Applications of Data Analytics in Healthcare

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Abstract

In the information era, enormous amounts of data have become available on hand to decision makers. Data analytics refers to datasets that are not only big, but also high in variety and velocity, which makes them difficult to handle using traditional tools and techniques. Due to the rapid growth of such data, solutions need to be studied and provided in order to handle and extract value and knowledge from these datasets. Analysis of these data requires a lot of efforts at multiple levels of knowledge extraction for effective decision making. Big data analysis is a current area of research and development. Additionally, it opens a new horizon for researchers to develop the solution, based on the challenges and open research issues.

Key words: Data analytics, Massive data, structured data, unstructured Data

1. Introduction

Data analytics is the process of interpreting quantitative data to reveal qualitative insights, answer questions, and identify trends. We can analyze data manually or with the help of software and algorithms. Visualizing data by creating graphs and charts can be useful for designing presentations and showing trends.

In health care, decisions often have life-altering outcomes—both for patients and the population as a whole. The ability to quickly gather and analyze complete, accurate data enables decision-makers to make choices regarding treatment or surgery, predict the path of large-scale health events, and plan long-term.

Data analytics can provide a foundation for sound, impactful decision-making working directly with patients or a health care administrator dealing with the industry's business side,

There are four key types of data analysis:

- Descriptive analysis, which examines and describes something that's already happened
- Diagnostic analysis, which seeks to understand the cause of an event

• Predictive analysis, which explores historical data, past trends, and assumptions to answer questions about the future

• Prescriptive analysis, which identifies specific actions an individual or organization can take to reach future outcomes or goals

In health care, all four types can be used. For example:

• Descriptive analytics can be used to determine how contagious a virus is by examining the rate of positive tests in a specific population over time.

• Diagnostic analytics can be used to diagnose a patient with a particular illness or injury based on the symptoms they're experiencing.

• Predictive analytics can be used to forecast the spread of a seasonal disease by examining case data from previous years.

• Prescriptive analytics can be used to assess a patient's pre-existing conditions, determine their risk for developing future conditions, and implement specific preventative treatment plans with that risk in mind.

2. Literature review

Multifaceted and huge datasets have various types of different and important features that are closely in resemblance with "Big Data". To administer these datasets is troublesome with the traditional information preparing frameworks. Furthermore, data storage, data transition, data visualization, data penetrating, data analysis, data security, data privacy violations and sharing propose different uphill challenges that the "Big Data" reinforces [1].

Data is processed in limited reckoning arrangements. Even the technologies introduced to support BD contain different variety of presentations, which ultimately make it hard to stimulate the creation of tools and applications to help encompass data from numerous sources. This study therefore identifies possible areas for uniformity within the BD technology expanse [2].

Data Analytics is a strategy used to analyze colossal information sets containing assorted qualities of information sorts, for example, enormous information to reveal every single shrouded example, obscure relationship, advertise drift, client inclinations and other supportive business data. These demonstrative outcomes could prompt to proficient advertising, new income openings, enhanced client benefit, enhanced operational skill, and upper hands over contender associations and different business repayment [3].

Analytics can be classified in to three types they are: Predictive Analytics, Descriptive Analytics and Prescriptive analytics [9].

Data is nearly ubiquitous. Every business such as health or general living standards could apply big data analytics. Big data is a field which can be used in any area whatsoever given that this big quantity of data can be harnessed to one's advantage. The major applications of big data are listed below [4].

Digitalisation refers to a next-generation of maintenance paradigm aiming to use sensors, manufacturing execution systems (MES) and so on to collect data. This collection of digital data enables the use of statistical and machine-learning methods to improve productivity in the maintenance process [5].

Preventive maintenance still remains as a standard approach for a huge number of manufacturers. This means that maintenance is carried out after a specific time or after a certain number of process steps have been completed by a piece of equipment or machine [6].

A modern manufacturing company's processes generate vast amounts of data from its interconnected information systems, machines and equipment [7].

The historical data stored in databases and real-time sensor data from production processes can be analyzed and used as a source of information and knowledge. This can improve many aspects of the company, including maintenance. Data analysis can be carried out by applying different types of analytic methods and using a variety of different technologies, including data mining, exploratory analysis, machine learning. Depending on the way the data is analysed and the knowledge intended to be gained from the analysis, the approaches can be classified as descriptive, diagnostic, predictive or prescriptive [8].

3. Materials and Methods

Hadoop is unique cloud calculating contexts to obtain verified to gauge and achieve sound on clouds. Presently, numerous recognized enterprises develop tenders constructed proceeding Hadoop, to say as Yahoo, Face book and etc. Hadoop , which is mainly instrument made of java for MapReduce(disseminated organization) industrialized by the Apache Software Foundation, so as is extremely error -prone and is considered near be installed on few expensive component, Hadoop customs hadoop disseminated file system(HDFS) towards sustenance the less - phase dispersed packing. HDFS affords from top to bottom material admittance to submission numbers and is appropriate meant for submissions that consume enormous records.

4. Applications of data analytics in health care

Data analytics can have far-reaching effects on the health care industry. Followings are the key application areas of healthcare –

- **Evaluating and Developing Practitioners**

Data gathered from patients regarding their experiences with medical practitioners can be analyzed to reveal areas for improvement. By analyzing patient-reported data, Riess discovered that training could increase physicians' empathy, which has been associated with greater patient safety and fewer malpractice claims.

- **Detecting Anomalies in Scans**

Another way to leverage data analytics in health care is with machine-learning algorithms. When used correctly, algorithms can analyze data more quickly and efficiently than humans.

- **Predicting Outbreaks**

Data analytics can also predict trends in the spread of illness, allowing doctors' offices, hospitals, schools, and individuals to adequately prepare.

- **IoT for Big Data Analytics**

Internet has restructured global interrelations, the art of businesses, cultural revolutions and an unbelievable number of personal characteristics. Currently, machines are getting in on the act to control innumerable autonomous gadgets via internet and create Internet of Things (IoT). Thus, appliances are becoming the user of the internet, just like humans with the web browsers. Internet of Things is attracting the attention of recent researchers for its most promising opportunities and challenges.

It has an imperative economic and societal impact for the future construction of information, network and communication technology. The new regulation of future will be eventually, everything will be connected and intelligently controlled. The concept of IoT is becoming more pertinent to the realistic world due to the development of mobile devices, embedded and ubiquitous communication technologies, cloud computing, and data analytics.

IoT presents challenges in combinations of volume, velocity and variety. In a broader sense, just like the internet, Internet of Things enables the devices to exist in a myriad of places and facilitates applications ranging from trivial to the crucial. Conversely, it is still mystifying to understand IoT well, including definitions, content and differences from other similar concepts. Several diversified technologies such as computational intelligence, and big-data can be incorporated together to improve the data management and knowledge discovery of large scale automation applications.

- **Quantum Computing for Data Analysis**

A quantum computer has memory that is exponentially larger than its physical size and can manipulate an exponential set of inputs simultaneously. This exponential improvement in computer systems might be possible.

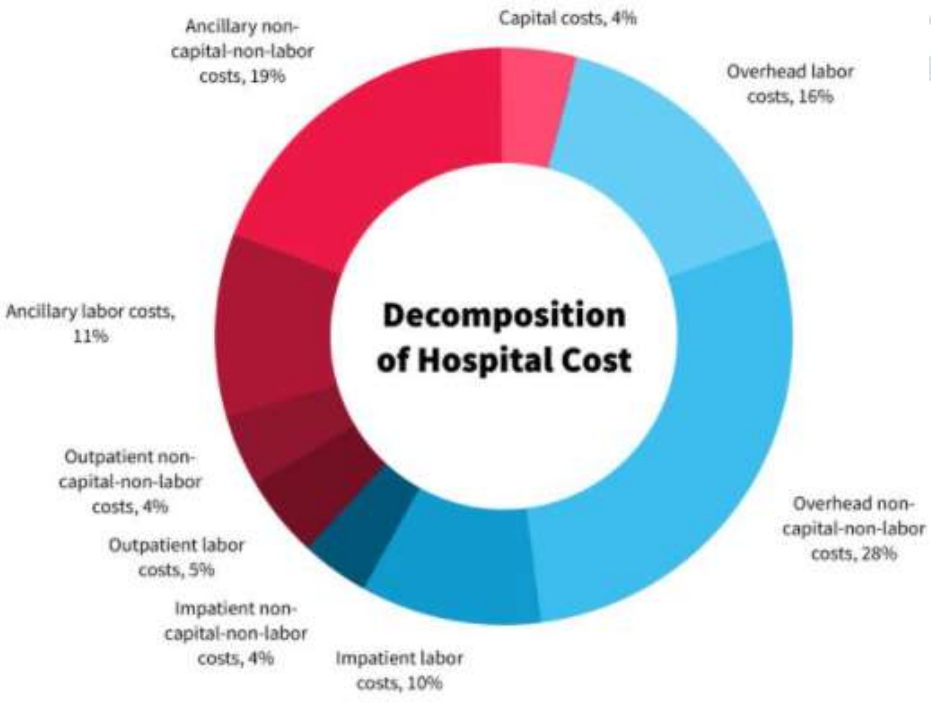
If a real quantum computer is available now, it could have solved problems that are exceptionally difficult on recent computers, of course today's big data problems. The main technical difficulty in building quantum computer could soon be possible. Quantum computing provides a way to merge the quantum mechanics to process the information. In traditional computer, information is presented by long strings of bits which encode either a zero or a one. On the other hand a quantum computer uses quantum bits or qubits. The difference between qubit and bit is that, a qubit is a quantum system that encodes the zero and the one into two distinguishable quantum states. Therefore, it can be capitalized on the phenomena of superposition and entanglement. It is because qubits behave quantumly. For example, 100 qubits in quantum systems require 2100 complex values to be stored in a classic computer system. It means that many big data problems can be solved much faster by larger scale quantum computers compared with classical computers. Hence it is a challenge for this generation to built a quantum computer and facilitates quantum computing to solve big data problems.

5. Results and Discussion

Predictive analytics is a branch of advanced analytics aimed at making a prognosis of future events based on the available data. These forecasts can then be used to make critical decisions, identify conditions early on, and avoid the risk of complications.

Using the data from multiple sources, with the help of advanced predictive analytics methods, the healthcare industry will be able to:

- Improve chronic disease management;
- Avoid hospital readmission;



- Get assistance with medical research;

- Reduce overhead costs (that account for 44% of a total hospital budget).

The predictive analytics use cases in healthcare, let's determine the main fields of use for predictive analytics:

- **Diagnosis** – predictive analytics can be used to determine the correct condition the patient has based on the predicted progression of their state;

- **Prognosis** – based on current and historical data, predictive analytics can help to foresee how the condition will progress and how it would respond to specific treatments;

- **Designing treatment course** – based on the diagnosis and the prognosis, predictive analytics can help to determine the correct course of action when it comes to the most effective patient treatment;

- **Clinical decision support** – clinical decision support system based on predictive analytics will help physicians to act at just the right time to seize the opportunity to help the patient;

- **Remote monitoring** – with the right equipment, predictive analysis can easily be conducted remotely;

- **Reducing adverse events** – using predictive analytics in healthcare can help to detect the potential for adverse events, like the chronic disease exacerbation, medication side effect manifestation, and others early on, thus offering a possibility to avoid them;

- **Improving care quality** – using predictive analytics increases the efficiency and accuracy of care provided, thus being higher quality from the alternatives;

- **Reducing healthcare costs** – predictive analytics can be used to better manage the hospital resources, thus lowering certain expenses connected to an unexpected crisis;

- **Fraud detection** – fraud in healthcare is a common problem, and billions of dollars are lost to it every year. Predictive analytics, enhanced with trained machine learning models, can identify certain abnormalities that mark the fraudulent actions, thus helping to catch on to them early on.

Conclusion

It explains on the ideas of big data took after by the applications and the difficulties confronted by it. At long last we have discussed the future open doors that could be saddle in this field. Big data is an advancing field, where a significant part of the research is yet to be finished. The data measure in all territories is detonating every day. The speed and variety of data development is expanding because of the expansion of sensor and cell phones with web association. Data produced by this way, is the best resource for enterprises in defining business procedures polices. Cloud services were utilized to prepare and break down tremendous measure of data and it has transformed into the new Big Data model to take care of the on-demand administrations.

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