Importance of Big data in Healthcare System-A Survey

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Abstract

The concern towards healthcare is increasing day by day with rapid increase in population. The development of technology and reduction in cost enabled many healthcare systems and hospitals to procure latest equipment with advanced technology for diagnosis, report generation and various tests. The hospitals are able to collect and store huge amount of information related to patient like disease, diagnosis, medicine, doctors etc. There is continuous increase in the growth of such databases. Big data analytics is one of the progressive area which can handle such huge databases and provide the require knowledge relevant to the user. Big data analytics tools and techniques helps to store and analyze healthcare data available in various formats , This paper is systematic review of importance of big data analytics in healthcare system and also describe various benefits to the society.

Keywords: Big data, big data analytics, electronic healthcare, healthcare diagnosis.

INTRODUCTION

The rapid development in technology facilitated the healthcare system to generate huge amounts of information related to patient followed by their records pertaining to disease, treatment history, test reports etc.   Usually the data is available in the form of hard copies , but due to technology development and in the era of digital world everything is collected and stored in the digitized form. It can be predicted that in future there will be significant growth in the health data. In addition to the huge information pertaining to the healthcare[4] system, other organizations like insurance companies, outsourcing agencies are emerging to provide healthcare compensation benefits. These organizations also use the healthcare databases to support patients and their welfare. The data in such organizations include the doctor's prescriptions, insurance information, family history, medical[5]diagnosis report, images and also data pertaining to administration. In addition to such information, other sources of information are social media like updates in facebook, twitter posts, data in web pages, sharing of information in the articles in medical[5] research papers in journals and conferences. Such enormous information from various sources are very complex and also in different formats like images, text, tabular forms. The aim of storing such huge information is to support and improve the quality of various medical treatments, healthcare system and awareness of health[9] in population..

Today the emerging discipline is big data[6] analytics and like any other applications it can also be applied to healthcare. Big data analytics can be used for healthcare[4] database which is, in electronic[8] format, large, complex and cannot not managed and processed with the existing database management tools . and techniques. Use of big data[6] analytics in healthcare system is preferred not only for the reason that healthcare database is large in volume but also because of its ability to process wide variety of data types. Big data analytics[10] helps the people and government by providing broad scope in medical and health care[9] industry by performing various operations like bringing awareness of diseases, survey of health conditions in particular location and using decision support system to control the diseases.

From the huge amount of data, the data analyst tries to discover the relation and association within the data. Such analysis gives novel ideas to apply various strategies to improve the health, prevention of diseases, measures by the physician to provide better medical treatment to the patient. It also helps the government to apply various strategies and plans for the welfare of the population. Analysis performed by big data analytics on healthcare databases also provides other stakeholders like medical instruments manufacturing companies, researchers in medical field to develop better medical instruments and medicines   with high quality and low cost and better outcome. Big data analytics has the capability to analyze the treatment of patient, medicines usage, and response behaviors of patient after the care. Such results help to provide treatment with less cost and develop better tools and techniques [7]for the benefit of people. Results offered by data analytics also tries to identify the people who can get the benefits by changing their life styles. Big data analytics helps to publish useful information on medical [5] measures to be published through different media to reach the people to take precautions and reduce disease spreading in big scale.

This paper gives an overview of usefulness of the emerging big data analytics in healthcare system. Various features and advantages and applications of big data analytics are discussed in this paper.

BIG DATA ANALYTICS APPLICATIONS IN HEALTHCARE

With effective use of digitization, huge amount of information is available in healthcare system starting from the prescription of individual physician , group of doctors, to large hospitals and other organizations who come forward for take care of and provide facilities to patients. Such big data in healthcare organizations provide significant benefits to community. One

of the promising benefit is that the disease can be detected at an early stage through the analysis of such huge information and proper care and treatment can be provided immediately in an effective way to an individual.

Big data analytics in healthcare gives answers to abundant queries and investigations through the analysis of huge historical information about the patient family history, chronic diseases, nature of surgery or medication for the patient, benefits and side effects of the surgeries and medication, progress in health[3] , time to recover the healthy state after illness.

Big data analytics [2] can provide various measures to be taken to save expenditure in healthcare by the people and to lead healthy life by taking initial care through predictable information.

Big data analytics can show improvement and efficiency in the following areas :

i)   Analysis of disease patterns, tracking the disease and dealing with disease eruption. Such analysis can enhance the level of public health [9]and awareness and rapid actions to control the diseases.

ii)   Development of required vaccines by the medical researchers.

iii)   Conversion of large amounts of healthcare information into predictive models to recognize the requirements, services to be supplied, predict and impede health disaster for the benefit of people. .

Other areas in which big data analytics[6] give enhanced profit are identifying the patients who uses maximum health resources and are at the greatest risk for adverse outcomes. Data analytics provides individuals with the information they need to make decisions and can take the measures to deal with their own health and can adopt and follow healthier behaviors like various programs that are not costlier but bring provable benefits. One of the advantage of big data analytics in healthcare is to supervise the public health [9] by detecting the vulnerabilities during the health   disasters and bring together collectively various filed like medical, economic and effective data to act to effectively and productively in real life.

SIGNIFICANT FEATURES OF BIG DATA IN HEALTH CARE ENVIRONMENT

With the rapid development in internet technology, mobile devices, storage media, and fast processing technique facilitated the collection of huge amount of health information. Such information is growing day by day. Not only the healthcare system are providing the information relevant to patient, but other organizations which also support the financial benefit to the patient like insurance agencies and pharmacy industries are also contributing to this information growth. This accumulation of information will continue in coming years. The main aim of such bulk information is to analyze it, use it for the benefit and improve the health conditions in the society. Monetary benefit is not the main motive behind the collection and analysis of such information, but to utilize the effective tools, techniques and infrastructure

of big data and consider the output results for decision making and providing better facility to the population and increase the conditions of health level. Healthy people will create healthy society and nation.

Big data characteristics in healthcare data

From the recent past years there is exponential growth in the data produced, collected, shared, by different organizations. Such Huge data cannot be managed and processed by the conventional methods is called Big data. The features of big data are volume, variety, velocity, and veracity[1]. also termed as 4 V's. The various features of Big data and its relevance to Healthcare data are discussed below.

Velocity

The term velocity in terms of Big data is the pace at which the huge amount of data is created, collected, shared and stored and analyzed. The source of such information generations are emails, social media messages, photos, audio and video information etc. In addition to the generation, collection and analysis, the major requirement is that the data should also be up-to-date. Instant updation of websites as well as information like rail reservation, flight bookings and cancellation, credit card data   etc. should be done immediately with the same speed as the data is generated in real world. Big data technology performs data analysis while the data is in the generating stage.

In the manner mentioned above, with the development of technology , huge amount of healthcare data in electronic[8] format is also generated by various sources like, clinical reports, patient records, Details in social media regarding healthcare benefits, medical images etc. Such data in structured and unstructured format cannot be processed by traditional database management tools and techniques. Hence Big data analytics are required in healthcare industry to facilitate clinical decision support system.

Volume

Volume refers to the incredible quantity of information produced every second through social media, mobile phones, images, videos etc. Traditional database technology and techniques [7]cannot store and analyze such continuous increase in volume of information. Hence other techniques are used to divide the huge data into parts and store in various locations , perform computation on these parts of data and then analyze together by software. It is great challenge to collect and analyze such information where in real world a simple click on button produces new pictures, messages in social media. Like the growth in volume of other organizations information, healthcare information is also growing day by day in volume. This voluminous information is from healthcare centers, educational institutes, government offices, insurance companies, social media, medical transcripts, medicine research etc.

Variety

Development of technology facilitated the users to create different types of data .Today the data is not only in the structured format like tables, text, numeric values. Today most of the data is in digital form and unstructured form like photos, videos, social media updates, etc. Big data is the upcoming technology which allows both structured and unstructured data to be gathered, stored, and use it. In healthcare system most of the data is in the structured form of text like prescription, medicines names etc. Other data are in unstructured form pictures like scanning reports, graphical images, x-Rays etc. It means varirty of data from various sources. Such information is collected stored and maintained in computers for further processing and analysis. The big data analytics provides fast process helps the researchers and developers and patient with the required information very quickly compared to past few decades,

Veracity

Another feature of big data is Veracity. Collecting the information from various resources is not useful unless it is true. Most of the information produced, collected and shared through internet may not be correct. False information may give wrong results and mislead the user and society.Veracity is the quality or confidence and faith on the data which is collected, stored and published. Generally the whole information posted on social media like Twitter, facebook and emails may not be correct based on the content and its accuracy. The information must be true, accurate and must be updated with reference time, as the user requires the recent information for decision making. One good example is regarding the bank transaction updation details, updation of GPS data. Such databases must give the accurate results to the people. Big data analytics [10]helps to perform computation and analysis on such huge databases like GPS, banking, Weather reports, DNA information etc. and give the result which can be trusted by the people. Big data analytics results helps the society as well as an individual.

SUPPORT OF BIG DATA ANALYTICS IN HEALTH CARE DATABASES

There are number of reasons to implement big data analytics in healthcare databases. Data related to healthcare is generally available in different places, in difference formats, Generally the data in the organization is assumed to be in the structured form , but in healthcare system data from various sources consist of diverse kind of data like images, X-rays, graphs, text, handwritten information which are obtained from diagnosis centre, medicine details, doctor prescription etc. Such data are in the structured and unstructured form . Analysis on such diverse and complex kind of data is difficult for analysis with usual database management tools and techniques. With the fast development of computing technology, big data is the solution to effectively utilize the important value of such accumulated information. Big data is the best solution in the field of healthcare and improve the quality of human life. The main goal of big data in health care is not only to increase the profits and reduce time and other wastages, but to forecast the outbreak of diseases and its cure . This helps the society to lead a quality life. As the population is increasing day by day , the need of timely medical treatment and suggestion are very much essential and main source to fulfill these requirements is data .The data obtained from various sources like hospitals, diagnosis center, insurance companies etc. are very useful to assist the patient by giving an indication as warning message if the disease in in early stage and inform the person about the seriousness of disease and take preventive measures which will be less expensive compared the disease which is diagnosed at last stage and need costly treatment.

With the development of mobile phones and advanced quality and very useful Apps enable the users to access the information regarding their queries about personal health, small health tips, doctors, specialized hospitals for particular disease treatment. Such Apps helps the public to improve their life style. Not only queries submission, people can also post and share their health experiences through the social media. Today online information submission to any health organization is so easily accessible with a nice and interactive format that it can be predicted that within few years, the complete details of a patient will be available with the hospital and doctor when he visit the doctor first time to discuss about his illness .Access to huge information on the internet is to educate the public to identify their health problem by discussion through online or by accessing the general preventive remedies and cause of a disease. The huge information obtained from various sources like healthcare centers, diagnosis centre, general public opinion on social network, , insurance companies, banks etc. related to a patient should be compiled and should be created in an all-inclusive manner such that it can be demonstrated as a complete package of healthcare to a naïve user. Today big data has the potential to provide the meaningful outcome to this huge healthcare data. Figure below shows various modules of big data analytics in healthcare system.
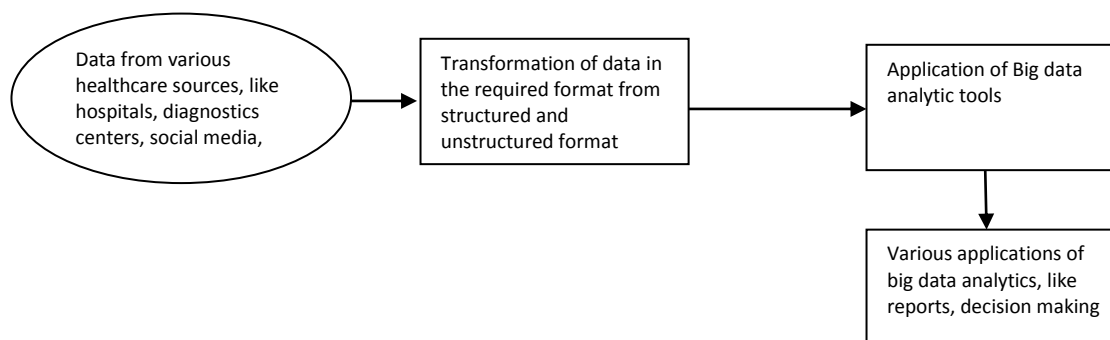
Figure 1: The conceptual model to use Big data analytics in healthcare system

Figure above shows the basic model of big data analytics in healthcare system. Data from various sources in electronic and various formats are collected and converted into required format. Then various big data analytic tools are applied on the transformed database which gives the output in the form of reports for analysis purpose.

CONCLUSION

The importance towards the healthcare is increasing with the increase in population. Today the people are more conscious about their personal healthcare and try to access the information from various sources.Lot of information is easily accessible The importance from various sources like social media, internet, hospitals, diagnosis centre, insurance companies. The cost reduction in computing process, storage and communication technology and mobile devices enabled the users to generate and access and store huge data. Such information can create value to it and provide knowledge, comfort, productivity, better,healthy society and in turn economical benefit. Big data in healthcare provides very sophisticated and fast analytic tools which works on the massive and diverse kind of information. The output of big data analytics in healthcare [10] databases enable the user to obtain the true information, and also increase the profits in many business sectors like insurance companies, banking, hospitals.

Solutions offered by big data in healthcare system, helps the users by providing the useful information about the disease predictions, hospital information, symptoms of health, and details of insurance companies who come forward to provide the financial benefits to the patients. Such useful information to the public with less expenditure improves the quality of life. Today to utilize the efficiency of big data in healthcare system many organizations, like medicine industry, insurance companies, diagnostic centers, banks are working together and coming forward with various new ideas and attempts to achieve the objective to provide better healthy society with less cost to the population.

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