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REVIEW ARTICLE

A REVIEW: BIG DATA IN HEALTHCARE CHALLENGES AND APPLICATION

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ABSTRACT

Big data is a term defining collection of large datasets. In this paper, the objective is to discuss the characteristics and challenges of big data in which the process is to extract the information from large sets of big data. Healthcare System is the organization of people, institution and resources that deliver health care services to meet the health needs of target population. The digital transformation of healthcare can help to simplify, unify and streamline existing processes across the patient journey from patient admission, in-house care and post discharge management .Now there are many healthcare systems which help in hospitals for patient's treatment but they cannot provide the interaction between the doctors. If there is a medical emergency due to some reasons like doctors are not available, so the patient moves from one place to another place. Recent research which targets utilization of large volumes of medical data while combining multimodal data from disparate sources is discussed. Potential areas of research within this field which have the ability to provide meaningful impact on healthcare delivery are also examined.

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INTRODUCTION

Big Data is a trendy which is reining the innovation market from quiet sometime. A tremendous measure of information frequently alluded to as Big Data is getting produced regular by various sections of ventures like business, fund, fabricating, human services, instruction, innovative work and so forth. The customary DBMS's and RDBMS's in market are unequipped for putting away such huge measure of information. We can't take full preferred standpoint of the concealed learning and data from this information as the customary information mining Calculations don't work successfully on this tremendous information. So there is need of creating and utilizing powerful, inventive devices and advances offered by Big Data. "In the event that you need to discover how Big Data is improving the world a place, there's no preferred case over the utilizations being found for it in social insurance." (Bernard Marr) The social insurance industry has produced tremendous measure of information till date which is measured in petabyte/Exabyte scale. As indicated by (Wullianallur Raghupathi and Viju Raghupathi, 2014), with such quickly developing rate of development of information, U.S. social insurance alone will soon achieve the zettabyte (1021 gigabytes) scale. The objective of social insurance industry is to investigations this enormous volume of information for obscure and valuable certainties, examples, affiliations and patterns with help of machine learning calculations, which can bring forth new line of treatment of sicknesses. The point is to give top notch social insurance at lower cost to all. This will profit the group and country all in all. The 5 V's of Big Data relevant to Healthcare are:

Volume: As mentioned earlier, healthcare industry generates prodigious data at staggering rate. The report from EMC and the research firm IDC anticipates an overall increase in health data of 48 percent annually. According to the report the volume of healthcare data in 2013 was 153 exabytes and it may increase to 2,314 exabytes by 2020 (Luke Dormehl).

Variety: Earlier, the emphasis had been on creating clinical information for patients with comparative side effects, putting away and breaking down it to infer the best course of treatment for the conceded persistent. Presently the social insurance industry is concentrating on entire human services, by giving a successful treatment through investigation of a patient's information from different sources as well. This refers to assortment. The fluctuated social insurance information by and large can be categorized as one of the three classes i.e. organized, semi organized and unstructured. For the most part the accompanying information is assembled: clinical information from Clinical Decision Support frameworks (CDSS) (doctor's notes, genomic information, behavioral information, information in Electronic Health Records (EHR), Electronic Medical Records (EMR)), machine produced sensor information, information from wearable gadgets, Medical

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Image information (from CT check, MRI, X Ray's and so on), restorative claim related information, doctor's facility's managerial information, national wellbeing register information, medication and surgical instruments expiry date ID in light of RFID data (Archenaa and Mary Anita, 2015), web-based social networking information like twitter sustains, Facebook status, site pages, websites, articles (Wullianallur Raghupathi and Viju Raghupathi, 2014).

Velocity: It refers to the speed at which new information is produced and moves around. The sensor gadgets and wearables gather ongoing physiological information of patients at a fast pace or speed. This new information being created each second represents a major test for information experts. Web-based social networking information additionally adds to speed as the clients sees, posts, and encourages scale up in seconds to huge sum in the event of pestilences/national debacles.

Veracity: It refers to dependability of information. Dissecting such voluminous, variable and quick paced information is a tropical storm undertaking. There is no degree for mistake particularly in basic social insurance arrangements where patient's life is in question. The essential point is to guarantee the information is solid. It is peaceful hard to guarantee the dependability of unstructured information for e.g. utilization of various terms/condensings for ailment/side effects, confused solutions because of terrible penmanship, false/fake remarks on social entrances, despicable readings from flawed machines/sensors, inadequate/incorrect information filled by patients and so forth.

Value: It refers to the nature of information. Ordinarily information from EMR's and EHR's are perceived as high approval information. Be that as it may, it is difficult to determine the estimation of information from online networking. The compelling investigation of high esteem information can prompt better quality, powerful human services arrangements and developments.

PHASES IN THE BDA (Big Data Analytics) PROCESS

We can define taken up while performing BDA Process to the information mining learning disclosure ventures as takes after:

- **Information securing and capacity:** as of now said the information is sustained to the framework through numerous outer sources like clinical information from Clinical Decision Support frameworks (CDSS), EMR, EHR, machine produced sensor information, information from wearable gadgets, national wellbeing register information, tranquilize related information from Pharmaceutical organizations, online networking information like twitter encourages, Facebook status, site pages, sites, articles and numerous more (Wullianallur Raghupathi and Viju Raghupathi, 2014). This information is either put away in databases or information distribution center. With coming of distributed computing, it is advantageous to store such voluminous information on the cloud as opposed to on physical circles. This is more practical and reasonable approach to store information.
- **Data cleaning:** The information which has been obtained should to be finished and should to be in an organized configuration, for performing compelling investigation. By and large it is found in that medicinal services information from defects like, numerous patients don't share their information totally like information about their dietary propensities, weight and way of life. In such cases the void fields should be dealt with fittingly. Another illustration can be for e.g.: for field like Gender of individual, there can be at most one of two esteems i.e. male or female. On the off chance that some other esteem or no esteem is available then such passages need to stamped and took care of likewise. The information from sensors, remedies, medicinal picture information and online networking information should be communicated in an organized shape appropriate for examination (Agrawal *et al.,* 2012).
- **Data integration:** The BDA process uses data accumulated across various platforms. This data can vary in metadata (the number of fields, type, and format). The entire data has to be aggregated correctly and consistently into a dataset which can be effectively used for data analysis purpose. This is a very challenging task, considering the big volume and variety of big data.
- **Data querying, analysis and interpretation:** Once the data is cleaned and integrated, the next step is to query the data. A query can be simple query like for eg: What is mortality rate in a particular region or complex query as how many patients with diabetes are likely to develop heart related problems in next 5 years? Depending on the complexity of the query, the data analyst has to choose appropriate platform and analysis tools.

A large no. of open source and restrictive stages and instruments are accessible in market. Some of them are Hadoop, Map Reduce, Storm, Grid Grain. Huge information databases like Cassanadra, HBase, Mongo DB, CouchDB, Orient DB, Terrastore, Hive etc. Data Mininginstruments like RapidMiner, Mahout, Orange, Weka, Rattle, KEEL and so on. Record frameworks like HDFS and Gluster. Programming dialects like Pig/PigLatin, R, ECL. Enormous information seek devices like Lucene, Solretc. Data Aggregation and exchange devices like Sqoop, Flume, Chukwa. Different instruments like Oozie, Zookeeper, Avro, and Terracotta. Some open source stages are additionally accessible like Lumify, IKANOW (Cynthia Harvey). The criteria for stage assessment can fluctuate for various associations. For the most part the usability, accessibility, the capacity to deal with voluminous information, bolster for representation, excellent confirmation, cost, security can be a portion of the factors to choose the stage and instrument to be utilized.

HEALTHCARE BIG DATA

Improving healthcare services and reducing medical cost are a definitive objectives of countries around the world. Be that as it may, the upsets of social insurance information measure remains an obstruction that frustrate accomplish this objective. In 2012, overall computerized social insurance information was assessed to be equivalent to 500 petabytes and is required to achieve 25,000 petabytes in 2020 (Sun and Reddy, 2013). Clearly, catching, putting away, looking, sharing and investigating such huge information to discover helpful bits of knowledge will enhance the results of the social insurance frameworks through more brilliant choices and will bring

down medicinal services fetched too, in any case, customary database administration devices are no longer reasonable to prepare these information. New effective calculations are required to finish this errand. For instance, in the United States, more than 71 million people are admitted to healing centers every year, as indicated by the most recent study from the American Hospital Association. Considers have inferred that in 2006 well over $30 billion was spent on superfluous healing facility confirmations. The Heritage Provider Network (HPN) emerges the question: "Would we be able to distinguish prior those most at hazard and guarantee they get the treatment they need?" and it trusts that the appropriate response is "yes". To accomplish its objective of building up a leap forward calculation that utilizations accessible patient information to anticipate and avert pointless hospitalizations, HPN supported the Heritage Health $3 Million Prize Competition. Winning arrangements will utilize a mix of a few prescient models and the triumphant group will make a calculation that predicts how long a patient will spend in a healing center in the following year. Once known, HPs can grow new care arrangements and systems to achieve patients before crises happen, in this manner lessening the quantity of superfluous hospitalizations. This will bring about expanding the strength of patients while diminishing the cost of care (Sun and Reddy, 2013).

Big data analytics is motivated in healthcare through the following aspects (Sun and Reddy, 2013):

- Healthcare data is now growing very rapidly in terms of size, complexity, and speed of generation and traditional database and data mining techniques are no longer efficient in storing, processing and analyzing these data. New innovative tools are needed in order to handle these data within a tolerable elapsed time.
- The patient's behavioral data is captured through several sensors; patients' various social interactions and communications.
- The standard medical practice is now moving from relatively ad-hoc and subjective decision making to evidence-based healthcare.
- Inferring knowledge from complex heterogeneous patient sources and leveraging the patient/data correlations in longitudinal records.
- Understanding unstructured clinical notes in the right context.
- Efficiently handling large volumes of medical imaging data and extracting potentially useful information and biomarkers.
- Analyzing genomic data is a computationally intensive task and combining with standard clinical data adds additional layers of complexity.

BIG DATA

Big data is a concept which is used to describe a huge amount of data which is collected from various individuals, organizations etc… that may either be structured or unstructured. It becomes very difficult to process such data using traditional database models like (DBMS, RDMS) and software methodologies. A most important concern is that, if the volume of data is too big or it moves too fast or it exceeds current processing capacity, then it becomes a risky one. Big data has the ability to provide, improve operations and it makes process faster, and take more intelligent decisions for the organizations. It gets origin from Web search companies who had the problem of querying very large distributed aggregations of loosely-structured data (XML, XHTML and web based document).

Big Data Use Cases

Big data in health-care refers to the patient care data such as physician notes, Lab reports, X-Ray reports, case history, diet regime, list of doctors and nurses in a particular hospital, national health register data, medicine and surgical instruments expiry date identification based on RFID data. Healthcare organizations are depending on big data technology to capture all of this information about a patient to get a more complete view for insight into care coordination and outcomes-based reimbursement models, health management, and patient engagement.

Need for Big Data Analytics in Healthcare

To improve the quality of healthcare by considering the following:

Providing patient centric services: To provide faster relief to the patients by providing evidence based medicine-- detecting diseases at the earlier stages based on the clinical data available, minimizing drug doses to avoid side effect and providing efficient medicine based on genetic makeups (1). This helps in reducing readmission rates thereby reducing cost for the patients.

Detecting spreading diseases earlier: Predicting the viral diseases earlier before spreading based on the live analysis. This can be identified by analyzing the social logs of the patients suffering from a disease in a particular geo-location (1). This helps the healthcare professionals to advise the victims by taking necessary preventive measures.

Monitoring the hospital's quality : Monitoring whether the hospitals are setup according to the norms setup by Indian medical council. This periodical check-up helps government in taking necessary measures against disqualifying hospitals.

Improving the treatment methods: The Customized patient treatment monitor the effect of medication continuously and based on the analysis dosages of medications can be changed for faster relief. Making an analysis on the data generated by the patients who already suffered from the same symptoms helps doctor to provide effective medicines to new patients.

Need for Big Data in Government

Big data analytics helps government in building smart cities by providing faster and reliable services to its citizens. Addressing Basic Needs Quickly: Today people need to wait for a long time to get EB, telephone, water, ration card and gas connection. These are the basic needs of citizen. It is the responsibility of the government to provide these services as quick as possible (3). Big data analytics plays a major role in achieving it because the data will be analysed on daily basis. People who are in need will be served immediately. Providing quality education: Education is one of the valuable assets that can be given to the children. It is the duty of government to provide quality education to children. BDA provides detailed report of children who are in the age to be admitted to the school. This helps government to assess the educational needs for these children immediately.

To reduce unemployment rate: To minimize unemployment rate by predicting the job needs before based the literacy rate. This can be achieved by analysis the students graduating each year. It enables government to arrange for special trainings in order to build young entrepreneurs.

Other Benefits

- To provide pension to senior citizens without any delay.
- To ensure that benefits provided by government reaches all the people.
- To control traffic in peak times based on the live streaming data about vehicles.
- To monitor the need for mobile ambulance facilities.

LITRATURE SURVEY

Ahuja *et al.* (2012) comprehensively looked into utilization and thought focuses in executing cloud human services framework. They recognized that the most vital focuses are framework and number of workplaces. Foundation has extraordinary impact since the vast majority of the medicinal services offices and office areas were assembled years prior and can't utilize cloud frameworks. Number of offices is essential on operation of wellbeing association and whether their IT foundation is appropriated between offices or is in a solitary datacenter. Moving to the cloud would help correspondence, application, and joint effort between wellbeing associations. Distributed computing lessens working expenses, in light of the fact that the requirement for IT staff in every office is lower and general IT spending plan is decreased.

Dai *et al.* (2012) recognized four bioinformatics cloud administrations. Those are DaaS (information as an administration), SaaS (programming as an administration), PaaS (stage as an administration), and IaaS (foundation as an administration). Bioinformatics produces immense measure of crude information and they ought to be accessible for information examination through DaaS. Furthermore, a vast assorted qualities of programming devices is fundamental for information investigation and SaaS is given as a choice in with respect to this issue. Stage as an administration gives programmable stage to improvement, testing, and conveying arrangements on the web. IaaS offers a total PC foundation for bioinformatics investigation.

As **Schatz *et al.* (2010)** expressed, sequencing of DNA chain is enhancing at a rate of around 5-overlay every year, while PC execution is multiplying just every 18 or 24 months. Hence, tending to the issue of planning information investigation emerges as a question. A down to earth answer for taking care of this issue is to focus on creating techniques that improve utilization of various PCs and processors, where distributed computing develops with promising results. They expressed that Hadoop/MapReduce innovation is especially appropriate, from genomic perspective, for examination of DNA grouping. TheCrossbow genotyping programleverages Hadoop/ MapReduce to dispatch many duplicates of the short perused in parallel utilizing of Hadoop/MapReduce and Crossbow for more prominent outcomes. In their benchmark test on the Amazon cloud, Crossbow Hadoop/MapReduce broke down 2.7 billion information focuses in around 4 hours, which incorporated the time required for transferring the crude information, for an aggregate cost of $85 USD. Alongside this, they depicted impediments which can posture noteworthy boundary in investigation of DNA arrangement.

Chae *et al.* (2013) concentrate on two developing issues in bioinformatics information examination. Those are calculation control and enormous information examination for the biomedical information. Biomedical examination requires huge figuring power with enormous storage room. They proposed BioVLab as a reasonable foundation on the cloud, with a graphical work process maker which gives a productive approach to manage these issues. BioVLab comprises of three layers. The primary layer is a graphical work process motor, called XBaya, which empowers the creation and administration of logical work processes on a desktop. The second layer, portal, is an electronic examination apparatus for the coordinated investigation of microRNA and mRNA expression information. Investigation is done on Amazon S3 Interface, which introduces third layer of engineering. Information and charges from passage are exchanged to cloud, which dissect information and profit results to client for desktop. They stressed that investigation of bigmedical information requires utilization of suitable devices and databases from an immense number of instruments and databases; in this way utilizing cloud would not tackle issues of computational power and huge information examination.

Liu and Park (2013) concentrated on difficulties and adjustment of e-human services cloud systems.This framework develops the cloud worldview with a specific end goal to fulfill worldwide requests in computerized medicinal services applications. In this way, innovation, social insurance process, and administration are recognized as the primary qualities of medicinal services cloud frameworks. Additionally, new difficulties emerged by the one of a kind necessities of the e-medicinal services industry for utilizing cloud administrations for direction, security issues, get to, intercloud network, and asset conveyance.

Fujita *et al.* (2013) called their usage "Cloud Cardiology®", specifying, that "a cloud server empowers to share ECG at the same time inside and outside the healing facility". No place in the further article itself, notwithstanding, are any points of interest displayed why this server should be a "cloud server" and not only a secured webserver for a telemedicine application, which gives a wellbeing data trade stage in the web.

Wang *et al.* (2014) propose in their calculated work a half breed distributed computing condition to store information from individual wellbeing sensors worn at the body, for example, ECG sensors and to perform handling errands. The reason for the cloud is to quicken calculation escalated preparing undertakings by moving them to the cloud server and in this way expand the battery life of cell phones.

Yoshida *et al.* (2012) depict the execution of a structure for dispersed picture handling and emphatically assessed the execution picked up by utilizing all the more preparing units. Be that as it may, the assessment utilized multi-center CPUs in a solitary machine and the exchange to cloud-conditions is specified just as an extra theoretical plausibility.

Avila-Garcia (2008) depicts the goals of a Microsoft-subsidized venture to execute a virtual research condition to bring down the hindrances to malignancy imaging. While the

paper refers to some lattice systems and enrolls some broad elements required by specialists, no unequivocal connections to cloud advances are given while portraying the capacities to be executed.

Botts *et al.* (2011) portray a pilot contemplate named HealthATM which is a cloud-based individual wellbeing framework to give people from underserved populace gatherings (i.e. individuals without medical coverage) with moment access to their wellbeing data. The creators see distributed computing as an approach to give expansive access to wellbeing information to populace gatherings however don't clarify how this exceptionally adaptable cloud engineering was executed in detail, in light of the fact that the fundamental concentrate of the paper was on the acknowledgment and ease of use of an individual electronic wellbeing records framework in underserved populaces.

CHALLENGES

- Data related issues can arise without effective management and governance, and these include unreliable, inaccessible, missing, or inaccurate data.
- The concept of big data has been introduced to the healthcare system as a solution to a variety of healthcare related information system problems as health systems grown increasingly complex and expensive.
- Molecule-level data frequently experiences the problem of “high dimensionality,” where the data has a large number of independent attributes; this is because molecule-level data tends to have thousands (or tens of thousands) of possible molecules, configurations of molecules, or molecule-molecule interactions, and these are represented in datasets as features.
- There are a number of issues that arise when dealing with these vast quantities of data, especially how to analyze this data in a reliable manner.
- Due to privacy issues it was decided to use synthesized electronic medical health records (EMR) and PHRs with help from a medical professional.

IMPORTANCE

- Applications from Big Data are innumerable, from retail industry where Big Data helps retailers gain insights into the customer to needs and habits, to Banking, HealthCare & Hospitality.
- The sheer volume of data generated these days by real time applications and other data sources such as twitter feeds, photos, videos on social media, click streams of web, sensor-enabled equipment is so mammoth it runs to petabytes and exabytes of data.
- In addition to just having more data, Big Data also generally refers to the application of machine learning for analyzing the data sets.
- One of the advantages of big data is the ability to go beyond improving profits and cutting down on wasted overhead to predict epidemics, cure disease, improve quality of life and avoid preventable deaths.
- An on-premise Hadoop based healthcare data management system is proposed showcasing the importance of Big Data Analytics and the way it could help the health care industry to grow and provide the quality of service to patients.

DISCUSSION

In past various works surveyed by various Authors, we look at about different or many present research thought as far as idea of the Big Data, Information and Communication innovation, Healthcare which are offered us to Even however enormous information advances appear to be overhyped and guaranteed to have awesome potential in the area of pharmaceutical, if the improvement happens in the incorporated condition in mix with other demonstrating techniques, it will going to guarantee an unvarying upgrade of in-silico solution and prompt positive clinical selection. This proposed research is wanted to investigate the significant issues to have a viable mix of huge information examination and productive demonstrating in human services. We live in on-request world with lion's share of information. Individuals and gadgets are always creating information, while gushing a video, dynamic in web-based social networking, playing amusements, seek any area utilizing GPS. This information increment step by step from numerous assets, different sorts of methods and advancements. The information is classes as "Large Data". Enormous Data is gigantic in Variety, Velocity and Sheer volume. It is organized and unstructured information and heterogeneous in nature. The objective of Big Data investigation is to remove helpful esteems, recommend conclusions or potentially bolster basic leadership. In this theme, we give a broad overview of enormous information investigation inquire about, while highlighting the particular worry in huge information world. As per Application development, we examine six sorts of huge information application, for example, organized information examination, Text investigation, Web investigation, Multimedia investigation, and Mobile examination. We present a structure for Healthcare Information Systems (HISs) in light of huge information examination in versatile distributed computing conditions. This system gives an abnormal state of coordination, interoperability, accessibility and sharing of human services information among social insurance suppliers, patients, and specialists. Electronic Medical Records (EMRs) of patients scattered among various Care Delivery Organizations (CDOs) are incorporated and put away in the Cloud stockpiling territory, this makes an Electronic Health Records (EHRs) for every patient. Portable Cloud permits quick Internet get to and arrangement of EHRs from anyplace and whenever by means of various stages. Because of the gigantic size of social insurance information, the exponential increment in the speed in which this information is produced and the many-sided quality of medicinal services information sort, the proposed system utilizes huge information investigation to discover valuable experiences that help professionals take basic choices in the ideal time.

Conclusion

This paper presents the overview of Big data in healthcare, the features of big data, the stakeholders of the data and the challenges dealing with the big data in healthcare informatics. Despite many opportunities and approaches for big data analytics in healthcare presented in this work, there are many other directions to be explored, concerning various aspects of healthcare data, such as the quality, privacy, timeliness, and so forth. Computational health informatics in the big data age is an emerging and highly important research field with a

potentially significant impact on the conventional healthcare industry .The future of health informatics will benefit from the exponentially increasing digital health data.

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