International Journal of Scientific Research and Engineering Development-– Volume 4 Issue 4, July- Aug 2021

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Applications of Big Data Analytics in Healthcare Management Systems

Shreyas Nopany *, Prof. Manonmani S**

*Department of Computer Science and Engineering, R. V. College of Engineering, Bengaluru, India

shreyasnopany.cs17@rvce.edu.in

** Department of Computer Science and Engineering, R. V. College of Engineering, Bengaluru, India

manonmanis@rvce.edu.in

----------**********----------

Abstract:

The healthcare industry has become increasingly demanding in recent years. The growing number of patients makes it difficult for doctors and staff to manage their work effectively. In order to achieve their objectives, data analysts collect a large amount of data, analyze it, and use it to derive valuable insights. Data analytics may become a promising solution as healthcare industry demands increase. The paper discusses the challenges of data analytics in the healthcare sector and the benefits of using big data for healthcare analytics. Aside from focusing on the opportunities that big data analytics has in the healthcare sector, the paper will also discuss data governance, strategy formulation, and improvements to IT infrastructure. Implementation techniques include Hadoop, HDFS, MapReduce and Apache in Big Data Analytics. A Healthcare Management System can be categorized into five divisions, namely, Drug discovery, Disease prevention, Diagnosis and treatment, Hospital operations, post-care, requiring comprehensive data management. Big Data analysis support transformation is identified as a required component in future research for the application of Big Data in HealthCare.

Keywords **—Big Data Analytics, Internet of Things, Healthcare Management Systems, Pharmaceutical, Drug Delivery, Clinical Diagnosis, Insurance.**

----------**********----------

I. INTRODUCTION

Human existence has become much smarter as a result of rapid advancements in telecommunications and the Internet of Things. Big data analytics and IoT for smart health care can help medical facilities become more efficient in terms of recognizing risk factors and illness treatment processes. It can not only meet the hospital management examination index requirements, but also improve cost expansion for care service and treatment.

Big Data refers to a massive extent of information of diverse types, i.e., structured, semi-structured, and unstructured. This information is generated via diverse virtual channels including Internet, mobile, social media, e-trade websites, etc. Big Data has been established to be of terrific use since its inception, as numerous agencies began figuring out its significance for diverse enterprise purposes. [13] Now those agencies have begun out interpreting this information, they've witnessed an exponential increase over the years. Impact on diverse sectors like Retail, Fraud detection and analyzing, Banking and investment, Operational analysis and Customer-centric packages.

In this way, the use of IoT, advanced investigation, and big data developments in medical care have resulted in a substantial information change. Breaking down information is critical at each of these steps, from data collection to transmission to analysis. Thus, there is a need for misusing calculations and strategies of information science for large amounts of information, which may need productivity in getting to, handling, and breaking down the information created from different sources like imaging advanced gadgets, lab tests, sensors, telematics, messages, outsider sources and clinical notes. Big Data is produced in an uncontrolled way consistently. Enormous information, such as client input, item surveys, use of applications or the substance shared by the client via online media, can help examine an individual, their inclinations, needs and conduct. The information produced can be abused by the associations to upgrade the medical care area. [1] Medical services observation is another field where a massive data storehouse is being made. Individuals are well-being cognizant, and thus, they self-screen themselves utilizing a few applications accessible for cell phones. Following glucose levels, pulse levels, dozing design investigation, and a lot more empower wellness and furthermore builds mindfulness toward a solid way of life.

Similarly, Business Intelligence (BI) can be characterized as an umbrella term that includes apparatuses, structures, data sets, information distribution warehouses (DW), execution of executives, approaches, etc, which are all coordinated into a brought together programming suite. Business investigation can be characterized as an interaction that includes the utilization of factual strategies, data framework programming,

and activities research approaches to investigate, picture, find and convey examples or patterns in information. [5]

Big data in medical care includes gathering enormous assortments of information from different medical care establishments followed by putting away, overseeing, investigating, picturing, and conveying data for powerful dynamics. [6] The six characteristics of big data in healthcare are: volume, variety, velocity, veracity, variability, and value.

Throughout the long term, powerful determination and arrangements accommodated some disastrous infections with headway in clinical science. Regardless, the expanding metropolitan populace and changing way of life request a keen medical services network which can give a speedy and productive therapy. [1] To give better medical care administrations, clinical, and drug organizations, medical care experts, scientists and city chiefs are chipping away at enormous information arrangements and IOT gadgets which can limit reaction time, give distant therapy, offer fast crisis administrations, lessen packing in clinics, and impart, share, and work together with specialists all throughout the planet.

II. Challenges and Opportunities

For the efficient application of Big Data Analytics in the healthcare management systems, we must first understand the challenges and opportunities in the healthcare management systems and the limitations of futuristic solutions to these challenges.

A. *Challenges in the Application of Big Data to Healthcare Management*

The main challenges dealt with in the application of Data Analytics in Healthcare Management Systems can be categorized into four categories, as follows:

1) ***Medical Internet of Things Challenges:*** Medical IoT stages were designed to help in fast creating analytics, learning from experiences, and completing organizational data change and integration. In any event, five major requirements pose a significant obstacle in this IoT-based restorative stage. These difficult requirements can be summarized as follows:
   - Cloud-based services provide a basic network for gadgets and information.
   - Activities related to the administration of a rehabilitative device.
   - APIs cleverly bridge the gap between information and the cloud by allowing for data capacity and modification.
   - Enlightening analytics of massive data in real time to gain knowledge and make better decisions.
   - By activating notifications and separating occurrences from impacting the dynamic IoT environment, unknown-source hazards can be resolved. [1]

2) ***Big Data Analytics Challenges:*** Big data is constantly changing. Big data storage, analysis, and retrieval face numerous obstacles as a result of this continually changing data. Due to its capacity and variability, traditional databases cannot be utilised to store, process, or retrieve data. The following are the primary issues that big data analysis faces:
   - Data storage and quality.
   - High-quality data analysis.
   - Skilled analysts.
   - Security and privacy.
   - Data sources.

Big data has its own set of issues in the healthcare industry. The primary obstacles that must be overcome are the peculiarities of big data. It also addresses the following topics that require consideration in addition to the aforementioned issues. Before assessing the statistics, some issues in the health industry must be examined. [1] Storage, structure, standardisation, query, cleanliness, ownership, inaccuracy, accuracy, real-time analysis, privacy issues involving personal health information, retrieval/collection from various sources, reporting, visualisation, and health management data are all issues that need to be addressed.

3) ***Challenges of Medical Big Data Technology:*** To provide better integrated medical services, a transition to big data technology is required. Big data technologies, on the other hand, may constitute a hazard to some people. The two types of big data difficulties that frequently occur in the medical industry are:
   - Fiscal Challenges: Medical field services are centred on patients and doctors having paid face-to-face encounters throughout their visits. As a result, encouraging technology engagement in this process burdens the medical community and invariably biases personnel against these unpaid activities. However, there is increasing motivation to employ new technologies to eliminate unnecessary office visits from the standpoint of values-based care.
   - Technology Challenges: From a technical standpoint, big data has created roadblocks to attaining the health data vision. The interchange of personal records between numerous parties necessitates data fragmentation, with data consolidation being the predicted future vision. Data aggregation has two additional advantages. For starters, data interchange or data structure conversion between the two proprietary systems is not required. It will also facilitate real-time machine learning and AI operations in a flexible manner. [1]

4) ***Privacy Issues and Big Data Security:*** Hacking has risen to the top of the list of reasons for data breaches. There are various financial benefits to security attacks. Health records will be accessed for a variety of reasons (e.g., illegally releasing a person's health information, grouping difficult-to-access medical facts, or simply to undermine systems). The health-care community's lack of awareness

of victimisation technology contributes to the likelihood of security attacks. One of these is huge knowledge technology, which is used in the health-care industry and has recently prompted significant concerns about security and patient privacy. Despite the fact that patient information is stored in data centres with varying levels of security, the protection of a patient's records cannot be guaranteed. Furthermore, medical knowledge derived from a variety of sources complicates knowledge storage, processing, and communication. As a result, patients' privacy and health information security are guaranteed in a medical setting. However, it is clear that security deficiencies will have a significant impact on people's privacy in the medical field, especially as the use of mobile devices grows. High-level implementations that protect medical data throughout use following transmission, storage, and collecting are always sought and sent by researchers. The following are some of the security requirements and requirements that have been agreed upon for the development of medical apps:

- When the patient's session is over, wipe the device's personal information.
- There is no interference from third-party programmes (for example, commercial announcements).
- To protect saved data, use two-factor authentication.
- SSL / TLS-based communication between apps and other systems encrypted end-to-end data and encrypted data during transmission. [1]

B. Opportunities in the Application of Big Data to Healthcare Management System

It's important to grasp the importance of big data analysis in healthcare in order to see how it can address these difficulties or provide viable answers to these obstacles:

1) ***Concept Evolution:*** The characteristics of BDA in bringing new concepts in healthcare are summarised in this article. Platforms and healthcare as a service, for example, can make a difference.

2) ***Data governance:*** This topic covers legal and ethical challenges around the use and security of data in healthcare, such as access rights management, patient data security, and the trade-offs between healthcare efficiency and privacy threats.

3) ***Decision Support:*** This topic examines how BDA can help healthcare organisations improve their decision-making processes by allowing them to make more evidence-based and speedier decisions. It also demonstrates how better design might lead to more effective public health strategies.

4) ***Disease prediction:*** This topic introduces the effective application of BDA to predict the serious medical condition of patients, for example, in disease prediction, disease pattern recognition, and disease-based surveillance systems.

5) ***Strategy formulation:*** This topic looks at how BDA can help medical institutions develop sustainable business strategies, such as capacity building, resource allocation, and profit enhancement of medical institutions.

6) ***Technological development***: This topic involves technological advances to discover new advantages of BDA in the healthcare sector, such as integrated intelligent technology, cloud-based infrastructure and parallel execution of accelerated kernels. [2]

III. TOOLS AND TECHNIQUES OF BIG DATA ANALYTICS

Big data must be kept and processed, and relevant information must be retrieved from huge data, according to the core notion of data analysis. Traditional databases are unable to keep comprehensive data due to the large amount of data. As a result, a database that enables unstructured data processing is required. Big data analysis can be accomplished using a variety of tools and methodologies. The following are the few tools and technologies that will be discussed:

- Hadoop Distributed File System (HDFS) - is a distributed file system that lets users instantly access data from applications. HDFS is a file system that runs on relatively inexpensive hardware. Hadoop is Apache's data management layer. Hadoop is a MapReduce implementation that is open source.
- Hadoop General - These are Hadoop modules that support other modules.
- Hadoop MapReduce - It's a large-scale parallel processing system based on YARN. It's not a database, and it's not a database competitor. MapReduce is a distributed computing method that has been used on a variety of platforms. It has two processes: Map and Reduce, which can efficiently process both structured and unstructured data. The input data is broken down into smaller chunks and fed into the Map process on the distributed file system. The block is converted into a set of key-value pairs via these map jobs. Each map task's key-value pairs are collected and sorted by the main controller according to the key-value. All Shrink tasks share the same key, therefore all key-value pairs with the same key will end up in the same Shrink task. The shrink task works with one key at a time, combining all of the values associated with it in a certain order. Map locates the data on the disc and runs the logic it contains. Reduce the number of summaries and increase the number of results. Cost-effective, easy to extend or enhance capacity, and data that may be easily tailored according to requirements are all advantages of MapReduce. The disadvantage of MapReduce is that it does not use a database, therefore there is no security, and the indexes, searches, and technologies are still in their infancy.
- Apache Hive - Developed primarily for managing and performing analytics on a Hadoop-specific data storage infrastructure. Hive Query Language

(HiveQL), a SQL-like programming language, is used to query data in a store that often holds a vast amount of historical data.

- Pig - is a parallel computing execution framework and a high-level data flow language.
- Spark - is a fast and scalable general-purpose Hadoop data computing engine. Spark is a programming language that may be used for a variety of tasks, including ETL (extract, transform, and load), machine learning, sequence processing, and graph computing.
- Mahout: is primarily concerned with the development of machine learning techniques. The major goal is to provide scalable clustering, classification, and collaboration algorithms to handle the fast increasing amount of big data. These algorithms are based on the MapReduce framework from Apache. Recommendation, classification, and clustering are three major machine learning techniques used. [1]

IV. Application of Data Analytics in Healthcare Management Systems

The applications of Data Analytics in Healthcare Management Systems can predominantly be classified into Pre-care, Care and Post-care. Pre-care encapsulates the discovery of drugs and the prevention of diseases, while Care corresponds to the diagnosis and treatment at hospital and clinic procedures and operations, lastly, Post-care corresponds to health insurance and recovery. These points are discussed further, as follows:

C. Drug Discovery

The medicate revelation preparation more often than not takes a long time, approximately 12 years, and the cost is as well high, around $2.6 billion. Information examination has expanded the speed of the medicate conveyance handle in restorative science, making a difference to induce endorsement from the Food and Drug Organization speedier and recuperate patients quicker. A few companies are creating artificial intelligence machines for different areas. Innovation revolutionizes the pharmaceutical industry by decreasing costs, decreasing failure rates, and conveying drugs to patients at a quicker rate.

Clinical research is concerned with the development of noninvasive tests, equipment, and therapies for determining the safety and efficacy of items intended for human consumption. Clinical research is mostly conducted for the purposes of infection prevention, therapy, diagnosis, and treatment. Large information gained from huge medical databases provides the opportunity to conduct clinical inquiries on a wide variety of conditions (such as sleep disorders, Parkinson's disease, and personalized medication) with a long-term future. It is true that genomic analysts and clinicians have a particular challenge getting consent, acquiring information, and avoiding inadvertent disclosure. Innovations in sensor technology are capturing different information and displaying precise data to assist clinical decision-making. [9]

D. Disease Prevention

Data analysis prevents disease by identifying risks early, and these tools also suggest prevention plans. Various smart devices that use data analysis use people's genetic information and historical patterns to identify problems before they get out of control. Several companies are developing smart devices and using data analytics to analyze various patient behavior plans at an early stage, which can help prevent chronic diseases such as diabetes, hypertension, high cholesterol and other diseases at an early stage.

1) ***Big Data Applications in 'Omics':*** Often called "omics" data, these are important sets of data pertaining to organic and molecular areas. By applying big data in this research, disease strategies can be realized and medical treatment can be more consistent. [6] As a result of advances in metabolomics, proteomics, genomics, and other omics technologies, a great deal of molecular biology-related data has been gathered. Genomic science is concerned with genes and their functions. With big data in genomics, it will be possible to deliver personalized treatment to each patient, which could prevent or cure diseases.

2) ***Disease transmission: Prediction:*** Disease transmission refers to the spread of infections from a tainted person or group to another person, regardless of whether the other person is tainted or not. Forecast of illness transmission amid plague is a noteworthy angle of BDA in healthcare administration because it makes a difference to anticipate and control the transmission of the infection particularly in current circumstances where the complete globe has been taken over by the Covid-19 widespread. [9] The spatio-transient information collected by the volunteers of the Ebola flare-up utilizing their portable gadgets was found to be exceptionally valuable in assessing the effect of organized structure on illness elements. The use of organized and unstructured information from healing centers, in conjunction with the territorial information for building solid forecast models for estimation of malady episodes.

3) ***Preventive healthcare:***When contrast to the treatment of an infection, preventive healthcare entails a variety of steps to avert illness. Clinical insights that forecast an understanding's long-term health risks will be a useful tool for assisting clinical decision-making for tailored preventative care. The vital use of electronic healthcare information centred on personalised healthcare and patient-centered results, as well as the perspectives of customised health evaluation, disease management, and wellness arrangement, will be profoundly competent in health administration. By comparing the measured detecting information with the condition of each decision stage within the stress-level expectation, day-by-day stretch levels can be used to predict individual health.

There are a few useful data mining layouts for identifying the significant components of cancer rates depending on the patients' living propensities. [9] Wearable innovations have been identified as an important source of big data for preventive health management. The findings of the BDA's impact on the health data innovation market and the appropriation of BDA within the e-health business may be used by wearable device manufacturers. The information will offer assistance to producers to plan ideal showcasing techniques on progressing the healthcare benefit quality.

E. Diagnosis and Treatment

Data science can also be applied in healthcare to medical imaging, where algorithms can be used to analyze X-rays, MRIs, mammograms, and other types of images to identify patterns in data and discover anomalies in cancer, organs, and arteries. A clearer, narrower picture. Through the use of Data analysis software, different stages of the care cycle can be tracked and costs can be managed. Compare the costs of treating a specific disease with the results. Find an opportunity to significantly reduce costs without compromising results.

1) ***Patient Care Healthcare: Personalized:***Big Data will make it conceivable to bring the finest and altered persistent care. By and by, new big data-derived impacts provoke appropriate overhauls of demonstrative help, clinical rules and quiet triage to allow more specific and altered treatment to develop restorative approaches for patients. [6]

2) ***Design and Manufacturing of Medical Device:***Big Data execution encourages a more extensive set of gadget materials, conveyance strategies, and tissue intelligent, anatomical arrangements to be assessed. Calculation procedures and Big Data can play a noteworthy part in therapeutic framework technique and fabricating. [6]

3) ***Clinical Diagnostics:*** Clinical diagnostics is the observable confirmation of an infection's type and cause, as well as the assurance of which illness or condition can explain a person's symptoms and signs. The restorative decision is made based on a causative investigation and employment facts gathered from the understanding's restorative history and physical assessment. The field of determination is exceedingly esteemed within the field of health administration. [7] A wealth of patient information incorporates point by point data about their sickness, drugs and treatment plans, utilization of therapeutic administrations, accessible health protections plans, etc. The healthcare industry is analyzing this information to convert big data into value-added information, distinguishing covered up patterns, designs and connections between this information, which can be utilized to make strides in arranging, restorative and administration choices. Infection diagnosis benefit involves a vital position at the social and individual level, and has stirred remarkable intrigue in therapeutic investigation. Big data within the frame of electronic restorative records, clinical reports, doctor's notes, master information, and body sensors have been distinguished as imperative sources. This information is collected through distinctive organized, semi-structured and unorganized sources. The challenge is to prepare huge sums of unstructured data in a moderately brief period of time. [10] Big data innovations such as Hadoop, MapReduce, and Apache Spark are utilized to clean the collected information and create prescient models valuable for decision-making. BDA moreover gives in-depth examination of the obsessive conditions of numerous complex diseases including the conclusion and treatment of diabetes, ailment, and Lyme illness. BDA has too found its application in distinguishing elective treatments for Parkinson's infection. Imaging, hereditary qualities, clinical and statistical information are utilized for determination. BDA is utilized to assess the characteristic course of the illness based on the statistical characteristics of patients admitted to the clinic with cerebral arteriovenous mutations. [9] BDA with a web-based application stage can be utilized to streamline complex health evaluation and observing methods. Numerous applications based on machine learning strategies and visual dashboards are getting to be increasingly well known in health observing, learning side effects, and health determination.

4) ***Pharmaceuticals:***Big data is used at all stages of pharmacological development, particularly for sedate disclosure. Pfizer has recently launched an Accuracy Medication Analytics Environment programme, which joins the dots between electronic medical record data, clinical trials, and genomes to identify opportunities to promptly pass on novel medications for specific persistent populations. [6]

F. Hospital Operations

The ever-increasing global demand and changes in the healthcare industry are increasing dramatically. Goals of Applied Business Intelligence (BI) Research analysis shows that healthcare organizations can use BI to solve the challenges and problems they face for four main reasons. These four basic reasons can be defined as [i] improvement of hospital process performance, [ii] improvement of clinical care and disease, [iii] analysis of hospital process performance, and [iv] management of data and better communication and cooperation.

1) ***Goals of applying business intelligence at Healthcare organizations:***The goals of healthcare organisations using BI as a powerful solution are discussed in this section. We identified four primary reasons why hospitals and HCOs employ the BI system and organised them as follows: [4]

- Hospitals process performance improvements: Researchers employ business intelligence (BI) to

improve specific issues in their procedures, whether in departments or across entire hospitals. For example, using business intelligence (BI) technology and solutions to boost infection rates. Online transaction processing (OLTP) BI solutions were replaced with online analytical processing (OLAP) BI solutions in the old healthcare system. In another study, in response to the problem of overcrowding in emergency rooms, a web-based BI application was created to allow patients to receive real-time waiting time information.

- BI is used by researchers to improve the clinical care and treatment of infection. One of the fundamental angles of infection control is tracking, screening, and analyzing restorative and clinical information using computer innovation. BI as a collection of choice back innovations, principles, and abilities can empower clinicians to analyze designs, distinguish patients at risk, create a formula for therapy, anticipate conditions ahead of time, and calculate whether a treatment plan is making a positive impact. According to the findings of the study, healthcare executives established BI arrangements to increase clinician and staff participation in decision-making (operational, strategic, and critical choices) and to improve treatment. Due to the high occurrence of lung cancer around the world, a study in the United States used several Decision Tree, Naive Bayes, and Clustering techniques to model lung cancer based on many hazard components.
- Analyzing hospital process performance: BI technologies and arrangements to analyze a particular process within the organization and to determine the quality of benefit. These estimations made a difference on-screen characters in related healthcare organizations to distinguish risky zones and to choose whether advancement ought to be taken. Data analytics was also used in categorizing the consultations into In-Patient and Out-Patient departments and raising feedback tickets to improve the quality of service and treatment.
- Managing data for better collaboration and communication: BI solutions are being used to manage various types of data within enterprises, increase internal communications and collaborations among employees, and increase patients' access to health specialists in a few ways. BI arrangements and instruments counting SAP R/3 and strong data warehouses are utilized to realize superior information availability, communication, and collaboration among offices. This execution leads to a decrease in IT framework taking a toll and way better information administration.

2) ***Capabilities and Solutions of Business intelligence in healthcare organizations:***This section goes through the many BI functions, solutions, and technologies that are employed in healthcare enterprises. As mentioned in the preceding section, BI has four basic functions that an organisation can choose from depending on its needs: organisational memory, information integration, information generation, and presentation capabilities. These abilities are distinct, but they are interdependent.

- Organizational memory capabilities: BI is used to manage various types of data within enterprises, increase internal communications and collaborations among employees, and increase patients' access to health specialists in a few ways. BI arrangements and instruments counting SAP R/3 and strong data warehouses are utilized to realize superior information availability, communication, and collaboration among offices. This execution leads to a decrease in IT framework taking a toll and way better information administration.
- Information integration capabilities: Data integration, in turn, linked all significant types of data both inside and outside the company. This capacity may provide the specified input for the creation capability to be understood. Data integration capability yields can be used as a starting point for determining creation capabilities.
- Insight creation capabilities: Knowledge creation by applying analytics strategies to information and data gives unused understanding into them and makes a difference for organizations to form superior and more educated choices. It manages distinctive sorts of investigation (graphic, demonstrative, prescient, and prescriptive) and encourages superior, quicker and more exact choices for clients. The result of understanding creation capability encourages introduction capability. [11] Particularly, including connected information mining strategies including Naïve Bayes, Decision Tree and Clustering procedures on data for examination, finding designs in information and foreseeing the risk level of the patient.
- Presentation capabilities: Presentation capability shows produced bits of knowledge and data in a user-friendly shape. It makes a difference for distinctive clients in decision-making to uncover the foremost insightful data at a glance. For instance, real-time information, effortlessly inquiring energetic questions, distinguishing issues in forms, budgetary adequacy, and quiet security advancement bolstered utilizing an Coordinates' information distribution center and outlined dashboards. Visualizations make a difference between clients (by different objectives) to superior get it data in a user-friendly stage and make more successful choices. [4]

3) ***Identification of Data Sources in Healthcare Management Systems:*** To use these BI technologies, we must identify all available data sources and capture all the

information needed to form knowledge and derive. Many areas of supply force the use of organized information as well as unstructured and semi-structured information to exacerbate successful and auspicious choices. Due to the structure of these medical records, these data sources are in contrast with different application domains. The following sections clarify the different sources and structures of medical data. [5]

- Electronic Patient Record (EPR): is a system that captures and stores data about individuals or populations of patients systematically and electronically.
- Based on the analysis of clinical data, the pharmaceutical industry summarizes the analysis of clinical data of these components in its market research and reviews new drugs based on industry data, ensures that the results of these trials will be valid and is derived from regulatory agencies
- Source of pharmacy data: Patient, physician, nurse, and other healthcare providers should collaborate in providing this database. Pharmacists are directly responsible to their patients for the pharmaceutical care that they provide in terms of costs, quality, and results.
- Information gathered for the pharmaceutical from hospitals: The data currently collected from hospitals does not provide enough information to help doctors make an informed decision, nor to help clinicians and patients understand the quality of the care they receive. You must use highly reputable analytics tools and algorithms to make an accurate decision. By using normalized data systems from one hospital or institute, we can get more accurate results in analytics. This is due to the fact that normalized data sets are more reliable than non-normalized data sets. It may however be difficult to analyze and make decisions with data collected from different hospitals and healthcare facilities if they are inconsistent. Having accurate and trusted decisions will be made possible when all kinds of healthcare data are integrated.
- CRM (Customer Relationship Management) and Patient Relationship Management (PRM) are two tools that will help an organization to plan an innovative application. Customers have developed a dependency on personalized follow-up communications through robotized frameworks based on devotion and relationship-based marketing. PRM frameworks in healthcare organizations can be established using similar concepts. Through a framework such as this, clinicians can develop closer connections with their patients and empower them to increase their focus on the future, while providing them with an unused instrument to support progress, tranquil well-being, and fulfilment. Organizations can monitor performance while addressing persistent problems through analytics regardless of how they are reported. [12] The use of portable technologies dispenses with data silos, streamlines forms, increases staff efficiency, and boosts understanding.
- Information from insurance companies: Healthcare insurance information presents a rich source of data that can be used essentially to direct trade decisions. In almost every perspective of the security esteem chain, BI can play a crucial role. To better oversee its operators and deals, as well as drive and propel actuarial and guaranteeing capacities, it can offer assistance with the accompanying back up arrangements. BI shapes the most fundamental element of the claims' management process, contributing to the location of extortion and the estimation of claims. The use of modern hazard models created by using information mining apparatuses can lower the security risk presented by resource management. The most imperative BI device for insurers is the ability to offer pivotal data to corporate clients, thus strengthening their relationship with clients.
- Data source of legacy systems: Legacy data is typically derived from data frameworks and is integrated with legacy frameworks. Numerous sources of legacy data exist, including social databases, object/relational databases, question sets, XML, and organized databases. [12] Dissimilar information is also referred to as legacy data. Some time recently, different data sources have been stacked into the information stockroom to enable the transition of different information not only from legacy frameworks but from all other different data sources as well. In the BI healthcare architecture, legacy data source components ensure that business victory variables can be calculated appropriately by saving bequest information.
- Combining lab data gives pathologists and other researchers a thorough understanding of the patient's condition, giving a significant difference in understanding care. Nearly all healthcare divisions are interconnected with it. [8] By getting at, combining, and analyzing vast amounts of data, we can advance the ability to anticipate and treat diseases. As a result of this data, we may be able to recognize waste within the healthcare framework and hit the Triple Point objectives: to advance the health of the population, advance the persistent encounter, and lower overall healthcare costs.
- For a complete understanding of all aspects of health care, such components must be incorporated into the framework. A radiology computer is a complex piece of hardware and software. [3] Medical image information is processed, stored, printed and transmitted using the Digital Imaging and Communication in Medicine (DICOM) protocol. In

addition, it provides information related to network protocols and file formats. Radiologists are limited in their ability to provide patient care with traditional film-based radiology systems. There are a number of problems that affect patients and clinical outcomes, including requiring clinicians to make decisions based on information that isn't always accurate, and making transferring film and previous research more challenging than it should be.

- Data on primary care: Primary care is defined as care given by common practice groups counting health guests, area medical attendants and mental health medical caretakers, and prohibits care given by dental practitioners, drug specialists, opticians, and birthing specialists. A healthcare entry, a versatile application, or a sensor that records essential healthcare information is considered essential care information.
- Source of data on Human Resources (HR): People providing care or working in Health Human Resources (HHR) are an important part of our healthcare system. Health segment human resources are altered to enhance administration quality and patient fulfillment. Most people characterize healthcare quality in two ways: specialized quality and sociocultural quality. Health administrations have a particular effect on the state of the health of a population through their specially formulated quality. The level of social quality is a measure of the efficiency of administrations and the ability of institutions to meet patients' needs.

4) ***Service Delivery System:*** Health personnel, acquisition, and supplies, as well as financing, are important inputs into the health system that determine the quality of benefit arrangements or delivery. As a result, it is critical that health organisations ensure the accessibility to health administrations that satisfy a minimum quality standard by addressing these inputs. [8] Benefit culture, representative engagement, benefit quality, and client involvement are the most often measured components of benefit conveyance frameworks. Multi-criteria decision-making processes have been discovered to play an important role in assessing massive data pertaining to patients with chronic illnesses. Such analytics will aid in the selection of critical treatment requirements, as incorrect selections could damage the patients' health. In healthcare administration, BDA provides high-quality experiences, captures best practices, and advances decision-making and administration quality. As a result, it's critical to determine the most important quality indicators and screen them for effective healthcare administration. A concurrent audit framework should be possible based on the results of the quality marker survey. Since the real-time BDA, there have been advancements in the fields of predictive modelling and healthcare office choice back frameworks. BDA provides profitable experiences based on hidden information designs and distributes the knowledge to all clients, which is also archived. Healing centres must re-evaluate their appraisal approaches on a regular basis in order to identify flaws in the healthcare system and achieve progress in clinical execution. Healing centers are also expected to make optimal decisions based on advanced explanatory approaches for all of their BDA requirements, such as selecting cloud data centres and servers. [9] BDA could be linked to patients' precise predictions of no-shows. Such expectancies may aid a clinician in developing feasible relief methods, such as overbooking therapeutic arrangement venues or personal administration of patients who are expected to be extremely unlikely to attend.When patients are unable to attend their appointments, resulting in no-shows, the arrangement planning framework becomes problematic. BDA can assess components that can provide understanding into how past behaviour influences future behaviour, leading to progressed quiet benefit, within the context of patients' participation records, to move forward the arranging and planning issue by assessing components that can provide understanding into the way in which past behaviour influences future behaviour, leading to progressed quiet benefit. [7] This programme, which is based on the notions of successive design mining, distinguishes between the directors and the arrangement makers with valuable healthcare data in real-time. The predictive parameters are statistical traits, financial variables, ethnic foundations, treatment histories, and access to healthcare resources.The findings are being used to guide restorative decision-making and open arranging. The use of BDA and machine learning procedures in crisis care administrations aids healthcare organisations in developing foresight capabilities that support directors in achieving progress, consistent results, and encouraging robotization. Within the healthcare community, the importance of nursing care organiserecommender systems is generally understood. These frameworks support clinical decision-making, nursing education, clinical quality control, and serve as a supplement to existing guidelines.

G. Post-Care

Another area where data analysis finds interesting applications is the treatment of family patients. Usually, patients complain of complications and recurrent pain after surgery, which is difficult for doctors to deal with when they are discharged from the hospital. Data analysis applications in remote home monitoring make it easy for clinicians to stay in touch with patients. Therefore, the need for expensive hospital resources is reduced.

In the Healthcare Insurance Industry, Big data is used by companies and payers for underwriting, fraud deductions, and claims management. Insurance companies are on the lookout for algorithmic fraud that goes beyond human-centered claims

processing. For example, how many similar claims are filed by the same person or how many insurance firms report on the same transaction? [6]

Health insurance covers one-third or more of a person's medical expenses, sharing the risk among a group of people. The elements that influence obtaining health insurance are determined using predictive analytics. Research aids health organisations in resolving the problem of disparities in health coverage between societies. In private health insurance, BDA is used to analyse large and complex claims data in order to identify information such as geographic differences in health care delivery practises and detect claims anomalies, which indicate hidden cost overruns; otherwise, the processing system will hide these cost overruns. During the life cycle of a health insurance policy, multiple intermediaries are used to ensure that information is delivered to all essential parties, making the process slow and inefficient.

Patients and healthcare providers, as well as doctors, labs, and pharmacies, can collaborate on smart contracts using block chain technology. If one of the participants of the registration chain starts it, the claim can be settled in a real-time public block. The claim can be resolved without the need for the file to be relocated or for a third party to be involved. [9] With its distributed, peer-to-peer (P2P), decentralized, freedom, and privacy capabilities, bringing block chain technology to healthcare and insurance is a fantastic concept. Inadequate health insurance can lead to poor health and even death. This can result in the use of ineffective drugs and treatments. [11] Through research, some progress has been made in overcoming this difficulty. More research is needed in this area. Artificial intelligence can be used to see if health insurance coverage changes. More research will be needed to better understand the social sectors that are largely uninsured, so that solutions or alternatives can be considered to help close the insurance gap.

V. Gaps and Future Scope

Mainly, the gap in data analysis applications lies in the big data analysis support transformation (BDET) of various stakeholders in the medical management system, which requires future research and implementation scope. According to numerous studies, big data analysis is a valuable instrument for organisational business change. Three consistent results concerning BDET emerged from an examination of the existing big data literature:

- Organizational transformation and performance are dependent on big data analysis and the ability to generate it;
- BDET occurs when organisationsutilise big data to analyse technology to improve organisationalpractises; and
- A comprehensive, multi-dimensional benefit framework should be used to understand the possible benefits of BDET.

According to several big data experts, a company's unique big data analysis capabilities can be substituted by configuring accessible big data analysis technical resources or synergistically integrating valuable, rare, inimitable, and inimitable organisational resources. And this ability leads to superior organizational performance. [14] Through IT-supported transformation practices, effective transformation can be achieved within the organization. Business process redesign, business network redesign, and business scope redefinition are also common practises. Users, on the other hand, can profit from big data analytics in a variety of ways. Some previous business analytics studies, for example, focus on IT infrastructure, management, and operational benefits, as well as strategic advantages including faster time to market, better understanding, and improved brand reputation. As a result, a comprehensive methodology for identifying the potential benefits of big data analytics must be built.

VI. Conclusion

Big Data Analytics provides the healthcare industry with a number of capabilities and applications. The implementation and enhancement of healthcare management systems can be largely achieved by using BDA. IoT systems, data extraction, storage, and security features present certain challenges to BDA in a healthcare management system. Despite these difficulties, BDA also has many opportunities in the healthcare sector, encompassing disease prediction, decision support, and strategy creation. With Hadoop, MapReduce and Apache as technologies, BDA is extremely refined today. In the healthcare management system, BDA's involvement contains five major aspects, such as drug discovery, disease prevention, diagnosis and treatment, hospital operations, and post-care facilities. BDA facilitates efficient treatment decisions and decisions regarding the diagnoses of patients. The use of BDA and Business intelligence is expanding greatly within hospital operations, and this is aided in driving very smooth workflows throughout the healthcare system. The post-care and health insurance sectors can see how BDA can streamline claims and insurance process execution. Finally, it is important to note that the biggest gap is in the evolution of healthcare systems to adopt Big Data and Big Data Analytics - and create a bridge for IT transformations. The use of Big Data Analytics in Healthcare Management Systems is expected to revolutionize the outlook of the industry.

REFERENCES

[1] Liyakathunisa Syed, SaimaJabeen, S. Manimala and Hoda A. Elsayed, (2019), 'Data Science Algorithms and Techniques for Smart Healthcare Using IoT and Big Data Analytics', Smart Techniques for a Smarter Planet. Studies in Fuzziness and Soft Computing, Vol 374, pp. 211-241.

[2] SayantanKhanra , Amandeep Dhir , A. K. M. Najmul Islam &MattiMäntymäki, (2020), 'Big data analytics in healthcare: a systematic literature review', Enterprise Information Systems, Vol - 14:7, pp. 878-912.

[3] Louis Ehwerhemuepha, Gary Gasperino, Nathaniel Bischoff, SharifTaraman, Anthony Chang & William Feaster , (2020), 'HealtheDataLab – a cloud computing solution for data science and advanced analytics in healthcare with application to predicting multi-centerpediatric readmissions', BMC Medical Informatics and Decision Making, Vol 20, Article 115, .

[4] Mona IsazadMashinchi, AdegboyegaOjo, Francis J. Sullivan, (2019), 'Analysis of Business Intelligence Applications in Healthcare Organizations', Proceedings of the 52nd Hawaii International Conference on System Sciences, pp. 4156-4164.

[5] Ayman Khedr, SherifKholeif, FifiSaad, (2017), 'An Integrated Business Intelligence Framework for Healthcare Analytics', International Journal of Advanced Research in Computer Science and Software Engineering, pp. 263-270.

[6] Senthilkumar SA, Bharatendara K Rai, Amruta A Meshram, AngappaGunasekaran, Chandrakumarmangalam S, (2018), 'Big Data in Healthcare Management: A Review of Literature', American Journal of Theoretical and Applied Business, pp. 57-69.

[7] João Vidal Carvalhoa, Álvaro Rochab, José Vasconcelosc, AntónioAbreud, (2019), 'A health data analytics maturity model for hospitals information systems', International Journal of Information Management, pp. 278-285.

[8] SamayitaGuha, Subodha Kumar, (2017), 'Emergence of Big Data Research in Operations Management, Information Systems, and Healthcare Past Contributions and Future Roadmap', Production and Operations Management Society, pp. 1724-1735.

[9] Sachin S. Kamble, AngappaGunasekaran, Milind Goswami&Jaswant Manda, (2018), 'A systematic perspective on the applications of big data analytics in healthcare management', International Journal of Healthcare Management, pp. 226-240.

[10] X. Ma, Z. Wang, S. Zhou, H. Wen and Y. Zhang, (2018), 'Intelligent Healthcare Systems Assisted by Data Analytics and Mobile Computing', 14th International Wireless Communications & Mobile Computing Conference (IWCMC), pp. 1317-1322.

[11] Nishita Mehta and Anil Pandit, (2018), 'Concurrence of big data analytics and healthcare: A systematic review', International Journal of Medical Informatics, Vol 114, pp. 57-65.

[12] Muhammad Shahbaz, Changyuan Gao, LiLiZhai, FakharShahzad&Yanling Hu , (2019), 'Investigating the adoption of big data analytics in healthcare: the moderating role of resistance to change', Journal of Big Data, Vol 6, Article 6, .

[13] Rahul Reddy Nadikattu, (2020), 'Research on Data Science, Data Analytics and Big Data', International Journal of Engineering, Science and Mathematics, Vol 9, pp. 99-105.

[14] YichuanWanga, LeeAnnKungb, William Yu Chung Wang and Casey G. Cegielski, (2017), 'An integrated big data analytics-enabled transformation model: Application to health care', Information & Management, Vol 5, pp. 64-79.

