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Research Article

THE IMPACT OF BIG DATA APPLICATIONS IN HEALTH CARE INDUSTRY

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ABSTRACT

With the advent of new technologies, devices and communication means like social networking sites the amount of data produced by mankind is increasing every year. Though the information produce is meaningful, it can be useful only with proper data analytics. There is a vast amount of data generated in the healthcare industry in recent years. This paper discusses about the recent research of big data tools and approaches for the analysis of healthcare informatics data gathered at various levels. The data thus collected is to be structured and analyzed for finding possible solutions. In this paper we use the predictive analysis algorithm in Hadoop and Map Reduce to predict the diabetes prevalent, complications associated with it and the type of treatment to be provided. The result is predicted based on the analysis of big data in an efficient way to cure and care the patients.

INTRODUCTION

The important challenge in the health care industry is the collection and processing of massive and heterogeneous data generated through record keeping, compliance and patient related data. The data such generated should be analyzed effectively to predict answers to the challenges that arise. There should be a technology to be built that performs real time analysis on the collected data sets. This will

provide instant results to the patients on analyzing with suitable parameters. This will be achieved by means of applications of big data. It helps in discovering valuable decisions by understanding the data patterns and the relationship between them with the help of machine learning algorithm. This paper provides an overview of big data analytics in healthcare and government system. It also describes the characteristics of big data, security issues in handling them and the application of big data to predict the result of the data sets.

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.

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Improving The Treatment Methods:Customized patient treatment-monitoring the effect of medication continuously and based on the analysis dosages of medications can be changed for faster relief. Monitoring patient vital signs to provide proactive care to patients. 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.

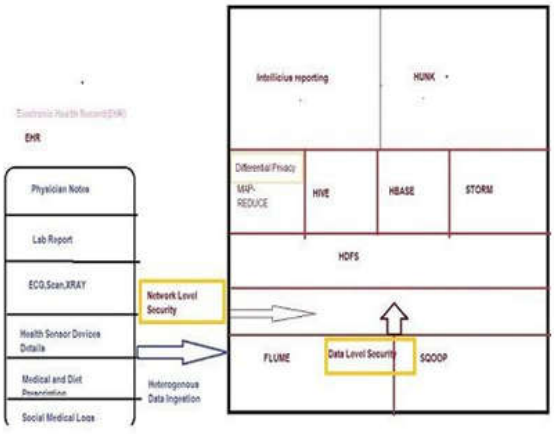
Addressing Basic Needs Quickly: Today people need to wait for a long time to get EB, telephone, water, ration card and gas connection. These are the basic needs of citizen. It is the responsibility of the government to provide these services as quick as possible(3). Big data analytics plays a major role in achieving it because the data will be analyzed 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(9). 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

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



The Secured Big Data architecture of healthcare is shown in figure 1. Electronic health record is a heterogeneous data set which is given as input to HDFS through flume and sqoop. Analysis on the data is performed using Map-Reduce and HIVE by implementing machine-learning algorithms which helps in analysing similar pattern of data. This helps in predicting the risk of patient health condition at the earlier stages. Hbase is used for storing the multi-structured data. STORM is used to perform live streaming and any emergency conditions such as patient temperature rate falling beyond the expected level can be intimated to care-takers immediately through AWS Lambda function. Report is generated through intellicius and hunk.

Big Data Ecosystem for Healthcare and Government

It is a complex system that constitutes of components and technologies to handle large scale data processing and analytics on it. It includes getting the data from various sources, store them in HDFS (Hadoop Distributed File System), process the data using Hadoop components such as Map-Reduce, perform analysis using PIG and generate Business Intelligence reports such as patient scorecards.

Big Data Lifecycle

Data Collection: It involves the collection of data from various sources and storing it in HDFS. Data can be anything such as case history,medical images, social logs, sensor data etc.

Data Cleaning: It involves the process of verifying whether there is any junk data or any data that has missed values. Such data needs to be removed.

Data Classification: It involves the filtering of data based on their structure. For example Medical Big data consists of mostly unstructured data such as hand written physician notes. Structured, semi-structured and unstructured data should be classified in order to perform meaningful analysis.

Data Delivery: It involves the generation of report based on the data modelling done. Based on the example after the data is processed it will generate a report based on malnourished children in a particular location. This will help the government to take necessary measures to avoid any further complications. At the all the stages of BDLC (Big Data Lifecycle) it requires data storage, data integrity and data access control.

Secured Big Data Architecture

The Security Challenges Faced by the big Data Processing in Distributed Environment are as Follows

1. To provide network level security
2. To provide authentication for users, nodes and applications involved in distributed environment.
3. To enable logging in distributed environment for identifying the malicious hackers.

The above figure represents secured layered architecture for BDA. Network level security is enforced by using SSL for the communication through RPC between distributed nodes. Two-way authentication can be provided for the data at rest and data in motion. Data stored in database can be encrypted. Data can be transmitted between nodes can encrypting it with Attribute based encryption method. This is effective in preventing the data from malicious users. Inbuilt logging can be implemented in JVM of Map-Reduce using differential privacy to store the user identity where the map-reduce job is done[(2)]. This helps to identify who is responsible for the leakage of sensitive data.

HDFS Architecture

Hadoop effectively handles the large data set. The below figure represents how a client contacts namenode for processing the data. Namenode communicates to Job Tracker and assign the task given by the client for eg to find out the list of patients who are in the risk of getting diabetes. Map reduce program performs the analysis on the data and returns the results to job tracker[(4)]. It also returns the block where the client can store its data. HiveQL is used to perform the data-warehousing task and it can also be combined with map-reduce program.

PIG provides the platform for analysing large data sets through parallel computations. The daemons in HDFS are

Name node: It is the master node which receives the request from the client (example patient monitoring system). It looks up the Meta data to find out which is the suitable data node for storing the data related to the client. It selects data node based on the locality and available free slots.

Secondary Name Node: It is the backup node for the name node. It stores the fsimage file which contains the details about the data node. Fsimage has to be restored from the secondary name node when name node fails.

Job Tracker: Map reduce program running in job tracker assigns job to the data node and task tracker. Data node stores the actual data and it periodically sends heartbeat to the name node about the data stored. Task tracker performs the task assigned by job tracker.

CONCLUSION

There is a lack of information in the analytics industry to perform the analysis task. The big data stored when analyzed will give future predictions for the health care problems. . To successfully identify and implement big data solutions and benefit from the value that big data can bring, government need to devote time, allocate budget and resources to visioning and planning. This big data tool is helpful in analyzing the data and for future predictions for curing diseases.

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