study is divided in several phases, each one with specific objective and method as fallow:

1. The study of current available layout, categorization, abstraction, and storage of Islamic information context by means of analyzing the mostly used Islamic books in each part. Indeed, result of this phase which is mostly present in literature section is essential step for knowing the current situation. In Islamic information part we will explore that what we have? What are the key and vital points? What are the important books in each part?
2. The study of available services, tools, and techniques of technology for processing the information. Indeed, the result of this phase is an essential step for selecting the right technological tools.
3. A deep study of available cutting-edge techniques, more specifically in recommendation systems part. Indeed, the result of this phase is an essential step for selecting the right technique in building the final recommendation system.
4. Practically developing section with consideration that, a recommendation system is depended on another information processing system. Therefore, we have a limitation, firstly, we need to have the required information system of essential components such as users, items for recommending and ratings. Indeed, with the result of this phase, we have the core building block of our recommendation system.

## Chapter 4

# Recommendation Systems in Deep Level

The main purpose of this chapter is to provide deep level knowledge for the readers in recommendation systems field which is organized as the following items:

- An introductory section about recommender systems
- Roles of recommendation system for business and users and why users may use recommendation systems
- What is the philosophy of recommendation systems?
- Application domain and terminologies of recommendation systems
- Architecture, implementation flow and data source of recommendation systems
- Models of recommendation systems and the advantages and disadvantages of each model, as well as, ways of creating hybrid recommender systems are mentioned.
- Technologies and techniques for recommendation systems, as well, training phases (steps) of recommendation systems and main similarity measures are described.
- Finally, we have evaluation of recommendation systems by describing the core parameters and their usages.

### 4.1 Recommender Systems (RSs) Description

Ricci et al. (2011) stated that, Recommender Systems (RSs) are software tools and techniques providing suggestions for items to be used by a user that may wish to utilize. The suggestions provided are aimed at supporting their users in various decision-making processes, such as what items to buy, what news or article to read, what video to watch, or to which journal a specified paper should publish. Recommender systems have proven to be valuable means for online users to cope or overcome with the information overload problem, and have become one of the most powerful and popular tools in electronic commerce (E-Commerce).

As Ricci et al. (2011); Charu C (2016) sources: (*Textbooks or Collection of Researches in Recommendation System Field*) demonstrated that, development of recommender systems

or recommendation systems is a multi-disciplinary effort which involves experts from various fields such as:

- **Artificial intelligence (AI)**
- **Human Computer Interaction (HCI)**
- **Information System (IS)**
- **Decision Support Systems**
- **Database**
- **Information Technology (IT)**
- **Data Mining (DM)**
- **Adaptive User Interfaces**
- **Statistics**
- **Marketing**
- **Consumer Behavior**

Additionally, for successfully development a recommendation system we need to know major concepts, theories, methodologies, trends, challenges and applications of recommendation systems.

## 4.2 Roles of Utilizing Recommendation Systems Technology

In this section, we define the roles a recommender system can play for a service provider and why a user may use the recommendation system.

### 4.2.1 Why E-Service Provider Introduce Recommendation Systems

- **Increase the number of items sold:** the most important function for a commercial RS is to be able to sell an additional set of items compared to those usually sold, Therefore, this goal is achieved because the recommended items are likely to suit the user's needs and wants.

Similarly, For non-commercial applications, even if there is no cost for the user that is associated with selecting an item. For instance, a content network aims at increasing the number of news items read on its site.

In general, we can say that from the service provider's point of view, the primary goal for introducing a RS is *to increase the conversion rate*, i.e., **the number of users that accept the recommendation and consume an item, compared to the number of simple visitors that just browse through the information.**

- **Sell more diverse items:** Another major function of a RS is to enable the user to select items that might be hard to find without a precise recommendation. RSs suggests or advertises not just the most popular items but unpopular items to the front of users.

- **Increase the user satisfaction:** An advisable RS can also improve the experience of the user with the application. The user will find the recommendations *interesting, relevant* and, with a right way designed human-computer interaction, she will also *enjoy* using the system. The combination of effective, i.e., **accurate, recommendations** and a **usable interface** will increase the user's subjective evaluation of the system. This will increase system usage and the probability that the recommendations will be accepted.
- **Increase user fidelity:** A user should be loyal to a Web site which, when visited, recognizes the old customer and treats him as a valuable visitor. This is a normal in RSs, since many RSs compute recommendations, investing the information acquired from the user in previous interactions, e.g., her ratings of items. Accordingly, the longer the user interacts with the site, the more refined her user model becomes, i.e., the system representation of the user's preferences, and the more the recommender output can be effectively customized to match the user's preferences.
- **Better understand what the user wants:** Another important function of a RS, we can use form generated data (*user's preferences: either collected explicitly or predicted by the system*) to many other applications. The service provider may then decide to re-use this knowledge for a number of other goals such as improving the management of the item's stock or production.

#### 4.2.2 Why Users May Use Recommendation Systems

As Herlocker et al. (2000) mentioned, the eleven popular tasks that a RS can assist users in implementing are as follow:

- **Find some good items:** Recommend to a user some items as a ranked list along with predictions of how much the user would like them (*e.g., on a one to five star scale*). Some RSs show the predicted rating to the user and other not.
- **Find all good items:** Recommend all the items that can satisfy some user needs. Importantly, when RS is mission-critical, such as in *medical or financial applications*. In these situations, in addition to the benefit derived from carefully examining all the possibilities, the user may also benefit from the RS ranking of these items or from additional explanations that the RS generates.
- **Annotation in context:** Given an existing context, e.g., a list of items, emphasize some of them depending on the user's long-term preferences.
- **Recommend a sequence:** Instead of focusing on the generation of a single recommendation, the idea is to recommend a sequence of items that is pleasing as a whole.
- **Recommend a bundle:** Suggest a group of items that fits well together and user can choose what to use.
- **Just browsing:** In this task, the user browses the catalog without any intention of purchasing an item. The task of the recommender is to help the user to browse the items that are more likely to fall within the scope of the user's interests for that specific browsing session.



Figure 4.1: Jam Experiment. Source: Schwartz (2004)

- **Find credible recommender:** Some users do not trust recommender systems thus they play with them to see how good they are in making recommendations.
- **Improve the profile:** This relates to the capability of the user to provide (input) information to the recommender system about what he likes and dislikes. This is a fundamental task that is strictly necessary to provide personalized recommendations. If the system has no specific knowledge about the active user then it can only provide him with the same recommendations that would be delivered to an “average” user.
- **Express self:** Some users may not care about the recommendations at all. Rather, what it is important to them is that they be allowed to contribute with their ratings and express their opinions and beliefs.
- **Help others:** Some users are happy to contribute with information, e.g., their evaluation of items (ratings), because they believe that the community benefits from their contribution. This could be a major motivation for entering information into a recommender system that is not used routinely.
- **Influence others:** In Web-based RSs, there are users whose main goal is to explicitly influence other users into purchasing particular products. As a matter of fact, there are also some malicious users that may use the system just to promote or penalize certain items.

As these various points indicate, the role of a RS within an information system can be quite diverse. Therefore, we need different knowledge sources and techniques.

### 4.3 Philosophy of Recommendation Systems

Pandey (2019) stated, *Too few choices are bad but too many choices can lead to paralysis*. This conclusion is drive form the research of psychologists Iyengar and Lepper (2000) from Columbia and Stanford University presented a study based on their field experiment: On a regular day, consumers shopping at an upscale marketplace store at a local food market were presented with a tasting booth which displayed 24 varieties of Jam. On some other day,

the same booth displayed only 6 varieties of Jam. The experiment was being conducted to adjudge which booth would earn more sales and it was assumed that more varieties of jam would fetch more people to the counter thereby getting more business. However, a strange phenomenon was observed. Whereas the counter with 24 jams generated more interest, their conversion to sales was pretty low (about 10 times lower) as compared to the 6 jams counter. Summarized view of this phenomenon is shown in Fig 4.1

So what just happened? Well, *it appears that a lot of choices does seem appealing but this **choice overload** may sometime prove to be confusing and hampering for the customers.* So even if the online stores **have access to millions of items**, without a good recommendation system in place, **these choices can do more harm than good.**

## 4.4 Application Domain of Recommendation Systems

In this part, Ricci et al. (2011) categorized the general classes of domains for the most common recommender systems applications:

- **Content** - personalized newspapers, recommendation for documents, recommendations of Web pages, e-learning applications, and e-mail filters.
- **Entertainment** - recommendations for movies, music, and IPTV (IP Television Provider).
- **E-commerce** - recommendations for consumers of products to buy such as books, cameras, PCs etc.
- **Services** - recommendations of travel services, recommendation of experts for consultation, recommendation of houses to rent, or matchmaking services.
- **Friends, Tweets or Followers** - recommendations in social media based on connection, and network.

## 4.5 Terminology of Recommendation System

As Google Developers (2020) describe, there are some important terms which are associated with Recommender systems.

- **Items/Documents:** The entities a system recommends. For example, apps in google play store, videos in Youtube, books or (goods) in Amazon.
- **Query/Context:** The information that a system uses to make recommendations. Queries can be a combination of the following:
  - **User Information** which may include **user id** or **items** with which the user has previously interacted.
  - **Some additional context** like the user's device, user's location etc.
- **Embeddings** are a way to represent a categorical feature as a continuous-valued feature. In other words, a mapping from a discrete set (in case of RSs, the set of queries, or the set of items to recommend) to a vector space called the embedding space.

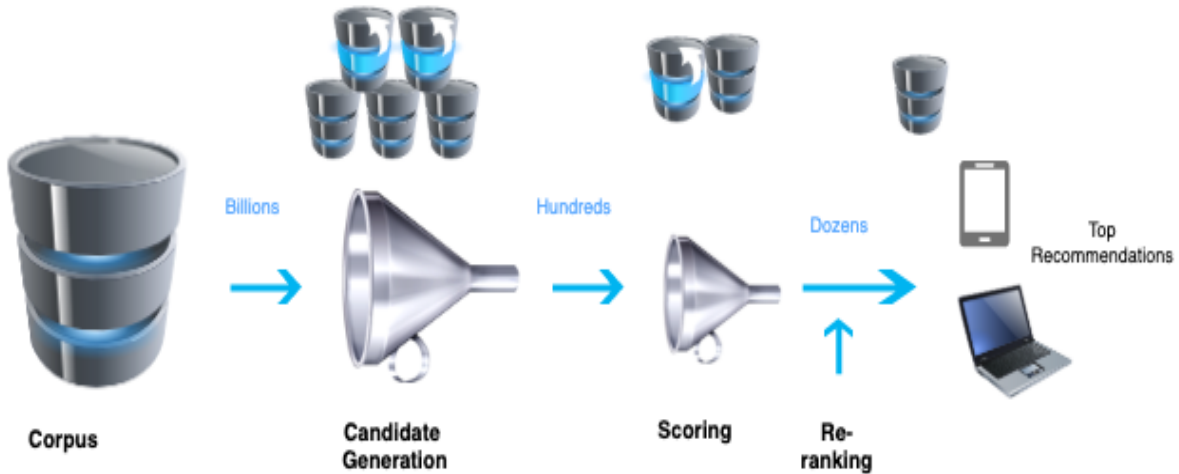


Figure 4.2: Three Essential Components of Recommendation Systems. Source:(medium.com)

## 4.6 Architecture of Recommendation System

As Google Developers (2020) mentioned, a common architecture of Recommender Systems comprises of the following three essential components:

1. **Candidate Generation:** This is the first stage of the Recommender Systems and takes events from the user's past activity as input and retrieves a small subset (hundreds) of items from a large corpus. The model needs to evaluate queries quickly given the large size of the corpus. A given model may provide multiple candidate generators, each nominating a different subset of candidates.
2. **Scoring:** This constitutes the second stage where another model scores and ranks the candidates in order to select the set of items usually on a scale of 10 to display to the user. Since this model evaluates a relatively small subset of items, the system can use a more precise model relying on additional queries.
3. **Re-ranking:** Finally, the system must take into account additional constraints for the final ranking. For example, the system removes items that the user explicitly disliked, filter and/or boosts the score of fresher content. Re-ranking can also help ensure diversity, freshness, and fairness.

The above three components are shown in the Fig.4.2.

## 4.7 Implementation Flowchart of Recommendation Systems

As mentioned by Severt (2020), the basic flowchart for implementing a recommendation system is show in Fig.4.3. In this flow iterative nature of recommendation system update, data, recommendation models are clear. Additionally, flowchart of implementing recommendation system is depend to the organization desire and challenges.

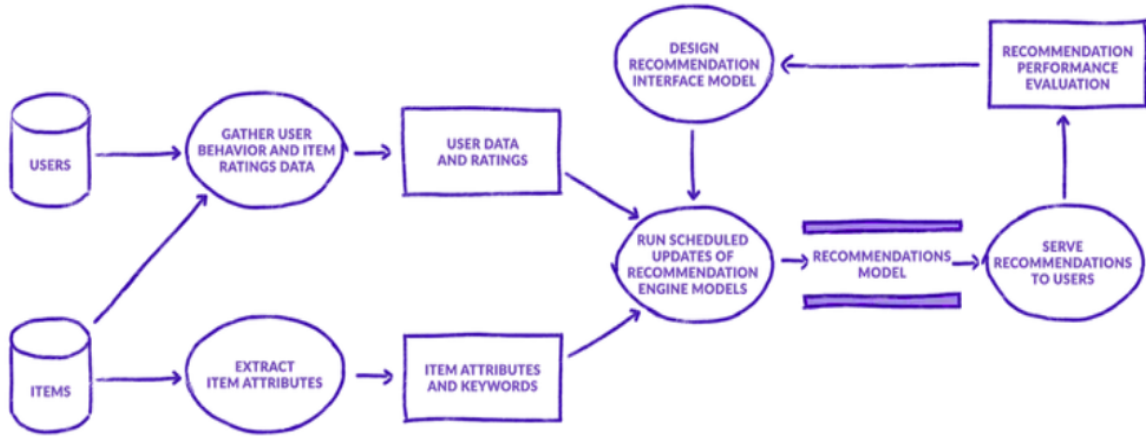


Figure 4.3: Example of Implementation Flowchart of Recommendation System. Source: Severt (2020)

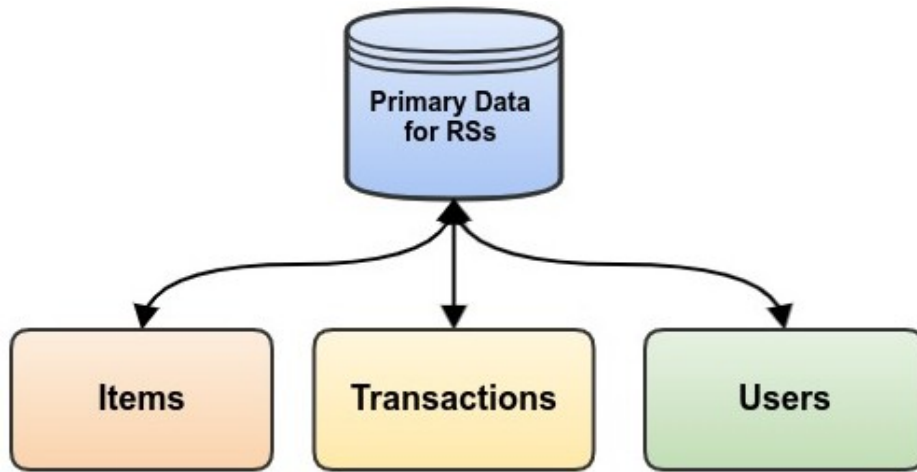


Figure 4.4: Primarily Data for Recommendation Systems

## 4.8 Data Sources in Recommendation Systems

Recommendation systems are information processing systems that actively gather various kinds of data in order to build their recommendations. The user can then browse the recommendations. she may accept them or not and may provide, immediately or at a next stage, an *implicit or explicit feedback*. All these user actions and feedbacks can be stored in the recommender database and may be used for generating new recommendations in the next user-system interaction. Data is primarily about the *items to suggest*, the *users* who will receive these recommendations and the *transactions* between the users and the items as shown in Fig 4.4.

- **Items:** Items are the objects that are recommended.
- **Users:** Users of a Recommendation Systems.

- **Transactions:** a transaction as a recorded interaction between a user and the Recommendation System.

#### 4.8.1 How do we provide data for Recommender Systems?

Data for a recommendation system can be provided in a variety of ways. The design of recommendation algorithms is commonly influenced by the method used for tracking ratings. The ratings are often specified on a scale that indicates the specific *level of like or dislike* of an *item by user(s)*. There we focus in two particularly important methods of providing data i.e explicit and implicit rating.

##### 4.8.1.1 Explicit Ratings

Those ratings that provided by *user* i.e they give their *opinion on the product or service*, are called explicit ratings. Actually, users often rate products or service. Therefore, it is hard to get explicit rating, because, it is extra work upon users. explicit rating is as follow:

- Star Ratings
- Likes
- Following
- Reviews
- Feedback
- etc

##### 4.8.1.2 Implicit Ratings

Ratings that provided by the user *on interaction with the item*, is called implicit ratings. They are *user's behavior* and is easy to get as users are subconsciously clicking and is user's natural behavior towards services.

- Clicks
- Views
- Purchases
- etc

##### 4.8.1.3 Other Ways to Category the Ratings

- **Numerical ratings or interval-based rating:** where a discrete set of ordered numbers are used to quantify like or dislike such as the *1-5 stars* provided in the book recommender associated with (Amazon.com). A 5-point rating scale might be drawn from the set  $-2, -1, 0, 1, 2$ , in which  $-2$  indicates an *extreme dislike*, and a rating of  $2$  indicates a strong affinity (Love) to the item. Other recommendation systems might draw the ratings set  $1, 2, 3, 4, 5$ . Fig.4.5 is an example of 1-5 stars rating.



Figure 4.5: Example of a 5-Star Rating

#### Overall Ratings

	Excellent	Very Good	Good	Fair	Poor	NA
1. The quality of the course content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. The instructor's overall teaching	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 4.6: Example Ordinal Rating

- **Ordinal ratings:** such as "*strongly agree, agree, neutral, disagree, strongly disagree*" where the user is asked to select the term that best indicates her opinion regarding an item (usually via questionnaire). Fig.4.6 is an example of 1-5 stars rating.
- **Binary ratings:** that model choices in which the user is simply asked to decide if a certain item is *good or bad*, or *like and dislike*.
- **Unary ratings:** can indicate that a user has observed or purchased an item, or otherwise rated the item positively. In such cases, the absence of a rating indicates that we have no information.

## 4.9 Models of Recommendation Systems

As Charu C (2016) demonstrated that, the common models of recommendation systems work with two kinds of data, first *the user-item interactions*, such as *ratings or buying behavior*, and second the *attribute information about the users and items* such as *textual profiles or relevant keywords*. Methods that use the first form of data, are referred to as *collaborative filtering* methods, whereas methods that use the second form, are referred to as *content-based recommender* methods. Note that content-based systems also use the **ratings matrices** in most cases, although the model is usually focused on the ratings of a single user rather than those of all users. In *knowledge-based* recommender systems, the recommendations are based on *explicitly specified user requirements*. Instead of using historical rating or buying data, external knowledge bases and constraints are used to create the recommendation. Some recommender systems combine these different aspects to create hybrid systems. *Hybrid systems* can combine the strengths of various types of recommender systems to create techniques that can perform more robustly in a wide variety of settings.

1			5		2
	5			4	
5	3		1		
		3			4
			3	5	
5		4			

Figure 4.7: Sparse Matrix

#### 4.9.1 Collaborative Filtering Models

Collaborative filtering models use the *collaborative power of the ratings* provided by *multiple users* to make recommendations. (*The logic behind collaborative filtering is, if a user agreed in the past with some users or items the other recommendations coming from these similar users or items should be relevant and of interest as well*). The main challenge in designing collaborative filtering methods is that the *ratings matrices are sparse*: (a matrix which contains very few specified elements). Sparse matrices is shown in Fig.4.7 and the Equation.4.1 is showing the sparsity in rating matrices:

$$Sparsity = \frac{Number\ of\ Rating}{Total\ Number\ of\ Items} \quad (4.1)$$

Consider an example of a e-commerce application in which users specify ratings indicating their like or dislike of specific item or goods. Most users would have (*viewed, buy or rate*) only a small fraction of the large universe of available goods. As a result, most of the ratings are unspecified. The *specified ratings* are also referred to as *observed ratings*. The *unspecified ratings* will be referred to as "*unobserved*" or "*missing*".

The basic idea of collaborative filtering methods is that these unspecified or missing ratings can be imputed because the specified ratings are often highly correlated across various users and items. For example, consider two users named Mojeeb Rahman and Samir Ahmad, who have very similar tastes. If the ratings, which both have specified, are very similar, then their similarity can be identified by the underlying algorithms. This similarity can be used to make reasoning about incompletely specified values. Most of the models for collaborative filtering focus on investing either *inter-item correlations* or *inter-user correlations* for the prediction process. Some models use *both types of correlations*. Moreover, some models use carefully designed *optimization techniques* to create a training model in much the same way a *classifier* creates a training model from the labeled data, and then this model is used to impute the missing values in the matrix, in the same way that a classifier imputes the missing test labels.

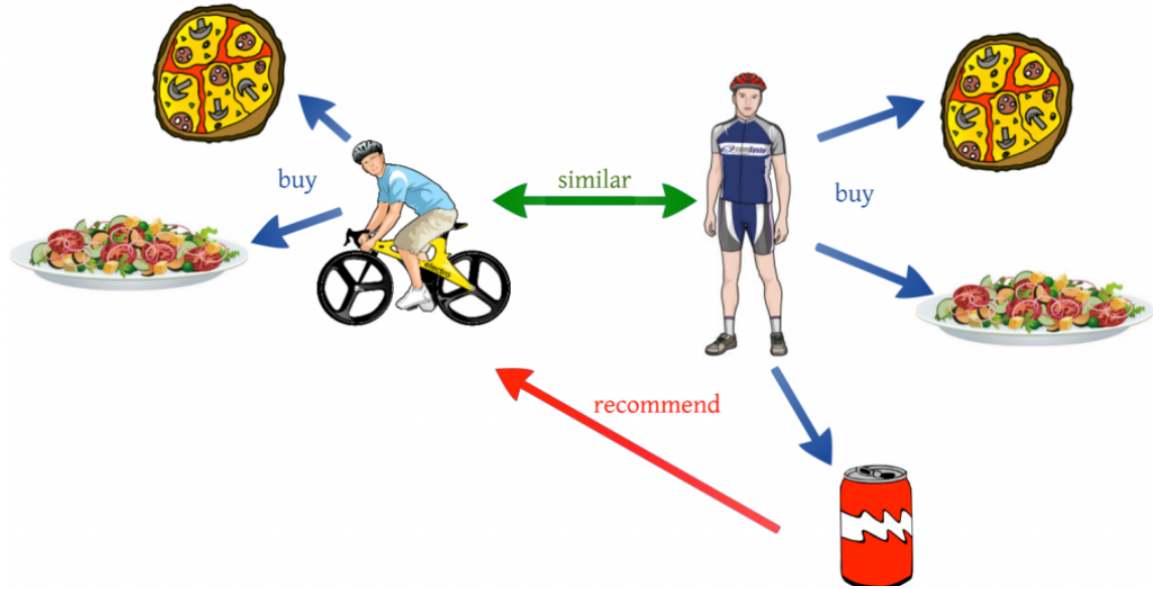


Figure 4.8: User-based Collaborative Filtering. Source: (medium.com)

There are two types of methods that are commonly used in collaborative filtering, which are referred to as memory-based or neighborhood-based methods and model-based methods:

1. **memory-based or neighborhood-based collaborative filtering algorithms:** were the earliest collaborative filtering algorithms, in which the ratings of user-item combinations are predicted on the basis of their neighborhoods. These neighborhoods can be defined in one of two ways:

- **User-based collaborative filtering:** In this case, the ratings provided by *like-minded users* of a *target user A* are used in order to make the recommendations for **A**. Therefore, the basic idea is to *determine users, who are similar to the target user A*, and recommend ratings for the unobserved ratings of **A** by computing weighted averages of the ratings of this peer group. Fig.4.8 are showing the user-based collaborative filtering.
- **Item-based collaborative filtering:**  
In this case, items recommended based on the item similarity. In order to make the rating predictions for *target item B by user A*, the first step is to determine a **set S of items** that are most similar to **target item B**. The ratings in item **set S**, which are specified by **A**, are used to predict whether the **user A will like item B**. Fig.4.9 are showing the Item-based collaborative filtering.

As Charu C (2016) demonstrated that, the advantages of memory-based techniques are that they are simple to implement and the resulting recommendations are often easy to explain. On the other hand, memory-based algorithms do not work very well with *sparse ratings matrices*.

An important difference between user-based collaborative filtering and item-based collaborative filtering algorithms is that the ratings in the **user-based** are predicted

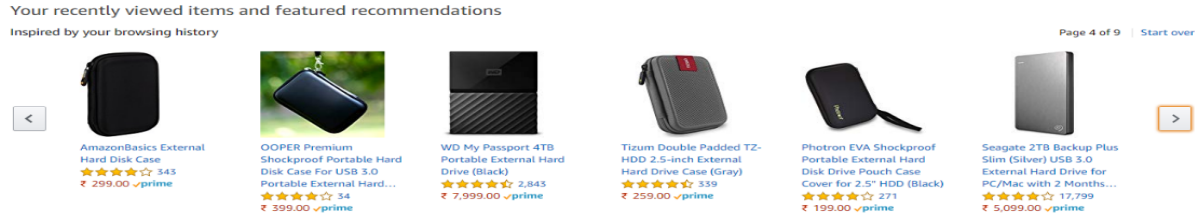


Figure 4.9: Item-based Collaborative Filtering. Source: (amazon.com)

using the ratings of **neighboring users**, whereas the ratings in the **item-based** are predicted using the user's own ratings on **neighboring closely related items**.

In the user-based case, neighborhoods are defined by similarities among users (rows of ratings matrix), whereas in the item-based case, neighborhoods are defined by similarities among items (columns of ratings matrix).

2. **Model-based methods:** In model-based methods, machine learning and data mining methods are used in the context of predictive models. Some examples of such model-based methods include decision trees, rule-based models, Bayesian methods, latent factor models and matrix factorization models. Many of these methods, such as latent factor models, have a high level of coverage even for sparse ratings matrices.

#### 4.9.1.1 Advantages

- **No requirement for product descriptions.** No metadata and attribute of items are required for generating recommendation.
- **It benefits from large user bases.** Simply put, the more people are using the service, the better your recommendations will become, without doing additional development work or relying on subject area expertise.
- **It's flexible across different domains.** Collaborative filtering approaches are well suited to highly diverse sets of items. Where content-based filters rely on metadata, collaborative filtering is based on real-life activity, allowing it to make connections between seemingly disparate items.
- **It produces more lucky recommendations.** When it comes to recommendations, accuracy is not always the highest priority. Content-based filtering approaches tend to show users items that are very similar to items they have already liked, which can lead to **filter bubble problems**. By contrast, most users have interests that span different subsets, which in theory can result in more diverse (and interesting) recommendations.
- **It can capture more refinement around items.** Even a highly detailed content-based filtering system will only capture some of the features of a given item. By relying on actual human experience, collaborative filtering can sometimes recommend items that have a greater affinity with one another than a strict comparison of their attributes would suggest.

#### 4.9.1.2 Disadvantages

- **Complexity and expense.** Collaborative filtering algorithms can run into scalability problems when the number of users and items gets too high (think in tens of millions of users and hundreds of thousands of items), especially when recommendations need to be generated in real-time online. Potential solution: This is where distributed clusters of machines running Hadoop or Spark come in handy. Depending on your project, it may also be possible to calculate relationships offline overnight by way of batch processing, which makes serving recommendations much quicker even if they are no longer being updated in real-time.
- **Data sparsity.** Many user signals are ambiguous. Just watching a video does not tell YouTube whether you liked that particular video or not, and just eating at a restaurant does not tell Yelp whether you liked it or not. That is why ratings are so important in collaborative-filtering systems. But users do not rate every item they interact with, and many users do not rate anything at all. Potential solution: Depending on the nature of the data, a common technique is to assume that missing reviews are equivalent to average reviews, though this is a very strong assumption in most cases.
- **The *cold start* problem.** As we have seen, collaborative-filtering can be a powerful way of recommending items based on user history, but what if there is no user history? This is called the "cold start" problem, and it can apply both to new items and to new users. Items with lots of history get recommended a lot, while those without never make it into the recommendation engine, resulting in a positive feedback loop. At the same time, new users have no history and thus the system does not have any good recommendations. Potential solution: Onboarding processes can learn basic info to jump-start user preferences, importing social network contacts.

#### 4.9.2 Content-Based Recommender Systems

In content-based recommender systems, the descriptive attributes of items are used to make recommendations. The term "content" refers to these descriptions. In content-based methods, the ratings and buying behavior of users are combined with the content information available in the items.

In content-based methods, the item descriptions, which are labeled with ratings, are used as training data to create a user-specific classification or regression modeling problem. For each user, the training documents correspond to the descriptions of the items she has bought or rated. The class (or dependent) variable corresponds to the specified ratings or buying behavior. These training documents are used to create a classification or regression model, which is specific to the user at hand (or active user).

This user-specific model is used to predict whether the corresponding individual will like an item for which her rating or buying behavior is unknown.

##### 4.9.2.1 Advantages

- **Works even when a product has no user reviews.**

#### 4.9.2.2 Disadvantages

- In many cases, **content-based methods provide obvious recommendations** because of the use of keywords or content. For example, if a user has never consumed an item with a particular set of keywords, such an item has no chance of being recommended. This is because the constructed model is specific to the user at hand, and the community knowledge from similar users is not leveraged. This phenomenon tends to reduce the diversity of the recommended items, which is undesirable.
- **Require Descriptive data of all content to recommend** which is time consuming.
- **Difficult to implement on large product databases** as user's have different opinions on each item.
- Even though content-based methods are effective at providing recommendations for new items, **they are not effective at providing recommendations for new users**. This is because the training model for the target user needs to use the history of her ratings. In fact, it is usually important to have a large number of ratings available for the target user in order to make robust predictions without overfitting.

#### 4.9.3 Knowledge-Based Recommender Systems

In Knowledge-Based users can specify relevant keywords in their own profiles. These profiles can be matched with item descriptions in order to make recommendations. In other word, the recommendations are based on explicitly specified user requirements such as external knowledge bases and constraints. Additionally, knowledge-based recommender systems uses knowledge about users and items to reason about what items meet the users' requirements, and generate recommendations accordingly. Such an approach does not use ratings in the recommendation process, and it is therefore useful in cold-start scenarios. However, such methods are often viewed as a distinct class of recommender systems, known as knowledge-based systems, because the similarity metrics are often based on domain knowledge. Knowledge-based recommender systems are often considered to be closely related to content-based recommender systems.

Knowledge-based recommender systems are particularly useful in the context of items that are not purchased very often. Examples include items such as real estate, automobiles, tourism requests, financial services, or expensive luxury goods. In such cases, sufficient ratings may not be available for the recommendation process. As the items are bought rarely, and with different types of detailed options, it is difficult to obtain a sufficient number of ratings for a specific item at hand.

The difference between Collaborative-Filtering, Content-Based and Knowledge-Based recommendation Systems is illustrated in Table.4.1.

#### 4.9.4 Demographic Recommendation Systems

As Çano and Morisio (2017) mentioned, demographic recommendation systems uses demographic data such as *age, gender, education, etc.* for identifying categories of users. It does not suffer from the new user problem as is does not use ratings to provide recommendations. Still, it is difficult today to collect enough demographic information that is needed because

Table 4.1: Difference Between Collaborative-Filtering, Content-Based and Knowledge-Based recommendation Systems. Source: Charu C (2016)

Approach	Conceptual Goal	Input
Collaborative	Give me recommendations based on a collaborative approach that leverages the ratings and actions of my peers/myself.	User ratings + community ratings
Content- based	Give me recommendations based on the content (attributes) I have favored in my past ratings and actions.	User ratings + item attributes
Knowledge- based	Give me recommendations based on my explicit specification of the kind of content (attributes) I want.	User specification + item attributes + domain knowledge

of online privacy concerns. By accounting this concern, utilization of demographic recommendation systems are limited. Although, it is still combined with other recommenders as a reinforcing technique for better quality.

#### 4.9.5 Hybrid Recommendation Systems

Different recommendation systems use different types of input, and have different strengths and weaknesses. Some recommender systems, such as knowledge-based systems, are more effective in cold-start settings where a significant amount of data is not available. Other recommender systems, such as collaborative methods, are more effective when a lot of data is available.

**Hybridization:** "the various aspects from different types of systems are combined to achieve the best of all worlds", is a good idea. Hybrid recommender systems are closely related to the field of ensemble analysis, in which the power of multiple types of machine learning algorithms is combined to create a more robust model.

**Ensemble-based recommender systems** are able to combine not only the power of multiple data sources, but they are also able to improve the effectiveness of a particular class of recommender systems (e.g., collaborative systems) by combining multiple models and algorithm of the same type.

##### 4.9.5.1 Ways of Creating Hybrid Recommender Systems

According to, Charu C (2016), there are three primary ways of creating hybrid recommender systems:

1. **Ensemble design:** In this design, results from off-the-shelf algorithms are combined into a single and more robust output.
2. **Monolithic design:** In this case, an integrated recommendation algorithm is created by using various data types. This approach tends to integrate the various data sources more tightly, and one cannot easily view individual components as off-the-shelf black-boxes.
3. **Mixed systems:** Like ensembles, these systems use multiple recommendation algorithms as black-boxes, but the items recommended by the various systems are pre-

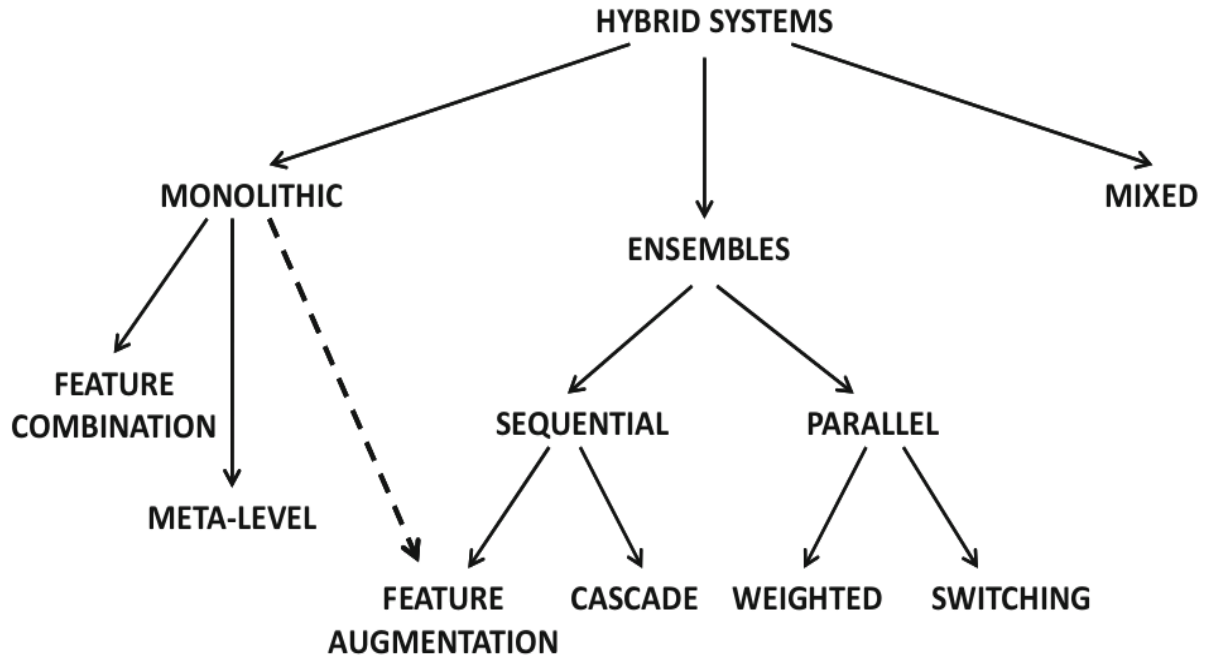


Figure 4.10: The taxonomy of hybrid systems. Source: Charu C (2016)

sented together side by side.

According to, Charu C (2016); Burke (2002) the categorization of hybrid recommender systems is shown in Fig.4.10. and can be classified into the following classes:

1. **Weighted:** In this case, the scores of several recommender systems are combined into a single unified score by computing the weighted aggregates of the scores from individual ensemble components. The methodology for weighting the components may be heuristic, or it might use formal statistical models.
2. **Switching:** The algorithm switches between various recommender systems depending on current needs. For example, in earlier phases, one might use a knowledge-based recommender system to avoid cold-start issues. In later phases, when more ratings are available, one might use a content-based or collaborative recommender. Alternatively, the system might adaptively select the specific recommender that provides the most accurate recommendation at a given point in time.
3. **Cascade:** In this case, one recommender system refines the recommendations given by another. In generalized forms of cascades, such as boosting, the training process of one recommender system is biased by the output of the previous one, and the overall results are combined into a single output.
4. **Feature augmentation:** The output of one recommender system is used to create input features for the next. Feature augmentation hybrids are order-sensitive as the second technique is based on the output of the first.
5. **Feature combination:** In this case, the features from different data sources are

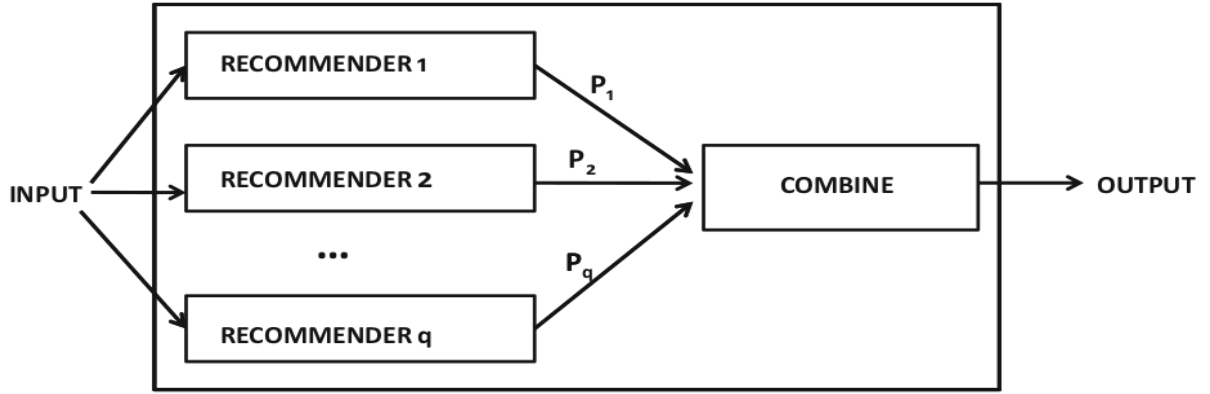


Figure 4.11: Parallel Design. Source: Charu C (2016)

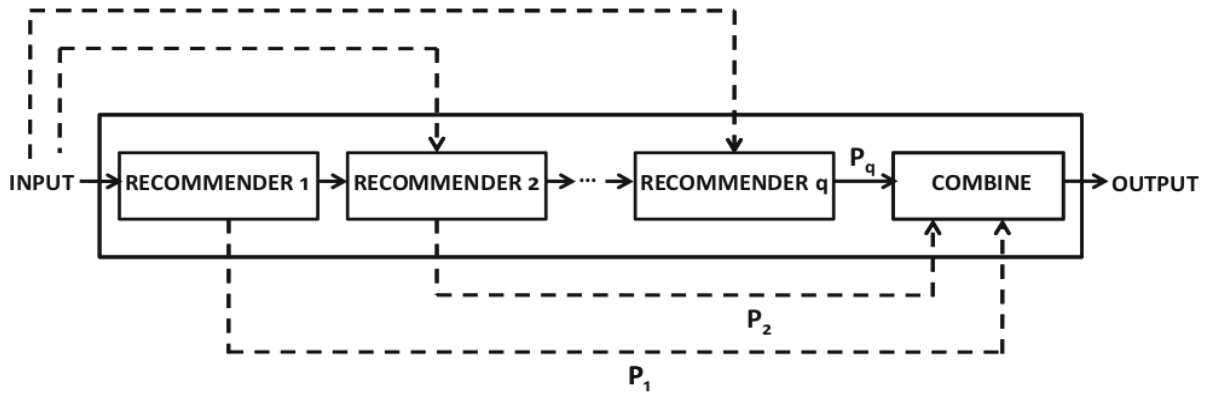


Figure 4.12: Sequential Design. Source: Charu C (2016)

combined and used in the context of a single recommender system. This approach can be viewed as a monolithic system, and therefore it is not an ensemble method.

6. **Meta-level:** Meta levels are also an example of order-sensitive hybrid recommendation systems that use an entire model produced by the first technique as input for the second technique. It is typical to use content-based recommenders to build item representation models, and then employ this models in collaborative recommenders to match the items with user profiles.
7. **Mixed:** Recommendations from several engines are presented to the user at the same time. Strictly speaking, this approach is not an ensemble system, because it does not explicitly combine the scores (of a particular item) from the various components. Furthermore, this approach is often used when the recommendation is a composite entity in which multiple items can be recommended as a related set.

The ensemble categories have the two formation, first *parallel design* as shown in Fig.4.11 , and second, *sequential design* as shown in Fig.4.12.

Table 4.2: Distribution of Studies by DM/ML Techniques for Recommendation Systems. Source: Çano and Morisio (2017)

DM/ML technique	Studies
K-NN	59
Clustering	34
Association rules	17
Fuzzy logic	14
Matrix manipulation	9
Other	19

## 4.10 Technologies and Techniques for Recommendation Systems

### 4.10.1 Data Mining and Machine Learning Techniques

According to Çano and Morisio (2017) systematic survey (76 published papers in conference proceedings and journals from 2005 to 2015), in this section we address the basic Data Mining (DM) and Machine Learning (ML) techniques which most companies and researchers use to build their hybrid recommendation systems. Result of mentioned survey is illustrated in Table.4.2.

#### 4.10.1.1 K-NN

K-Nearest Neighbors is a well known classification algorithm with several versions and implementations, widely utilized in many data mining and other applications. This technique is popular among collaborative filtering RSs which represent the most common family of recommenders. It is mostly utilized to analyze neighborhood and find users of similar profiles or analyze items' catalog and find items with similar characteristics. Some description of K-NN algorithm is as follow:

- K-Nearest Neighbour is one of the simplest Machine Learning algorithms based on Supervised Learning technique.
- K-NN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that is most similar to the available categories.
- K-NN algorithm can be used for Regression as well as for Classification but mostly it is used for the Classification problems.
- It is also called a lazy learner algorithm because it does not learn from the training set immediately instead it stores the dataset and at the time of classification, it performs an action on the dataset.
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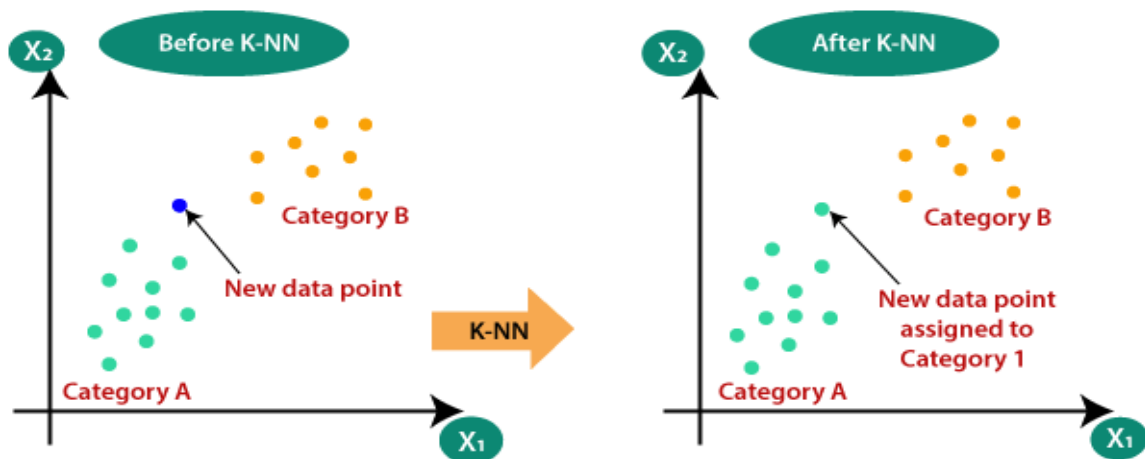


Figure 4.13: K-Nearest Neighbour. Source: javatpoint.com (2020a)

#### 4.10.1.1.1 How does K-NN work?

An Example of K-NN is shown in Fig.4.13, and the algorithm is as follow:

1. Select the **number K** of the neighbors
2. Calculate the **Euclidean distance of K number** of neighbors
3. Take the **K nearest neighbors** as per the calculated Euclidean distance.
4. Among these k neighbors, **count the number** of the data points in each category.
5. Assign the new data points to that category for which the number of the neighbor is **maximum**.
6. Our model is ready.

#### 4.10.1.1.2 Advantages of KNN Algorithm

- It is simple to implement.
- It is robust to the noisy training data.
- It can be more effective if the training data is large.

#### 4.10.1.1.3 Disadvantages of KNN Algorithm

- Always needs to determine the value of K which may be complex some time.
- The computation cost is high because of calculating the distance between the data points for all the training samples.

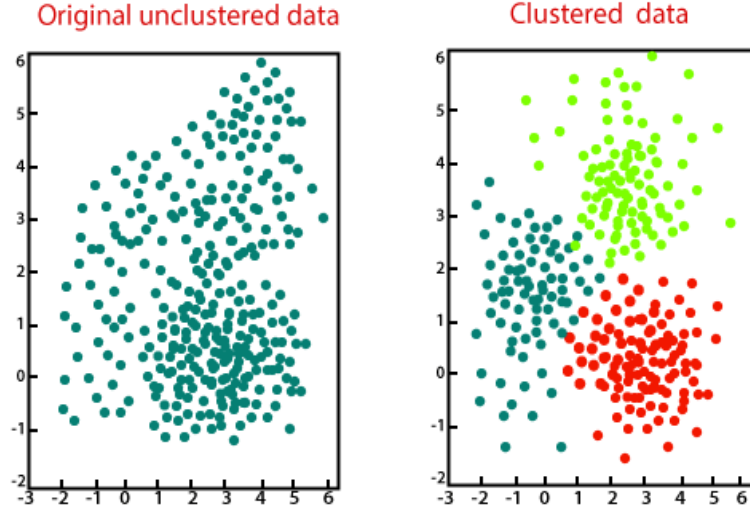


Figure 4.14: Clustering. Source: javatpoint.com (2020b)

#### 4.10.1.2 Clustering

Clustering is an unsupervised Machine Learning-based Algorithm that comprises a group of data points into clusters so that the objects belong to the same group. Clustering helps to splits data into several subsets. Each of these subsets contains data similar to each other, and these subsets are called clusters. There are various clustering algorithms used in RSs and other data mining applications. They typically try to put up a set of categories with which data can be identified. The most popular is K-means which partitions the entire data into K clusters. In RSs clustering is mostly applied to preprocess the data. Fig. 4.14 showing as example of clustering.

#### 4.10.1.3 Association Rules

Association rule mining tries to discover valuable relations (association rules) in large databases of data. These associations are in the form  $X \Rightarrow Y$ , where **X and Y** are sets of items. The association that are above a minimum level of support with an acceptable level of confidence can be used to derive certain conclusions. In recommender systems this conclusions are of the form "X likes Y" where X is a user to whom the system can recommend item Y.

In other word, as mentioned by saedsayad.com (2020), association rules find all sets of items (itemsets) that have *support* greater than the minimum support and then using the large itemsets to generate the desired rules that have *confidence* greater than the minimum confidence. The *lift* of a rule is the ratio of the observed support to that expected if X and Y were independent. An example of association rules is shown in Fig.4.15 , equations of support, confidence and lift is shown in below:

$$Support = \frac{(Item\ A + Item\ B)}{(Entire\ dataset)} \quad (4.2)$$

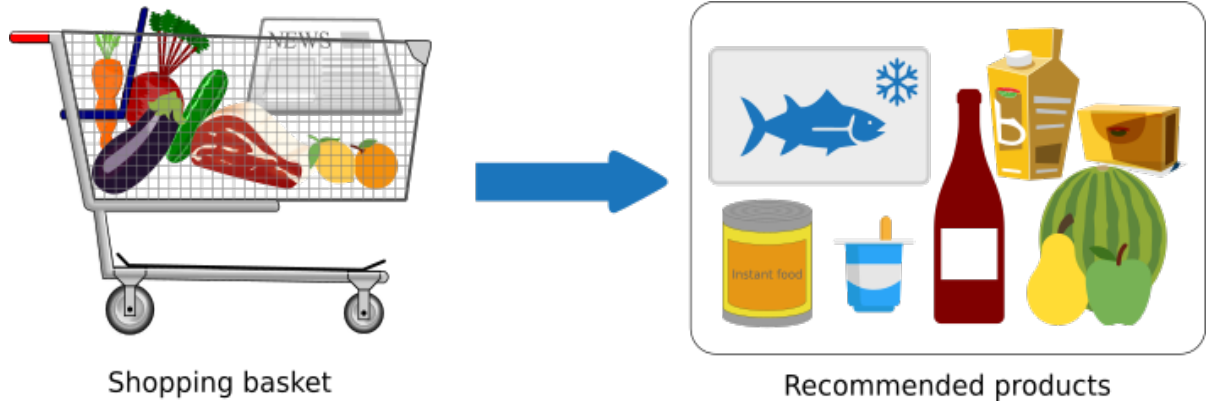


Figure 4.15: Association Rules. Source: neuraldesigner.com (2020)

$$Confidence = \frac{(Item A + Item B)}{(Item A)} \quad (4.3)$$

$$Lift = \frac{Support}{Support(Item B) * Support(Item A)} \quad (4.4)$$

- **Support:** This measurement technique measures how often multiple items are related (e.g., purchased) and compared it to the overall dataset.
- **Confidence:** This measurement technique measures how often **item B** is (e.g., purchased) when **item A** is purchased as well.
- **Lift:** This measurement technique measures the accuracy of the confidence over how often **item B** is (e.g., purchased).

#### 4.10.1.4 Fuzzy logic

Also called fuzzy set theory it is a set of mathematical methods that can be used to build hybrid RSs. Those methods are also called reclusive in the literature. Reclusive methods are complementary to collaborative methods and are often combined with them to form hybrid RSs.

As Novák et al. (1999) describe, fuzzy logic is a form of many-valued logic in which the truth values of variables may be any real number between 0 and 1 both inclusive. It is employed to handle the concept of partial truth, where the truth value may range between completely true and completely false. By contrast, in Boolean logic, the truth values of variables may only be the integer values 0 or 1. Example of fuzzy logic is shown in Fig.4.16.

#### 4.10.1.5 Matrix manipulation

In mathematics, matrix multiplication is a binary operation that produces a matrix from two matrices. Here we put together the different methods and algorithms that are based on matrix operations. The methods we identified are *Singular Value Decomposition (SVD)*,

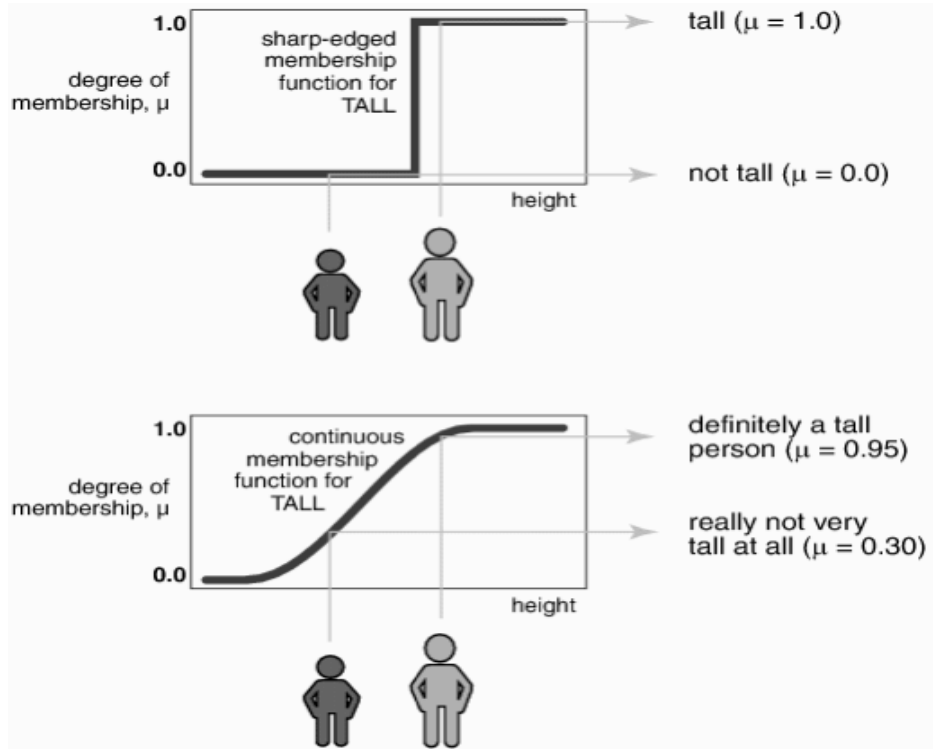


Figure 4.16: Fuzzy logic. Source: dosesafety.com (2020)

*Singular Value Decomposition (SVD++)*, *Latent Dirichlet Allocation (LDA)*, *Principal Component Analysis (PCA)*, *Dimensionality Reduction* and similar matrix factorization techniques. Matrix manipulation methods are often used to build low error collaborative RSs and were especially promoted after the Netflix challenge was launched in 2006. An example of matrix multiplication (Matrix Factorization) is shown in Fig.4.17.

#### 4.10.1.6 Deep Neural Networks

Deep Neural Networks is the subclass of Machine Learning and AI which nowadays use in almost every part of machine learning problems such as (Classification, Regression, Computer Vision, NLP and etc).

**Deep Learning Based Recommendation Systems** are STATE-OF-THE-ART technique in the field of recommendation system. Because of, nonlinear transformation, representation learning, sequence modeling and flexibility features of Deep Learning as mention in the *Survey and New Perspectives*(2019) by Shuai Zhang. General information about AI, Deep Learning and Deep Neural Networks are presented in section.2.3.3.1 of literature review chapter, as well as, Deep learning techniques that are used in Recommendation Systems part are presented in our result chapter in section.5.4.0.1.

#### 4.10.1.7 Other

Other less frequent techniques such as Genetic Algorithms, Naive Bayes, Notion of Experts, Statistical Modeling, etc. as well use for creating recommendation systems.



Figure 4.17: Matrix Factorization. Source: Google Developers (2020)

## 4.11 Training Phases (Steps) of Recommendation Systems Model

All typical model training of machine learning consists of the following five phases as shown in Fig.4.18:

- **Pre-Processing:** e.g (Utility matrix conversion, Normalization of Ratings)
- **Model Training:** e.g (Matrix Factorisation , Neighborhood methods)
- **Hyper-parameter Optimization**
- **Post Processing:** (sorting all of the predicted ratings and get the top N recommendations. excluding or filtering out items)
- **Evaluation**

## 4.12 Similarity Measures

The similarity is measured using the distance metric. Nearest points are the most similar and farthest points are the least relevant. The similarity is subjective and is highly dependent on the domain and application. For example, 2 books are similar because of categories or author or year of publish or languages and etc.

We should taken care when calculating distance across dimensions/features that are unrelated. The relative values of each element must be **normalized**, or one feature could end up overlooking the distance calculation. we have several similarity measures techniques such as: Minkowski Distance, Manhattan Distance, Euclidean Distance, Cosine Similarity, Pearson Coefficient, Jaccard Similarity and Hamming Distance.

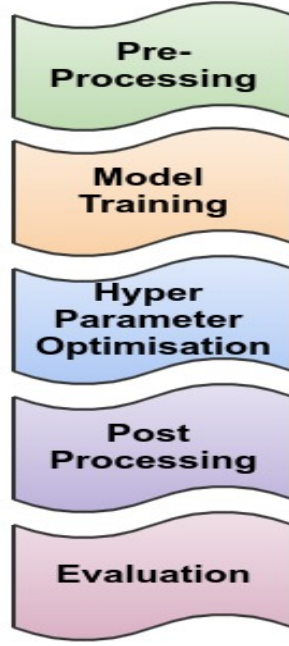


Figure 4.18: Models Training Phases (Steps) of Machine Learning

#### 4.12.1 Minkowski Distance

When the dimension of a data point is numeric, the general form is called the Minkowski distance. The Minkowski distance is a metric in a normed vector space which can be considered as a generalization of both the Euclidean distance and the Manhattan distance. It is named after the German mathematician Hermann Minkowski. Compute the Minkowski distance between two variables. The case where  $p = 1$  is equivalent to the **Manhattan distance** and the case where  $p = 2$  is equivalent to the **Euclidean distance**.

$$d(x, y) = \left( \sum_i^n |x_i - y_i|^p \right)^{\frac{1}{p}} \quad (4.5)$$

#### 4.12.2 Manhattan Distance

The distance between two points measured along axes at right angles. Black (2006) described, Manhattan Distance is a form of geometry in which the usual distance function or metric of Euclidean geometry is replaced by a new metric in which the distance between two points is the sum of the absolute differences of their Cartesian coordinates. The Manhattan Distance metric is also known as rectilinear distance, L1 distance, L1 norm, snake distance, city block distance, taxicab geometry or Manhattan length, with corresponding variations in the name of the geometry.

$$d(x, y) = \sum_i^n |x_i - y_i| \quad (4.6)$$

### 4.12.3 Euclidean Distance

It is the square-root of sum of squares of the difference between the coordinates and is given by Pythagorean theorem. In mathematics, the Euclidean distance or Euclidean metric is the "ordinary" straight-line distance between two points in Euclidean space.

$$d(x,y) = \sqrt{\sum_i^n (x_i - y_i)^2} \quad (4.7)$$

### 4.12.4 Cosine Similarity

This measures the cosine of the angle between two vectors. It is a judgment of orientation rather than magnitude between two vectors with respect to the origin. The cosine of 0 degrees is 1 which means the data points are similar and cosine of 90 degrees is 0 which means data points are dissimilar.

$$\sin(x,y) = \cos(\theta) = \frac{\vec{x}\vec{y}}{||x|| ||y||} \quad (4.8)$$

Cosine similarity is subjective to the domain and application and is not an actual distance metric. For example data points [1,2] and [100,200], are shown similar with cosine similarity, whereas in the Euclidean distance measure shows they are far away from each other i.e they are dissimilar

### 4.12.5 Pearson Coefficient

It is a measure of correlation between two random variables. It ranges between [-1, 1].

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}} \quad (4.9)$$

If the value is 1 it is a positive correlation and if -1 then there is a negative correlation among variables.

### 4.12.6 Jaccard Similarity

In the other similarity metrics, we discussed some metrics to find the similarity between objects, where the objects are points or vectors. We use Jaccard Similarity to find similarities between finite sets. It is defined as the cardinality of the intersection of sets divided by the cardinality of the union of the sample sets.

$$J(A,B) = \frac{|A \cap B|}{|A \cup B|} \quad (4.10)$$

#### 4.12.7 Hamming Distance

All the similarities we discussed were distance measures for continuous variables. In the case for categorical variables, Hamming distance must be used.

$$D_H = \sum_{i=1}^k |x_i - y_i| \quad (4.11)$$
$$x = y \Rightarrow D = 0$$
$$x \neq y \Rightarrow D = 1$$

If the value (x) and the value (y) are same, the distance D will be equal to 0 . Otherwise D=1.If we have data that is binary i.e classification, one would go for Hamming distance. The lower value means high similarity and higher value means less similarity between variables. eg: Hamming distance between 1101111 and 1001001 is 3, Hamming distance between ‘batman’ and ‘antman’ is 2

### 4.13 Evaluation of Recommendation Systems

As Charu C (2016) described, recommendation systems can be evaluated using either **online** methods or **offline** methods. In an online system, the user reactions are measured with respect to the presented recommendations. Hence, user participation is important in online systems. For example, in an online evaluation of a news recommender system, one might measure the conversion rate of users clicking on articles that were recommended. Such testing methods are referred to as **A/B testing**, and they measure the direct impact of the recommender system on the end user. At the end of the day, increasing the conversion rate on profitable items is the most important goal of a recommender system, and it can provide a true measure of the effectiveness of the system. However, since online evaluations require active user participation, it is often not feasible to use them in benchmarking and research. On the other hand, offline methods are the most common methods for evaluating recommender systems from a research and practice perspective.

#### 4.13.1 General Goals of Evaluation Design

In traditional machine learning, we split our original dataset to create a training set and a validation set. This, however, does not work for recommender models since the model would not work if we train all of our data on a separate user population and validate it on another. So for recommenders, we actually mask some of the known ratings in the matrix randomly as shown in Fig.4.19. We then predict these masked ratings through machine learning and then compare the predicted rating with the actual rating.

Apart from the well known goal of offline evaluation which is **accuracy**, other general goals and factors such as **diversity**, **serendipity**, **novelty**, **robustness**, and **scalability** are also important. Some of these goals can be concretely quantified, whereas others are subjective goals based on user experience. In such cases, the only way of measuring such goals is through user surveys.

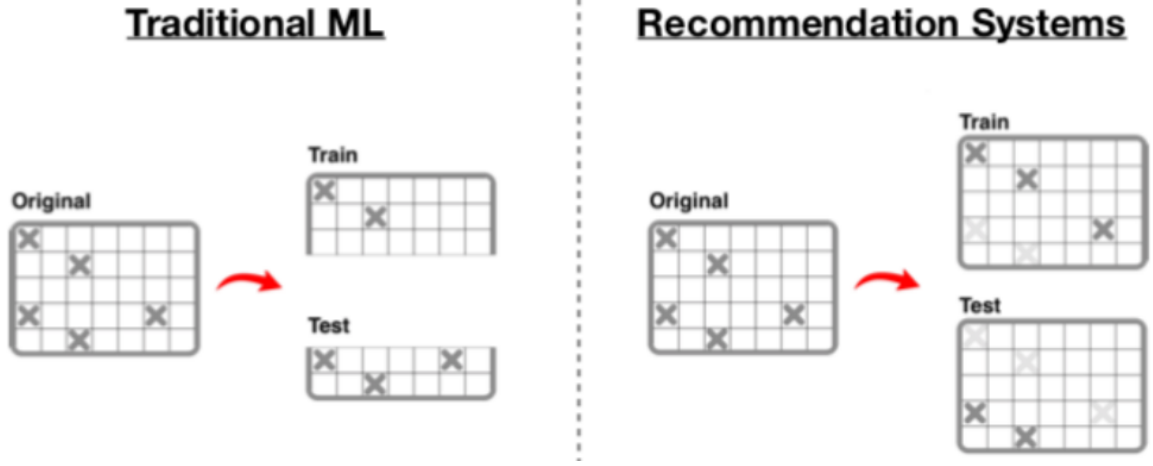


Figure 4.19: Evaluation Process of Recommendation System

#### 4.13.2 Accuracy

The most fundamental measures through which recommender systems are evaluated is accuracy. Accuracy is the proportion of true results among the total number of cases examined. For evaluation we consider the confusion matrix as shown in Fig.4.20 and the equation 4.12. Additionally, the preferred way for evaluating the accuracy in recommendation system is by calculating the **RMSE (root mean squared error)**, Hit rate, leave-one-out cross validation.

$$Accuracy = \frac{(TP + TN)}{(TP + FP + FN + TN)} \quad (4.12)$$

$$Precision = \frac{(TP)}{(TP + FP)} \quad (4.13)$$

$$Recall = \frac{(TP)}{(TP + FN)} \quad (4.14)$$

$$F1\ score = 2 * \frac{Precision * Recall}{Precision + Recall} \quad (4.15)$$

##### 4.13.2.1 Root Mean Squared Error (RMSE)

The evaluation technique is the chosen measure by Netflix in Netflix Price competition. RMSE can calculate by the equations 4.16 or 4.17

$$RMSE = \sqrt{\frac{\sum_{i=1}^N (y - \hat{y})^2}{N}} \quad (4.16)$$

		Actual	
		Positive	Negative
Predicted	Positive	<b>True Positive</b>	<b>False Positive</b>
	Negative	<b>False Negative</b>	<b>True Negative</b>

Figure 4.20: Confusion matrix

$$RMSE \text{ for } (RSs) = \sqrt{\frac{\sum_{(u,j) \in E} e_{uj}^2}{|E|}} \quad (4.17)$$

$$\text{entry-specific error} = e_{uj} = \hat{r}_{uj} - r_{uj}$$

- $S$  is the set of specified (observed) entries
- $E \subset S$  is the set of entries in the test set used for evaluation
- Each entry in  $E$  is a user-item index pair of the form  $(u, j)$  corresponding to a position in the ratings matrix
- $r_{uj}$  is the value of the (hidden) rating of entry  $(u, j) \in E$ , which is used in the test set
- $\hat{r}_{uj}$  is the predicted rating of the entry  $(u, j)$  by the specific training algorithm being used

#### 4.13.2.2 Hit Rate

Top-N recommenders is a type of recommendation system that recommends top (N) number of items for users. Top (10) is a good recommendation list. Furthermore, for evaluating the Top-N list of items for each specific user, we have the hit rate, average reciprocal hit rate, cumulative hit rate, rating hit rate, leave-one-out cross validation and etc.

Hit Rate can be calculated by the following steps: First, we should generate top-n recommended items for each user by the recommendation engine and then calculate the number of already rated items by users divided by the total number of users.

$$\text{Hit Rate} = \frac{\text{hits}}{\text{users}} \quad (4.18)$$

Hit rate has several variations such as (Average reciprocal hit rate, cumulative hit rate)

##### 4.13.2.2.1 Average Reciprocal Hit Rate

Average reciprocal hit rate "ARHR" by equation 4.19, it shows where in the top-n your hits appear.

$$ARHR = \frac{\sum_{i=1}^N \frac{1}{\text{ranks}_i}}{\text{users}} \quad (4.19)$$

#### 4.13.2.2.2 Cumulative Hit Rate

Cumulative hit rate "cHR", it means that throw away hits if our predicted rating is below some threshold. The idea is that we should not get credit for recommending items to a user that we think they would not actually enjoy. Therefore, if our threshold is **3 stars**, we throw away the **1 and 2 stars** from hit rate metric and would not count them as at all.

#### 4.13.2.2.3 Rating Hit Rate

In rating hit rate "RHR" we break down our rating by predicted rating score. It is a good way to get an idea of the distribution of how good your algorithm thinks recommended items are that actually get a hit.

#### 4.13.2.3 Leave-one-out cross validation

In leave-one-out cross validation we do the following: Compute the top-n recommendations item for each users in our training data and intentionally remove one of those items from that users training data. We then test our recommender system's ability to recommend that item that was left out in the top-n results it creates for that user in the testing phase.

### 4.13.3 Coverage

Even when a recommender system is highly accurate, it may often not be able to ever recommend a certain proportion of the items, or it may not be able to ever recommend to a certain proportion of the users. This measure is referred to as **coverage**. This limitation of recommender systems is an artifact of the fact that *ratings matrices are sparse*. In other word, coverage is the (%) percentage of possible recommendations that your system is able to provide.

$$Coverage = \frac{(user,item) \text{ pairs that can be predicted}}{Total \text{ number of items in the system (Catalog)}} \quad (4.20)$$

### 4.13.4 Diversity

Diversity show how broad a variety of items the recommender system is putting in front of people. The notion of diversity implies that the set of proposed recommendations within *a single recommended list* should be as diverse as possible. But diversity is not always good because we can get high diversity by just recommending items in random.

$$Diversity = (1 - S) \quad (4.21)$$

$$S = Avg \text{ similarity between recommendation pairs}$$

#### 4.13.5 Novelty

The novelty of a recommender system evaluates the likelihood of a recommender system to give recommendations to the user that they are not aware of, or that they have not seen before. Unseen recommendations often increase the ability of the user to discover important insights into their likes and dislikes that they did not know previously. High novelty is not always good. There is a concept of **user trust** in a recommendation system. People want to see at least a few familiar items in their recommendations list.

#### 4.13.6 Confidence and Trust

Confidence measures the system's faith in the recommendation and predicted rating, trust measures the user's faith in the evaluation. Therefore, user trust in a recommendation system show, user familiar items in the list and in which perspective items are related to the user.

#### 4.13.7 Serendipity

Serendipity is a measure of the level of surprise in successful recommendations. In other words, recommendations need to be unexpected. In contrast, novelty only requires that the user was not aware of the recommendation earlier. Serendipity is a stronger condition than novelty. All serendipitous recommendations are novel, but the converse is not always true.

#### 4.13.8 Robustness and Stability

A recommendation system is stable and robust when the recommendations are not significantly affected in the presence of attacks such as fake ratings or when the patterns in the data evolve significantly over time.

##### 4.13.8.1 Stability

As Charu C (2016) mentioned, In recent years, it has become more and more easy to collect large numbers of ratings and implicit feedback information from various users. In such cases, the sizes of the data sets continue to increase over time. As a result, it has become increasingly essential to design recommender systems that can perform effectively and efficiently in the presence of large amounts of data. Stability of a recommendation system is related to (Training time, Prediction time, Memory requirements) factors.

## Chapter 5

# Results

After systematic literature review and analyzing the practical work and limitation of technologies and techniques we finalize our result of this research by developing our Hybrid Recommendation System. Therefore, this chapter include the following:

- Overall system deployment general layout and system flow.
- Which techniques and technologies use choose and why?
- Which data we have? and how we preprocessed the data?
- Which hybridization and chaining methods we select to form our final recommendation?
- Finally, the offline evaluation result of our each RSs models.

### 5.1 System Flow and Layout

Indeed, system flow is an essential analytical road-map for development and studying a system. Therefore, we first describe and discussion our system general flow chart as shown in Fig.5.1 with the fallowing components:

- **Front-end API Clients:** Mobile and Web-based application
- **Back-end API-based Application:** Server side application that controller all back-end functionalities such as response to all requests: API calls, Authentication, Authorization Tokens, Cookies management, serving the css, js, document, font and image files and etc.
- **Authentication Data:** All users information with encrypted passwords.
- **Main Data:** Islamic Books and papers contents and sections with the desire and flexible structures.
- **Trained Hybrid Recommendation Engine:** means combine of more than one recommendation engines or techniques to generate final Top-N recommendations to the user.
- **Users Constrain Data:** needed categories of information

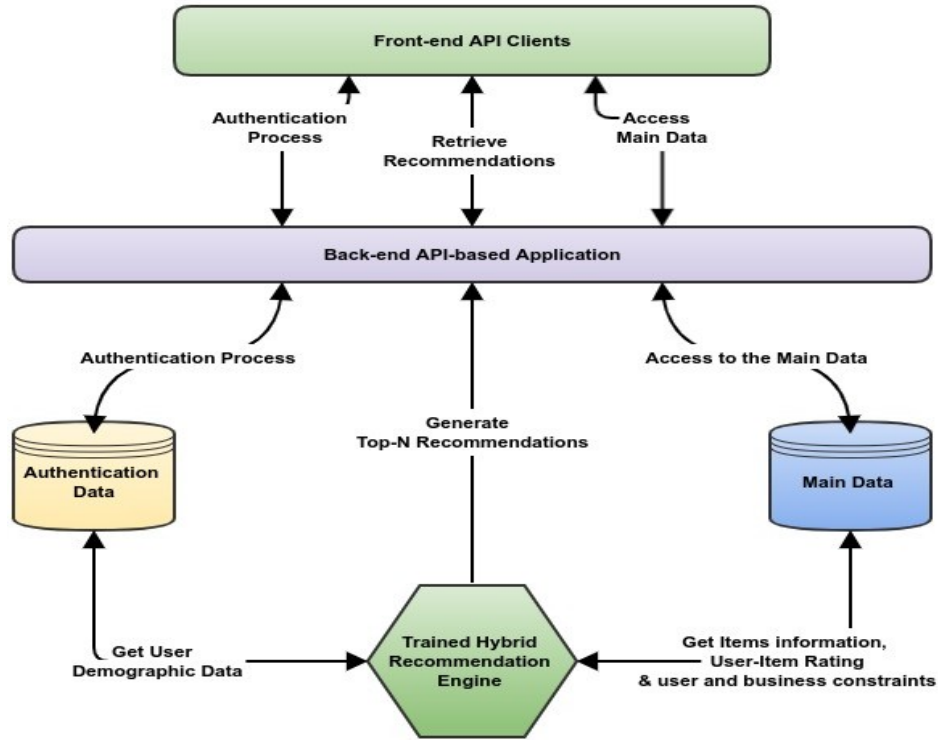


Figure 5.1: System Flow Layout

- **Users Demographic Data:** (Age, Life stage)
- **Item Data:** (title keywords, tags, categories, subcategories)
- **User-Item Rating Data:** history of users in 5-Star Rating form for items

## 5.2 Data of Our Application

In the data section, as mentioned, our application has to store textual form such as Islamic books and research papers. Therefore, Islamic text in books or paper mainly include various type of text as fallow:

- Block Level Quranic Verses
- Inline Quranic Verses
- Quranic Verse's translation in different languages
- Block Level Hadith of Allah's beloved prophet Muhammad Mustafa "S.A.W"
- Inline Hadith
- Translation of Hadith
- Basic text (Heading, Paragraph)
- Poetry

- Quotations
- Text Makers (Important Sentence, Definition, Good and Bad Actions and etc...)
- List of Items
- Images
- External Links
- Footnotes
- References

Additionally, each of the above types may have association with a list of references and as well be present in a single topic under a heading section.

Our application as well has supportive data as fallow:

- Categories and sub-category that will be associated with each books and papers.
- Authors information
- Translators information
- Document type (Books, Paper), language, publication date (Century, Year), published or printed by info, edition, number of physical pages and volumes.
- Cover image, spell checked flag, status (Active, Inactive).
- Importance impact in which life cycle or period of life such as (Child, Teenager, Youth, Adult, or All)
- Importance impact in which part of life such as (Islamic believes, Worship, Style of viewing the world, Individual life, Family life, Society behave, Cultural, Ethics, Economical points, Politics and governmental points, Works and jobs, Science, technologies and modern tools, Defense, military and Jahd, Historical point's of view)
- Importance impact in which gender type such as (Men, Women, or all)
- Context level (Basic, Intermediate, Advanced) and text type (Legacy text, Modern)
- Keywords (main key words in titles of books, papers or section headings)
- Tags
- Total Statistical numbers (View, Read, Bookmark, Recommend, and Search appearance)
- Total rating numbers (1-5 stars)
- Order of sections, top section, next and previous sections, time to read, is searchable and is recommendable flags.
- Bookmarks
- Users Data
- Users Interaction Data (Rating)
- Search history

### 5.2.1 Storage of Data

Indeed, data of our application is more dynamic and unstructured. Therefore, for storage and management of our data, we choose the MongoDB database that support these type of data vary well with good performance with JSON (JavaScript Object Notation) storage format. The following is shown possibilities of MongoDB database storage format.

```
1 {"book": {  
2     "id": "...",  
3     "title": "Tafsir Marif Quran",  
4     "sections": [  
5         {"text-content": [  
6             {"type": "basic", "content": "..."},  
7             {"type": "quranic", "content": "..."},  
8             ...  
9         ]}  
10    ]  
11    ...  
12 }}
```

## 5.3 Complete Data Flow Setups and Data Pipeline for Our System

By consideration of system activities flow we have a clear view for data pipelining and flow setups. Therefore, The application activities of our system can be view in two different perspective, first form users dimension, second form content dimension.

### 5.3.1 Users Activity Flow

System activity flow with paying more attention in users perspective are shown in Fig.5.2 with the following items:

- Creating user account: Gathering the required information about the users, and as well making our system aware of identification and authentication essential information (Username, Password).
- Management the user interest: By choosing or modifying the interested categories and sub-categories, part and period of life. These data is the first form of data which is needed in recommendation models.
- Login: Authentication (mapping the username and password to verify the user)
- View recommended Top-N list of section heading: After a user successfully logged in to the system, recommendation engine will provide the Top-N (10) topic to read form different books and papers for the user.
- Search: Searching will be by search keywords and search mode. Therefore, the system will return the result with the consideration of these search keywords and the mode or categories of search and then mapping with the associated keywords and tags of books, section of books and paper.

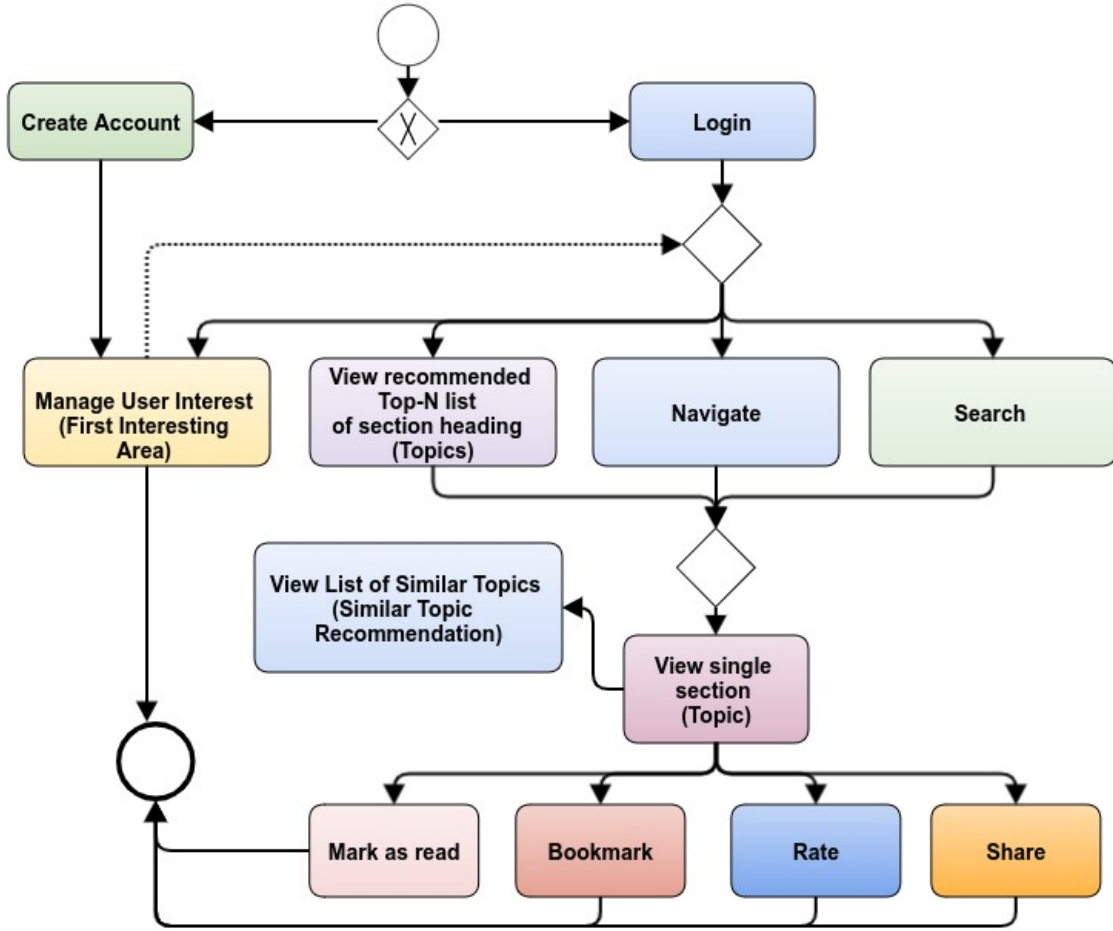


Figure 5.2: Users Activity Flow

- Navigation: finding to desired topic by navigating the navigation bar, through tags or table of content of books.
- Rating: after reading a topic user may rate form 1-5 stars and then these rating consider as interest of user for such group of topics and used for farther recommendation list in next interact.
- Mark as read: will maintain the read topics of a user.
- Bookmark: mark a topic for farther interaction for reading in future times.
- Share: sharing the topic though social medias.

### 5.3.2 Content Activity Flow

System activity flow with paying more attention in administration perspective are shown in Fig.5.3 with the following items:

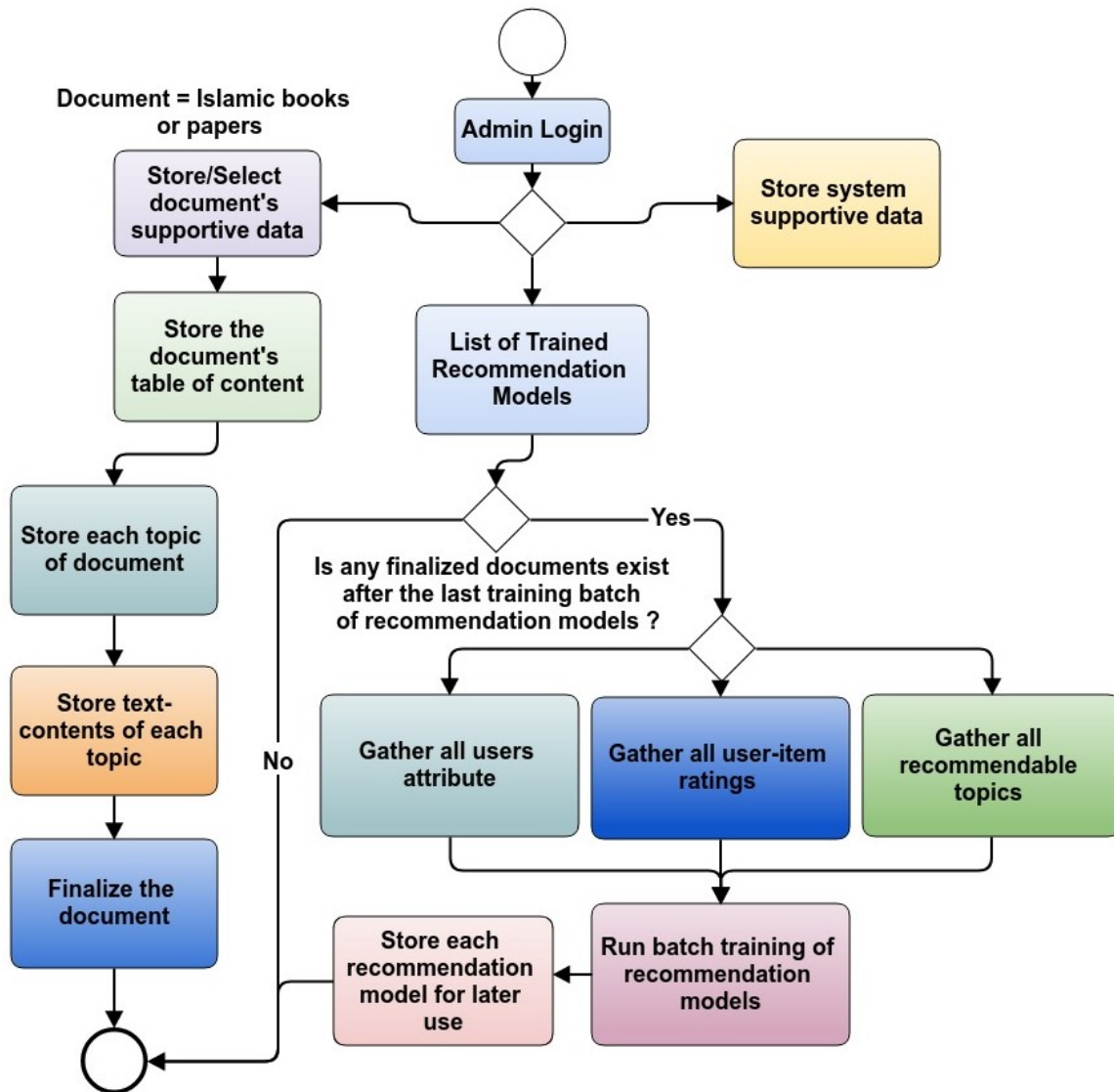


Figure 5.3: Administration Activity Flow

- Store system supportive data: supportive data such as categories, sub-categories, authors and translators information and etc...
- Store and Select document's supportive data: some of supportive data about a document will be saved such as document title, document total pages in physical form, total number of volume, publishing info and etc, and the other, will be select form system supportive data such as category and sub-category and as well as authors and translators.
- Store the document's table of content: after storing document, then table of content of document which include the hierarchy of topics in a book or paper will be store and manage.
- Store each topic of document: then supportive data of each topic store separately.
- Store text-contents of each topic: main data storage of each topic with their type and reference
- Finalize the document: the last step for a document storage process is the finalization step after all (main and supportive) information stored successfully.
- List of Trained Recommendation Models: the system work in offline models (models train and update in different process or machine and the result trained models use for active recommendation, sometime, this technique is called batch processing or offline or inactive recommendation systems).
- Gather all users attribute: those attribute of users that recommendation engine need for training such as gender, life period, interested parts or categories and etc.
- Gather all user-item ratings: 1-5 stars rating of each users for viewed items (Topic).
- Gather all recommendable topics: topics that has active sign for recommendation in supportive data are recommendable.
- Run batch training of recommendation models: train the models with the new data, indeed, the new gathered data for training RSs models, have already include the new users, new and updated topics, more user-item rating. Therefore, the new model will have more, accuracy, coverage, performance.

## 5.4 Utilized Technologies and Techniques

As for as, we develop a Information System for Islamic Textual Information (Data) with the capabilities to recommend Top-N (Titles:sections of books or papers) to a specific user in each categories. Therefore, basic cycle of technologies that a information system need are: firstly, we need to have a technology to store the books or papers contents in digital form, secondly, a technology to make the use of stored data easy for clients, and as well as, provide supports of basic and advance querying functionalities between database (data storage) and back-end selected language and technology, thirdly, client side frameworks to support the laying out of the transmitted data for clients more efficiently.

After preparation of the basics, for recommendation capabilities we also need to make use of data science, data mining, machine learning and deep learning required techniques.

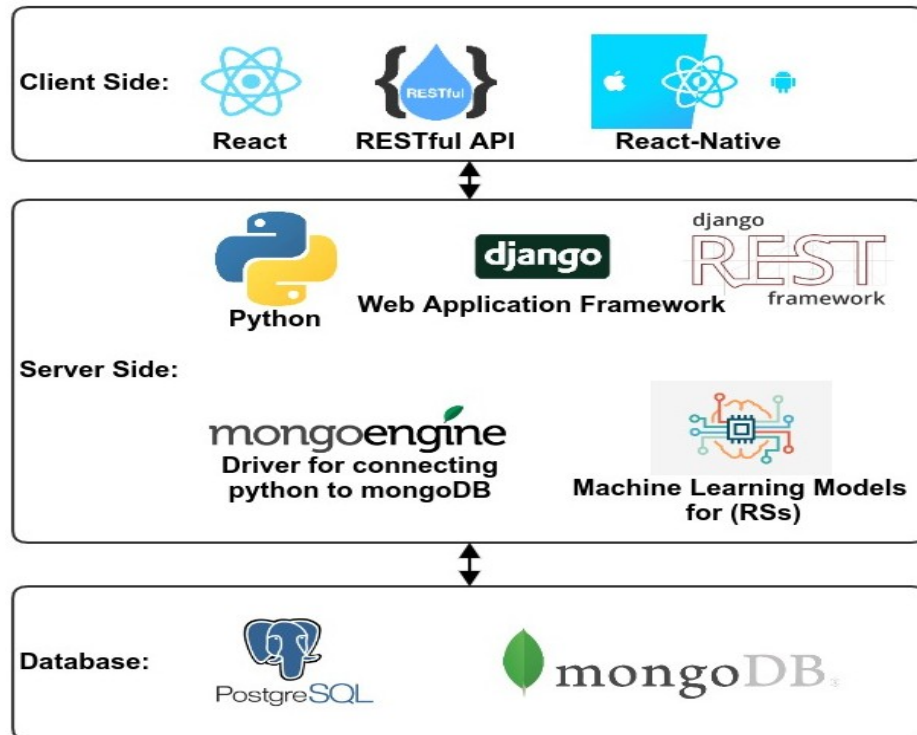


Figure 5.4: Core Technologies Stack

Indeed, we can say that recommendation system will be made up on the existent information systems that have adequate data (items e.g. products, ratings or users feedback for items, profile of users and etc), and the goal to provide the recommendation systems facilities for the users and their own businesses.

Core technologies stack for our is shown in Fig.5.4.

- **Client Side:** are the technologies that are run in client device, and are used to provide data in more stylish manor for clients.
  - **React** <sup>1</sup>: as Facebook Open Source (2020) mentioned, react (as well as known as React.js or ReactJS) is a JavaScript library for building user interfaces. It is maintained by Facebook and a community of individual companies and developers. React can be used as a base and core in the development of single-page or mobile applications. Nevertheless, React is only concerned with rendering data to the DOM, and so creating React applications usually requires the use of additional libraries for state management and routing. Redux <sup>2</sup>: "A Predictable State Container for JS Apps" and React Router <sup>3</sup>: "a collection of navigational components for react app" are respective examples of such libraries. According to the stackshare.io <sup>4</sup> "a company which compare technologies in various parts", react is used in more than **8204** companies until now (2020). Top 10 companies

<sup>1</sup><https://reactjs.org/>

<sup>2</sup><https://redux.js.org/>

<sup>3</sup><https://reacttraining.com/react-router>

<sup>4</sup><https://stackshare.io/>

which use react technology are (Facebook, Airbnb, Netflix, Instagram, Twitter, Medium, Udemy, Coursera, LinkedIn, Shopify).

- **React Native** <sup>5</sup>: React Native is an open-source mobile application framework created by Facebook with the slogan "Learn once, write anywhere. and Create native apps for Android and iOS using React". It is used to develop applications for Android, iOS, Web and UWP by enabling developers to use React along with native platform capabilities. According to the stackshare.io and react native core site, react native is used in more than **1141** companies until now (2020) such as "Facebook, Facebook Ads Manager, Facebook Analytics, Instagram, Pinterest, Skype, Yahoo, Tesla, Uber and etc".
- **RESTful API**: REST is acronym for REpresentational State Transfer. It is architectural style for distributed hypermedia systems. RESTful API was explained in background information of our thesis.
- **Server Side**: are the technologies that are run on server, and are used to provide required data and other resources for clients side technologies.
  - **Python**: Kuhlman (2009) described that, Python is an interpreted, high-level, general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects. python is popular for data science, machine learning, deep learning, data analytic projects. According to the stackshare.io, python is used in more than **6246** companies until now (2020) such as "Google, Netflix, Instagram, Udemy, Shopify, Uber, Dropbox, Reddit, Paypal, MIT and etc".
  - **Django** <sup>6</sup>: according to Django Software Foundation (DSF) (JANG-goh; stylised as django) is a Python-based free and open-source web framework, which follows the model-template-view (MTV) architectural pattern. It is maintained by the (DSF), an independent and non-profit organization. Django is a high-level Python Web framework that encourages rapid development and clean, pragmatic design. and as well as, Django is a tool in the Frameworks (Full Stack) category of a tech stack. Django's primary goal is to ease the creation of complex, database-driven websites. The framework emphasizes *reusability* and *pluggability* of components, less code, low coupling, rapid development, and the principle of don't repeat yourself. Python is used throughout, even for settings files and data models. According to the stackshare.io, Django is used in more than **1992** companies until now (2020) such as "Instagram, Udemy, Pinterest, Public Broadcasting Service, MIT, Coursera, Mozilla, The Washington Times, Disqus, Bitbucket, Nextdoor and etc".
  - **Django REST framework** <sup>7</sup>: It is a powerful and flexible toolkit that makes it easy to build Web APIs. Django REST framework is a tool in the Microframeworks (Backend) category of a tech stack. According to the stackshare.io, Django REST framework is used in more than **254** companies until now (2020) such as "Robinhood, Uploadcare, Festicket, OrderGroove and etc".

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<sup>5</sup><http://reactnative.dev/>

<sup>6</sup><https://www.djangoproject.com/>

<sup>7</sup><https://www.django-rest-framework.org/>

- **MongoEngine** <sup>8</sup>: is a Document-Object Mapper (think ORM, but for document databases) for working with MongoDB from Python. It uses a simple declarative API, similar to the Django ORM.
- **Database:** are the technologies that are responsible to store, retrieve, manipulate, delete and manage all aspect of data which is required for application.
  - **PostgreSQL** <sup>9</sup>: is an advanced object-relational database management system that supports an extended subset of the SQL standard, including transactions, foreign keys, subqueries, triggers, user-defined types and functions. PostgreSQL is a tool in the Databases category of a tech stack. According to the stackshare.io, PostgreSQL is used in more than **3964** companies until now (2020) such as "Uber, Netflix, Spotify, Instagram, Udemy, Stackshare, Reddit and etc".
  - **MongoDB** <sup>10</sup>: MongoDB stores data in JSON-like documents that can vary in structure, offering a dynamic, flexible schema. MongoDB was also designed for high availability and scalability, with built-in replication and auto-sharding. MongoDB is a tool in the Databases category of a tech stack. According to the stackshare.io and mongodb core site, MongoDB is used in more than **3123** companies until now (2020) such as "Facebook, Ebay, Google, Adope, in-vision, Sega, Uber, Lyft, Codecademy, MIT, CircleCI, Banksaled, Delivery Hero, and etc".

#### 5.4.0.1 Chosen Technologies and Techniques for (RSs):

The core techniques and technologies for our recommendation system are as fallow:

- **Word2Vec:** an artificial neural network model used mostly in NLP to capture semantic and position of words in a sentence, developed by google in 2013 as mentioned by Mikolov et al. (2013b,a).
- **TF-IDF:** *term frequency-inverse document frequency*, is a numerical statistic that is intended to reflect how important a word is to a document in a collection or corpus as mentioned by Rajaraman and Ullman (2011).
- **Deep Neural Networks (DNN):** is an artificial neural network (ANN) with multiple layers between the input and output layers. More information about neural network and its implementation is mentioned by Bengio (2009); Elkahky et al. (2015); Sarwar et al. (2001); He et al. (2017); Cheng et al. (2016); Bengio et al. (2013); Schmidhuber (2015); LeCun et al. (2015). We use two different (DNN) model architectures for generating the candidates for our system. Deep Learning nowadays, is used for generating recommendations by super large companies like Google in Google Personalized Search, YouTube , Play Store and etc. Sources are mentioned in Sullivan (2012, 2017); Joshi et al. (2013); Covington et al. (2016).

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<sup>8</sup><http://mongoengine.org/>

<sup>9</sup><https://www.postgresql.org/>

<sup>10</sup><https://www.mongodb.com/>

### 5.4.1 Data Preprocessing Steps of Our Application

Indeed, for every machine learning and AI project first need is the dataset to train the model. we generate the initial dataset which contain about **300** book sections (Topics), **500** ratings form **20** test users. second, we identify needed features (numerical, categorical) and label (ratings). and then, apply our general preprocessing as fallow:

- Rating was normalized by equation 5.1.
- Section title with combination of keywords and tags, was preprocessed by removing the stopwords, html, punctuation and duplicate words.

Further preprocessing was done according to each model's need.

$$Normalized\ Rating(x) = \frac{x - \min(Rating)}{\max(Rating) - \min(Rating)} \quad (5.1)$$

### 5.4.2 Trained Models of Our Recommendation Engine

By consideration, for our app we need three kind of recommendation. First, recommend top 10 (Top-N) topics in (*suggestion to read*) page or component of app. Second, recommend similar topics to the current view topic. Third, popular topics (book sections) for all users.

Therefore, we train five recommendation models by help of different techniques as fallow:

1. **Content-based RS** by combining result of Word2Vec model which is a dense vector with the result of TF-IDF model as shown in Fig.5.5. This model support new (unseen) users without update but need to update if new (unseen) item with different titles, keywords or tags arrived.
2. **Sequence-based RS** by help of Word2Vec model. In this model sequence of interaction (rated sections by specific user) was threaded as a sequence of words in a sentence as shown in Fig.5.7. This model as well as support new (unseen) users but need to update if new (unseen) item arrived.
3. **Collaborative Filtering RS** by help of Keras (High Level Framework for implementing DNN on top of tensorflow). In this model we have integer encoded book section and user as input and rating as output as shown in Fig.5.6. The key advantage of this model is the using of embedding: (*technique of representing categorical or string features as a continuous-valued feature vector with fixed length; and every similar vectors will automatically placed closed together*).; for every section and also user which achieved in training phase. Therefore, the model is capable to generate recommendation in three different manner.
  - (a) Input the specific user with the a list of book section to the model and then the model will predict all inputted sections for you.
  - (b) Using the Dot product or cosine similarity of users and sections embedding directly.
  - (c) Using of sections embedding for recommending similar sections with the specific section. This is possible because placing nature of vector embeddings. Therefore, by using of K-NN (K-nearest neighbors) we can find most similar sections.

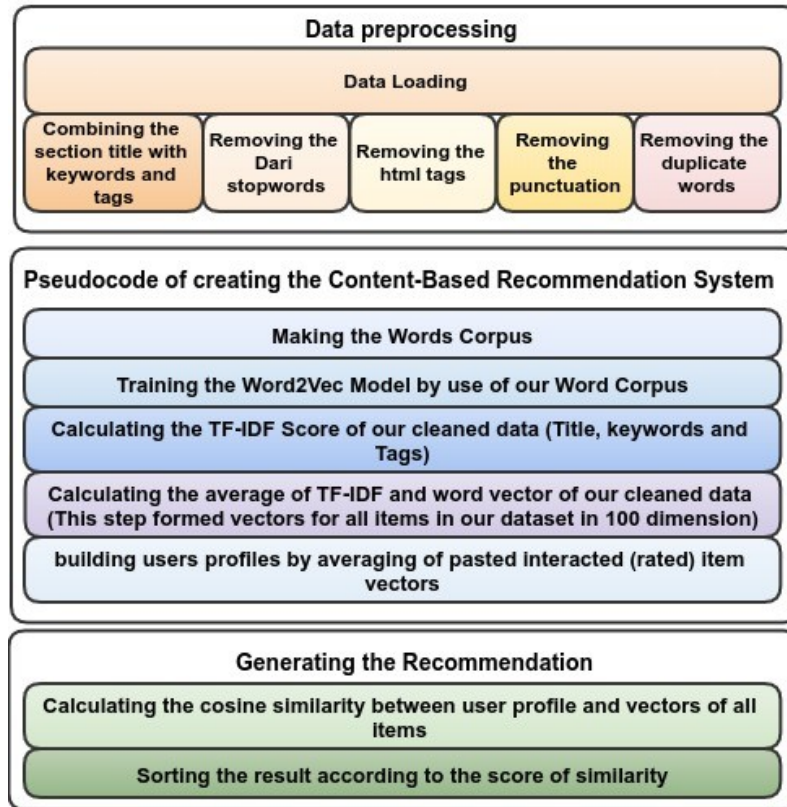


Figure 5.5: Content-based RS by combination of Word2Vec model and TF-IDF technique

This model support unseen users and need to fit unseen sections.

4. **Collaborative filtering plus users and items descriptive attributes RS.** This system is also a kind of DNN based RS which we implement by use of Keras. Model inputs are the integer encoded section and user plus section title, language, user gender and age; the output is the rating. This model support unseen user and also section without to fitting new data or updating (retraining) the model. Fig.5.8 are showing the architecture of this model.
5. **Popularity-based RS** is calculated form sum of normalized rating of each section.

### 5.4.3 Used Strategies of Chaining Models to Form Our Final Hybrid Recommendation Engine

We used the switching and weighted strategies for hybridizing the recommendation engine. Recommendations for each specific part of application are generated by different RS models with sequence of default fallback models in case of need. Fig.5.9 shown the hybrid recommendation engine architecture.

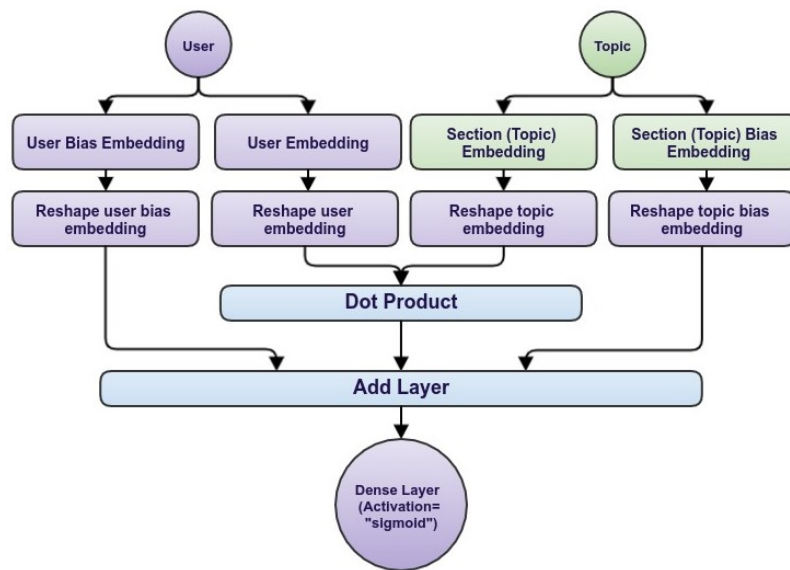


Figure 5.6: Collaborative Filtering RS by help of DNN (Deep Neural Network) and embedding

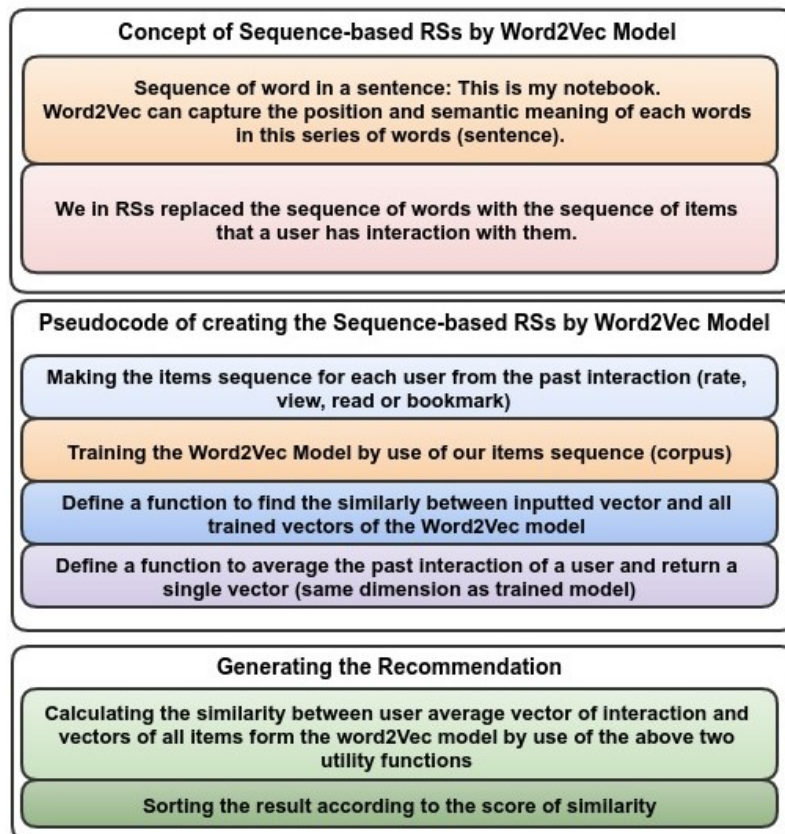


Figure 5.7: Sequence-based RS by help of Word2Vec technique

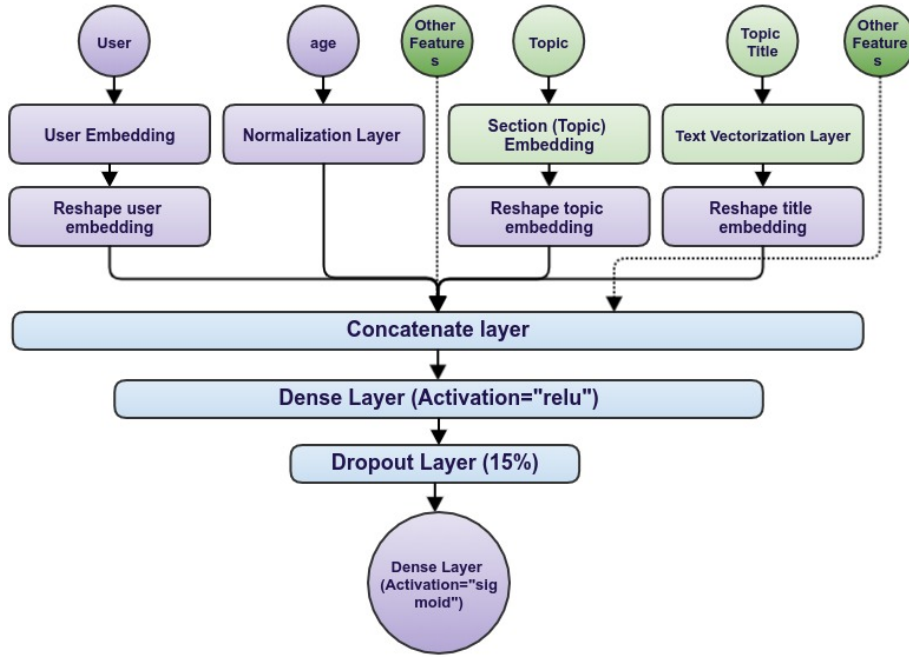


Figure 5.8: Collaborative filtering plus users and items descriptive attributes RS

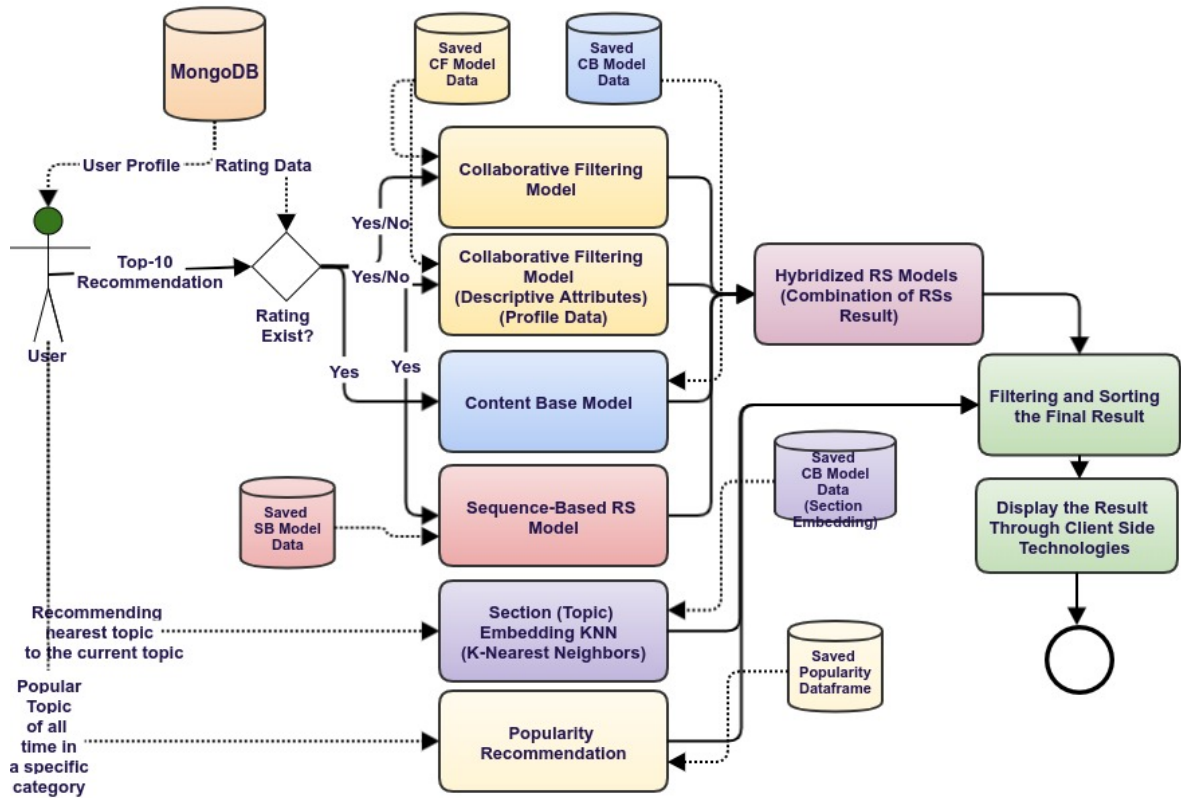


Figure 5.9: Hybrid Recommendation Engine Architecture

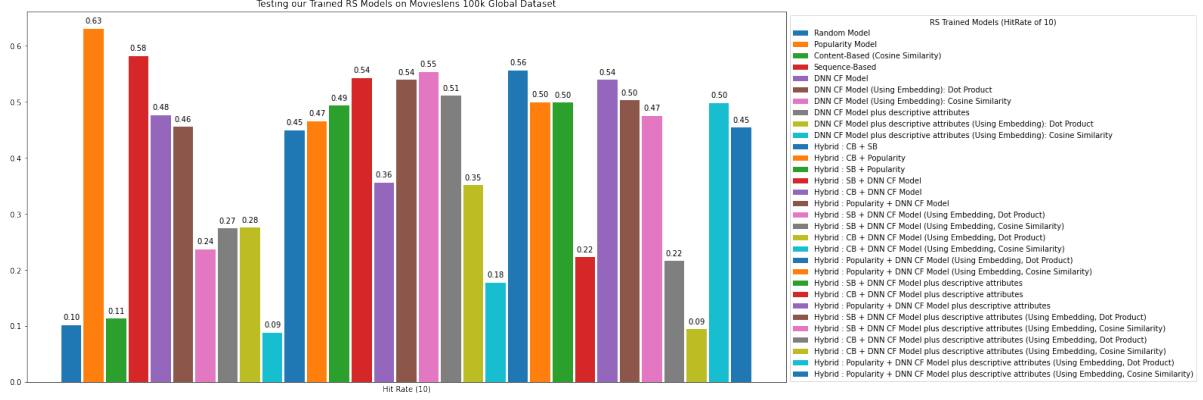


Figure 5.10: Chart Hit Rate

#### 5.4.4 Evaluation and Discussion

In evaluation part, we used the **Hit Rate** for evaluating the Top-N accuracy and power of ranking of the trained models. The testing environment is setup as follow:

- Split train and test sets for cross-validate. This approach named holdout, which a random data sample (20% in our case) are kept aside in the training process, and exclusively used for evaluation purpose.
- We generate the Top-N (10) recommendation by each models for a user, and then, comparing to the items the user has actually interacted in test set and calculate the hit 5 rate (position of a item in first 5 items in the recommended list), hit 10 and 20 rates.

$$\binom{n}{r} = \frac{n!}{r! \times (n-r)!} \quad (5.2)$$

Fig.5.10 and Table.5.1 are shown the (Hit Rate) in our mini dataset and as well as Movielens 100k global dataset.

This above offline testing result demonstrate that our trained model do better job than random and also in popularity, ranking power, novelty, serendipity, robustness and stability attributes. The models has capability to recommend popular and non-popular items, as well as, can easily hybridized to improve the desired (RS attributes). We have five trained models but 10 capable ways to generate identical recommendation. Therefore, in the equation.5.2 of combination we pass  $n = 10$  and  $r = 2$  which shows that we have 45 possible ways of combination that we can weighted hybridized our trained models. Table.5.2 are shown the our testing infrastructure. For better evaluation of recommendation systems we should preform online A/B testing form real end-users.

Table 5.1: Hit Rate and ranking power of trained models

Model Name	Our Mini Dataset		Movielens 100k	
	Hit Rate Top-5	Hit Rate Top-10	Hit Rate Top-5	Hit Rate Top-10
Random Model	0.29	0.31	0.08	0.10
Popularity Model	0.64	0.79	0.49	0.63
Content-Based (Cosine Similarity)	0.35	0.48	0.06	0.11
Sequence-Based	0.31	0.45	0.47	0.58
DNN CF Model	0.30	0.43	0.36	0.48
DNN CF Model (Using Embedding): Dot Product	0.32	0.39	0.35	0.46
DNN CF Model (Using Embedding): Cosine Similarity	0.32	0.46	0.15	0.24
DNN CF Model plus descriptive attributes	0.25	0.43	0.20	0.27
DNN CF Model plus descriptive attributes (Using Embedding): Dot Product	0.30	0.37	0.19	0.28
DNN CF Model plus descriptive attributes (Using Embedding): Cosine Similarity	0.23	0.41	0.05	0.09
Hybrid : CB + SB	0.32	0.41	0.22	0.45
Hybrid : CB + Popularity	0.50	0.67	0.21	0.47
Hybrid : SB + Popularity	0.58	0.85	0.45	0.49
Hybrid : SB + DNN CF Model	0.25	0.43	0.46	0.54
Hybrid : CB + DNN CF Model	0.30	0.47	0.16	0.36
Hybrid : Popularity + DNN CF Model	0.59	0.77	0.42	0.54
Hybrid : SB + DNN CF Model (Using Embedding, Dot Product)	0.30	0.37	0.47	0.55
Hybrid : SB + DNN CF Model (Using Embedding, Cosine Similarity)	0.33	0.49	0.45	0.51
Hybrid : CB + DNN CF Model (Using Embedding, Dot Product)	0.35	0.45	0.15	0.35
Hybrid : CB + DNN CF Model (Using Embedding, Cosine Similarity)	0.31	0.44	0.9	0.18
Hybrid : Popularity + DNN CF Model (Using Embedding, Dot Product)	0.53	0.76	0.44	0.56
Hybrid : Popularity + DNN CF Model (Using Embedding, Cosine Similarity)	0.50	0.71	0.29	0.50
Hybrid : SB + DNN CF Model plus descriptive attributes	0.26	0.37	0.44	0.50
Hybrid : CB + DNN CF Model plus descriptive attributes	0.35	0.43	0.11	0.22
Hybrid : Popularity + DNN CF Model plus descriptive attributes	0.58	0.76	0.42	0.54
Hybrid : SB + DNN CF Model plus descriptive attributes (Using Embedding, Dot Product)	0.24	0.38	0.44	0.50
Hybrid : SB + DNN CF Model plus descriptive attributes (Using Embedding, Cosine Similarity)	0.26	0.40	0.43	0.47
Hybrid : CB + DNN CF Model plus descriptive attributes (Using Embedding, Dot Product)	0.29	0.43	0.10	0.22
Hybrid : CB + DNN CF Model plus descriptive attributes (Using Embedding, Cosine Similarity)	0.25	0.42	0.06	0.09
Hybrid : Popularity + DNN CF Model plus descriptive attributes (Using Embedding, Dot Product)	0.49	0.66	0.35	0.50
Hybrid : Popularity + DNN CF Model plus descriptive attributes (Using Embedding, Cosine Similarity)	0.41	0.62	0.22	0.45

Table 5.2: Test Infrastructure Environment

Component	Property
Operating System	Ubuntu 18.04.3 LTS
CPU	Intel® Core™ i5-6200U CPU @ 2.30GHz × 4
RAM	8GB
Tensorflow	2.3 CPU-only
Python	3.85
Notbook	6.1.1

## Chapter 6

# Conclusion

Information is essential, but overloading with more of them is more problematic. Especially, when information processing technologies arrive in the field which can process more and more information for users. In first seen, it will be attractive to have lots of information in the page in front of users, but the user will be puzzled to choose from a large, unrelated or even 1000 options in one related area. Other problem is that, if those options select randomly for each user, those will change in every revisiting the application page (Web or Mobile page) and if we even store them, then we just limit to those options only. Therefore, by consideration of information technologies in storage, retrieval, processing power, accessibility and availability features, we could, retrieve and filter needed information by use of personality, history, and interest of each user. This type of system is a recommendation system. We in this research develop a hybrid RS for Islamic textual information: (*Islam is full of information in every part of life for humanity, we have more Islamic available data in the format of text by the traditional history and way of storage of information*). We developed five individual RS models such as (Content-based, Sequence-based, DNN CF Model, DNN CF plus descriptive attributes Model and finally popularity-based) with the capability of 10 ways to individually generate recommendation, and 45 ways to combine two RS together to improve the power of their final recommendation.

## Chapter 7

# Limitation and Future Work

### 7.1 Limitation

Firstly, recommendation systems are a multidisciplinary research field (data science, AI, machine learning, statistic, information system, business processing management) which require separate knowledge of theory, technology, and languages. Secondly, in the data science projects, the time-consuming and challenging phase is the dataset creation. In our case, we also needed to have a lot of data to train the models and evaluate them. And if I just used the ready-made datasets for modeling (is fine with limitation in research). Because, the model is not applicable for production at all, and data pipeline, data cleaning and preprocessing will to be fully failed. Therefore, I tried to create our own dataset (fewer data but our own domain related data), which will help me to production and deployment process.

By the plan in mind, I attempt to develop the core functionalities of a complete information system for managing the Islamic textual information (book's content) with the support of recommendation functionalities component. Other limitation was that all technologies with support of fully text data such as the databases, server side and client-side technologies, languages with highly capabilities to support all our ecosystem and models; were different from those that I had already experienced.

### 7.2 Future Work

In-sha-allah, (If Allah<sup>"S.W.T"</sup> will "By help of God"), plan is to establishment a central information system for storing and retrieval of Islamic textual information in different languages (Dari, Pashto, Arabic, English, Urdu, and other global languages). Through this system, important Islamic book in each domain will be accessible in web and mobile platforms with enterprise and standard technologies.

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# Appendix A

## Glossary

This document is very easy to understand because we have written by simple words which is understandable to any one who will read it.

- (S.W.T) = Subhaana wo Tahallah (*Allah "S.W.T" is the great*) (Arabic: **الله عَظِيمًا**)
- (S.A.W) = Sahle Allah Aali Wasalam (Arabic: **سَاحِلُ اللهِ عَلَيْهِ السَّلَامُ مُحَمَّدٌ مَصْطَفَى**) (*Peace and bless of Allah "S.W.T" upon him*)
- (R.A) = Radi Allah Tahalla (*Allah "S.W.T" peace and mercy upon him*)
- RSs = Recommendation Systems
- NLP = Natural Language Processing
- ML = Machine Learning
- DNN = Deep Neural Network
- IS = Information System
- MIS = Management Information System

## Appendix B

## Attachments

Table B.1: About Primary Collection or Books of Tafsir that are used in Islamic Nation

No	Tafsir Name	About Commentator / Mufasir	About Tafsir
1	<b>Gami al-bayan</b> an ta'wil ay al-Quran ( <b>Tafsir Garir at-Ṭabari</b> ) (تفسير جرير طبري - جامع البيان)	Abu Gafar Muhammad b. Garir at-Ṭabari (Arabic: أبو جعفر محمد بن جرير الطبري) live in <b>(224 - 310 AH)-(839 - 923 AD)</b> in Baghdad. He was a great Muhaddith, Commentator, Islamic historian and scholar of Islam. According to his own information, at-Ṭabari was a hafiz at the age of seven and with eight imams . At the age of twelve he left his homeland on his extensive study trip to Syria , Egypt , Baghdad, Kufa and Basra "in search of knowledge" ( fi ṭalab al-ilm). After further study trips and the pilgrimage to Mecca and Medina , he returned to Baghdad around 870 and devoted himself to his literary work for the last 50 years of his life.	Has overall and summary of explanations for the interpretation of the Quranic Verses. It is a collection of both accurate and non-accurate narratives with its references and citations. This Tafsir is more of used for referencing the narratives.
2	<b>Kashf al-Asrar wa 'Iddat Abrar</b> (تفسير كشف الاسرار و عدة الابرار)	Khawaja Abdullah Ansari (Persian:خواجه عبدالله انصاری) also known as Pir-i Herat (پیر هرات) "Sage of Herat", was a Persian Sufi, saint of Arab origin who lived in the <b>(396 - 481 AH) - (1006 - 1088 AD)</b> 11th century in Herat (then Khorasan, now Herat province, Afghanistan). One of the outstanding figures in Khorasan in the 5th/11th century: commentator of the Qur'an, traditionist, polemicist, and spiritual master, known for his oratory and poetic talents in Arabic and Persian.	The volume is arranged in the order of the chapter and verses of the Qur'an and 1,500 pages of Persian text. There are 97 chapters, each corresponding to one Qur'anic chapter (which is to say that 17 of the short chapters do not have commentaries). Each chapter consists of explanations of from one or two to as many as 85 verses. Topics include most of the major issues in Islamic theology, metaphysics, cosmology, and spiritual psychology. The language is relatively simple and poetic, making the book much easier to access than any Qur'anic commentary now available in English.
3	<b>Tafsir Al-Kashshaaf</b> (تفسير الكشاف)	Abu al-Qasim Mahmud ibn Umar al-Zamakhshari (Persian:ابو القاسم محمود بن عمر الزمخشري) <b>(18 March 1075 – 12 June 1144) (467 - 538 AH)</b> , was a medieval Muslim scholar of Persian origin He was a great Hanafite jurist, rationalist theologian and authority on Arabic language philology.	This Tafsir written in the 12th century. Considered a primary source by all major scholars, it is famous for its deep linguistic analysis, demonstrations of the supremacy of declamation of the Qur'an, and the representation of the method the Qur'an uses to convey meaning using literary elements and figurative speech. However, it is criticized for the inclusion of Mu'tazilah philosophical views.

( To be continued)

No	Tafsir Name	About Commentator / Mufasir	About Tafsir
4	<b>Mafatih al-Ghayb</b> (Arabic: مفاتيح الغيب 'Keys to the Unknown') <b>al-Tafsir al-Kabir</b> ( تفسير الكبير)	Abu Abdullah Muhammad ibn Umar ibn al-Husayn at-Taymi al-Bakri at-Tabaristani Fakhr al-Din al-Razi (Arabic: أبو عبد الله محمد بن عمر بن الحسن بن الحسين بن علي التيمي البكري نغزالدين الرازي) (544 - 606 AH) - (1150 - 1210 AD) was born in Rey (in modern-day Iran), and died in Herat (in modern-day Afghanistan). He also wrote on medicine, physics, astronomy, literature, history and law. He left a very rich corpus of philosophical and theological works that reveals influence from the works of Ibn Sīnā, Abu'l-Barakāt al-Baghdādī and al-Ghazali.	Tafsir al-Kabir is a classical Islamic tafsir book, written by the twelfth-century Persian Islamic theologian and philosopher Muhammad ibn Umar Fakhr al-Din al-Razi. The book is an exegesis and commentary on the Qur'an. At 32 volumes, it is even larger than the 28-volume Tafsir al-Tabari. It is not unusual for modern works to use it as a reference. One of [Muhammad ibn Umar Fakhr al-Din al-Razi] major concerns was the self-sufficiency of the intellect in Tafsir Kabir.
5	<b>Tafsir al-Qurtubi</b> ( تفسير قرطبي - تفسير جمال الحكم القرآن) or <b>Al-Jami'li Ahkam al-Qur'an</b>	Abu 'Abdullah Muhammad ibn Ahmad ibn Abu Bakr al-Ansari al-Qurtubi (Arabic: أبو عبد الله محمد ابن احمد ابن ابى بكر الانصارى القرطبي رح) (610 - 671 AH) - (1214 - 1273 AD) was an Andalusian jurist, Islamic scholar and muhaddith. He was taught by prominent scholars of Cordoba, Spain.	The basic objective of this tafsir was to deduce juristic injunctions and rulings from the Quran yet, while doing so, al-Qurtubi has also provided the explanation of verses, research into difficult words, discussion of diacritical marks and elegance of style and composition. The book has been published repeatedly.
6	<b>Anwar al-Tanzil wa-Asrar al-Ta'wil</b> (Arabic: أنوار التنزيل وأسرار التأويل lit. 'The Lights of Revelation and the Secrets of Interpretation'), better known as <b>Tafsir al-Baydawi</b> (Arabic: تفسير البيضاوي)	Nasir al-Din Abu al-Khayr 'Abd Allah ibn 'Umar al-Bayḍawī, (Persian: ناصر الدين أبو الخير عبد الله بن عمر بن محمد البيضاوي) (623 - 685 AH) - (1226 - 1286 AD) was an Islamic scholar, born in Fars, where his father was chief judge, in the time of the Atabek ruler Abu Bakr ibn Sa'd. He himself became a judge in Shiraz, and died in Tabriz. Many commentaries have been written on Baydawi's work. He was also the author of several theological treatises.	Tafsir al-Baydawi is considered to contain the most concise analysis of the Qur'anic use of Arabic grammar and style to date and was hailed early on by Muslims as a foremost demonstration of the Quran's essential and structural inimitability (i'jaz ma'nawi walughawi) in Sunni literature. Thus, the work has been selected by scholars as being culturally important and significant, because of its fame and influence, and many commentaries have been written on Baydawi's work. According to the contemporary Islamic scholar Gibril Fouad Haddad, the work "became and remained for seven centuries the most studied of all tafsirs," and it is to be regarded as "the most important commentary on the Qur'an in the history of Islam".
7	<b>Tafsir al-Bahr al-Muhit</b> (Explanation of the Ocean) ( تفسير البحر المحيط)	Muhammad ibn Yūsuf bin 'Alī ibn Yūsuf ibn Hayyān (Arabic: محمد ابن يوسف ابن علي ابن يوسف بن حيّان), (654 - 744 AH) - (1256 - 1344 AD) sometimes called Ibn Hayyan, was a celebrated commentator on the Quran and foremost Arabic grammarian of his era. He was born in Spain. Abu Hayyan, the so-called 'king of grammar', was celebrated as the unrivalled linguistic scholar and religious expert of hadith, historiography and Sharia.	Tafsir al-Bahr al-Muhit (Explanation of the Ocean) is the most important reference on Qur'anic expressions and the issues of grammar, vocabulary, etymology and the transcriber-copyists of the Holy Qur'an.
8	<b>Tafsir Ibn Kathir</b> ( تفسير ابن كثير)	Hafiz Imad Ad-Din Abu al-Fida Isma'il bin Kathir al-Qurashi Al-Damishqi Shafi' (Arabic: حافظ عماد الدين اوالقدا اسماعيل ابن كثير قرشي دمشقي شافعي رح) live in (699-774 AH)-( 1300-1373 AD) in Syria. He was an expert on tafsir (Quranic exegesis) and faqih (jurisprudence), he wrote several books, including a fourteen-volume universal history.	Tafsir Ibn Kathir has 4 volume. It has accurate narratives and as well as used some criticism.

( To be continued)

No	Tafsir Name	About Commentator / Mufasir	About Tafsir
9	<b>Tafsir al-Jalālayn</b> 'Tafsir of the two Jalals' (تفسير الجلالين)	Abu 'Abd Allah Muhammad ibn Shihab al-Din Jalal al-Din al-Maḥallī (Persian: جلال الدين) (791-864 AH)- (1389-1460 AD) was an Egyptian scholar of the Qur'an and Islamic Jurisprudence. He authored numerous and lengthy works on various branches of Islamic Studies, among which the most important two are Tafsir al-Jalalayn and Kanz al-Raghibin, an explanation of Al-Nawawi's Minhaj al-Talibin, a classical manual on Islamic Law according to Shafi'i fiqh. The other author or commentator is Abd al-Rahman ibn Abi Bakr ibn Muhammad Jalal al-Din al-Khūḍayri al-Suyūṭī (Arabic: جلال الدين عبد الرحمن بن أبي بكر بن محمد الخضيري السيوطي رح	His Tafsir Tafsir al-Jalalayn is considered as one of the most famous and popular interpretations of the Qur'an. The mission of preparing the Tafsir was initiated by Jalal al-Din al-Maḥallī in 1459 and completed after his death by his pupil Jalal al-Din as-Suyuti in 1505, thus its name, which means "Tafsir of the two Jalals". It is recognised as one of the most popular exegeses of the Qur'an today, due to its simple style and its conciseness, as it is only one volume in length. The work has been translated into many languages including English, French, Bengali, Urdu, Persian, Malay/Indonesian, Turkish, and Japanese. There are two English translations.
10	<b>Tafsir Al-Durr Al-Manthur Fi Tafsir Bil-Ma'thur</b> (تفسير الدر المنثور في تفسير المأثور)	Abd al-Rahman ibn Abi Bakr ibn Muhammad Jalal al-Din al-Khūḍayri al-Suyūṭī (Arabic: جلال الدين عبد الرحمن بن أبي بكر بن محمد الخضيري السيوطي رح) lived in (849 - 911 AH) - (1445 - 1505 AD) in Cairo, Egypt; an Egyptian of mixed Persian and Circassian origin. As an historian, biographer, jurist, teacher and scholar of Islamic theology, he was one of the most prolific writers of the Middle Ages. Iman Jalaluddin Suyuti's studies included: Shafi'i and Hanafi jurisprudence (fiqh), traditions (hadith), exegesis (tafsir), theology, history, rhetoric, philosophy, philology, arithmetic, timekeeping (miqat) and medicine. He started teaching Shafi'i jurisprudence at the age of 18, at the same mosque as his father did.	The exegesis explains each passage of the Qur'an by the reports and narrations from the Islamic prophet Muhammad <sup>"S.A.W"</sup> , his Companions <sup>"R.A"</sup> and the immediate generations following the Companions <sup>"R.A"</sup> . Iman Jalaluddin Suyuti compiled all the reports and narrations that he could gather for each particular passage - even contradictory reports.
11	<b>Tafsir al-Mazhari</b> (تفسير مظهری)	Qazi Muhammad Sanaullah Panipati <sup>"R.A"</sup> (Arabic: قاضي محمد تال الله پانی رح) (1144-1225 AH)- (1731-1810 AD) lived for 79 years. He was a direct descendant of Uthman ibn Affan <sup>"R.A"</sup> . That's he used name of Usmani he was student of Shah Waliullah Dehlawi and Shah Fakhir Allah abadi. His mother belonged to an ansari family. Qazi Muhammad Sanaullah Panipati <sup>"R.A"</sup> belongs to the Naqshbandi Sufi tariqah Spiritual Chain.	He has named this tafseer as 'Al-Tafsir al-Mazhari, after the name of his spiritual master, Mirza Mazhar Jan-e-Janan Dehlavi. This tafsir of his is very simple and clear, and extremely useful to locate brief explanations of Qur'anic verses. Along with the elucidation of Qur'anic words, he has also taken up related narration's in full details, and in doing so, he has made an effort to accept narration's after much more scrutiny as compared with other commentaries.
12	<b>Ruh al-Ma'ani</b> (تفسير روح المعاني)	Abu al-Thana' Shihab ad-Din Sayyid Mahmud ibn 'Abd Allah al-Ḥusayni al-Alusi al-Baghdadi (Arabic: أبو الثناء شهاب الدين سيد محمود بن عبد الله بن محمود: المحسني الآلوسي البغدادي) lived in 10 December 1802 – 29 July 1854 (1217 / 1270 AH). He was a great Arab Islamic scholar best known for writing Ruh al-Ma'ani, a tafsir (Tafsir) of the Qur'an.	Ar-Ruh al-Ma'ani fi Tafsiri-l-Qur'ani-l-'Azim wa Sab'u-l-Mathani (Arabic: روح المعاني في تفسير القرآن العظيم والسبع المثاني) is a 30-volume tafsir of the Qur'an, authored by the 19th-century Iraqi Islamic scholar Mahmud al-Alusi <sup>"R.A"</sup> . Tafsir Ar-Ruh al-Ma'ani is one of greatest tafsir that include lots of knowledge (Collection of all knowledge) such as terminologies and word of Arabic, Fiqh, Believe, philosophical aspect, tasawof (Purification) and etc. This Tafsir is the biggest reference source in every Quranic studies.

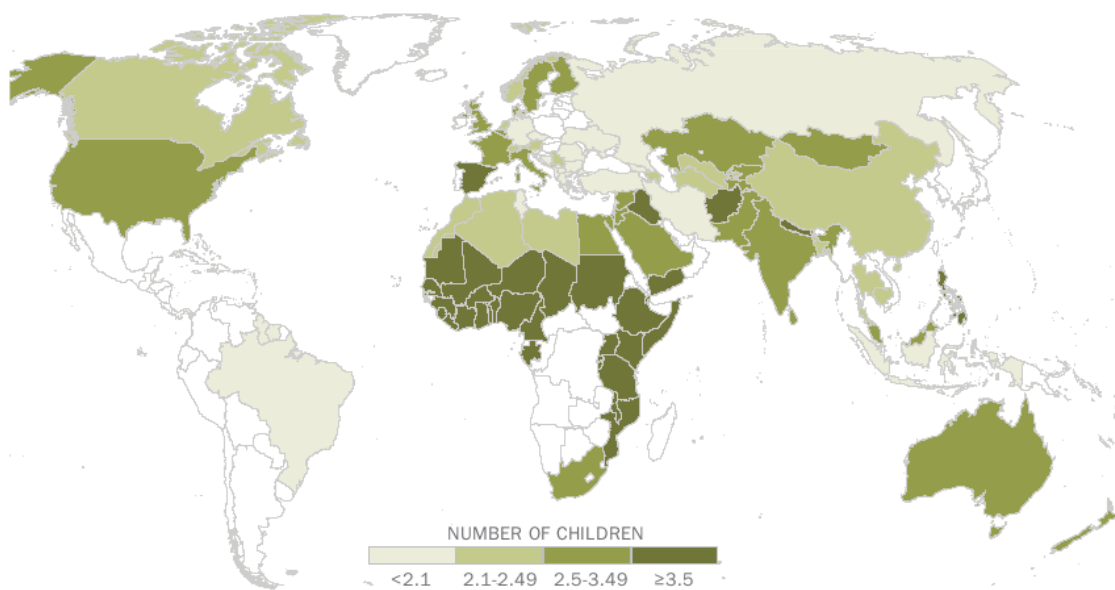
( To be continued)

No	Tafsir Name	About Commentator / Mufasir	About Tafsir
13	<b>Ma'ariful Qur'an</b> (تفسير معارف القرآن)	Mufti Muhammad Shafi' ibn Muhammad Yasin 'Usmani Deobandi <sup>RA</sup> (Arabic: محمد شفيع بن محمد (ياسين العثماني الديوبندي رح مغني) lived in <b>25 January 1897 – 6 October 1976</b> ) ( <b>1314 / 1396 AH</b> ), often referred to as Mufti Muhammad Shafi. He was a Pakistani Sunni Islamic scholar of the Deobandi school of Islamic thought. A Hanafi jurist and mufti, he was also an authority on shari'ah, hadith, tafsir (Qur'anic exegesis), and tasawwuf (Sufism). Born in Deoband, British India, he graduated in 1917 from Darul Uloom Deoband, where he later taught hadith and held the post of Chief Mufti. He resigned from the school in 1943 to devote his time to the Pakistan Movement. After the independence he moved to Pakistan, where he established Darul Uloom Karachi in 1951. Of his written works, his best-known is Ma'ariful Qur'an, a tafsir of the Qur'an.	The work consists of eight volumes (Urdu) (in Persian translation in 14 volumes). A detailed introduction, included at the beginning of the first volume, focuses on some of the basic issues of the Quran. Notable among them are the wahy, the modes of descent, the chronology of the revelation of the Quran, the first revealed verses (ayah), Meccan and Medinan verses, the preservation of the Quran, the printing of the Quran, the sources of tafsir, Arabic language etc. The work adopts a simple narrative style: first, several verses are provided in the original Arabic with their literal translation in Urdu; it is then followed by subject-wise discussion on almost every important issue. This narrative technique is repeated until the end.

Estimated number of Muslim children per woman, in 2010 up to 2015 is shown Fig.B.1.

## Total Fertility Rates of Muslims, by Country

*Number of children per woman, 2010-2015 estimate*



Source: The Future of World Religions: Population Growth Projections, 2010-2050  
Note: Only countries for which there are sufficient data are shown.

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Figure B.1: Total Fertility Rates of Muslims, by Country

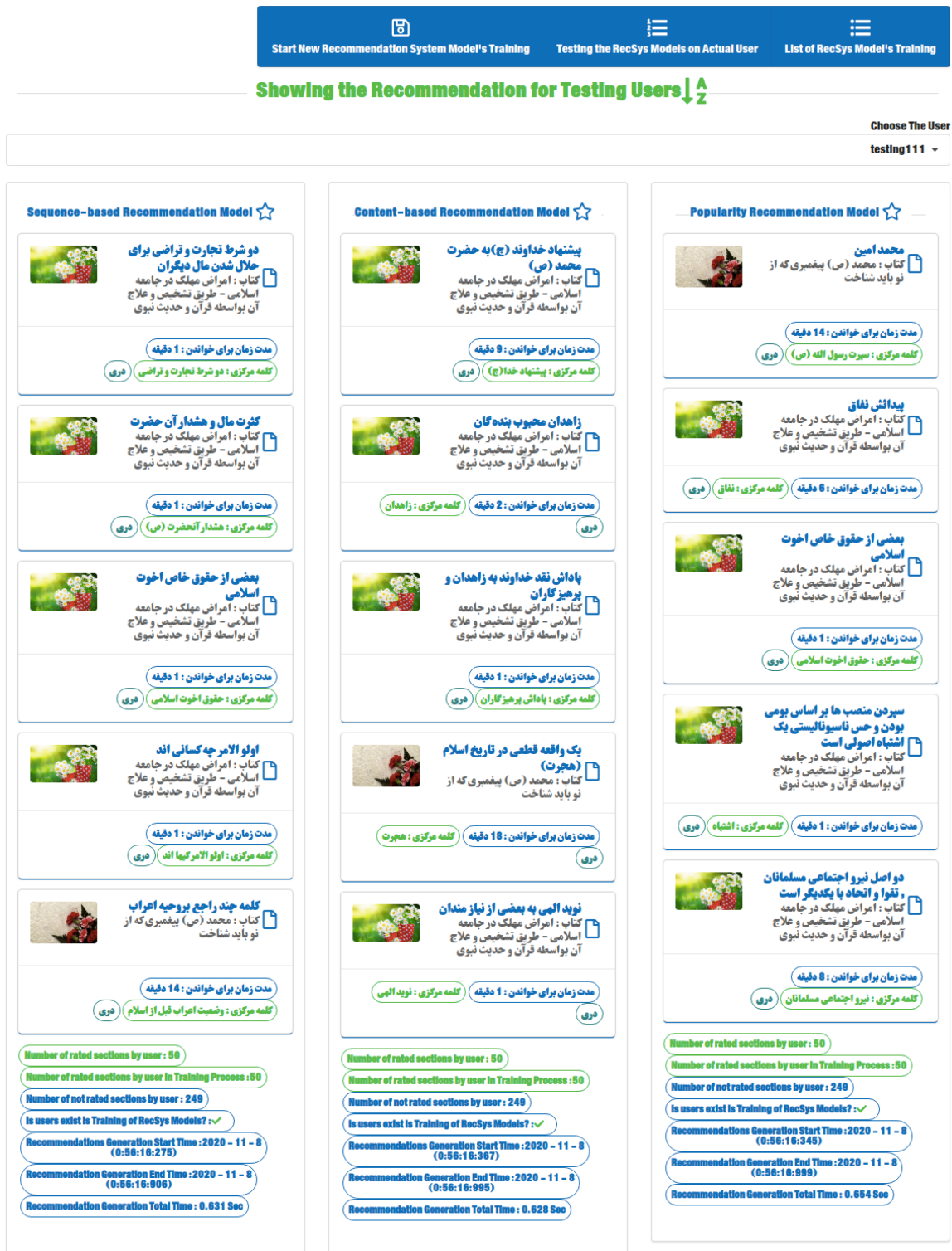


Figure B.2: Top-5 Generated Recommendations from 5 Individual Developed RS Models for a Test User (Part1)



Figure B.3: Top-5 Generated Recommendations from 5 Individual Developed RS Models for a Test User (Part2)