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Increasing the Approach towards Healthcare Informatics and Data Analytics in Medical Science

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***Abstract*—In the past, the majority of the data produced at the point of care was unstructured and included paper prescriptions, handwritten notes from nurses and doctors, hospital admission and discharge records, and pictures from MRIs and CT scans. Thus, it is necessary to study importance of developing healthcare informatics and data analytics. Due to patient treatment, compliance with legal and regulatory obligations, and record keeping, the healthcare industry has historically produced enormous amounts of data. In the field of healthcare, health informatics combines computer science and information science. Health informatics encompasses a variety of study fields, including bioinformatics, clinical informatics, public health informatics, image informatics (e.g., neuro-informatics), and translational bio informatics (TBI). Different studies are made for analyzing the importance of healthcare and the data security for the medical data for each individual. Thus, it can be easily said that there are still many changes required in the field of medical healthcare but still in the coming time healthcare data storing will become crucial with time as the number of individuals will increase so that data analysis of health is analyzed and stored.**

Keywords—data analytics, HER, healthcare, informatics, medical science.

I. Introduction

In the past, the majority of the data produced at the point of care was unstructured and included paper prescriptions, handwritten notes from nurses and doctors, hospital admission and discharge records, and pictures from MRIs and CT scans [1]-[4]. The healthcare industry's growing digitalization of data has begun to generate data that satisfies all of the criteria and characteristics of big data. The healthcare business will profit from the multifaceted benefits that the analytics of these digital data will bring to clinical practices, illness surveillance, population health administration, and management. New innovations and improved organization have been made possible by information [5], [6]. As we become more conscious of this, we have introduced technological advancements in this area and have begun to produce and collect more data about nearly everything. Because of this, the phrase big data was coined to refer to massive, unmanageable data sets. A specific social necessity that exists is healthcare.

In the field of healthcare, health informatics combines computer science and information science. Along with various subfields, health informatics enriches data from a variety of sources, including sensors, photos, text (clinical notes, biomedical literature, etc.), electronic health records (EHD), omics, and more. The variety in the methods used to gather and portray the data creates many difficulties for the processing and analysis of the underlying data. Big data is a multifaceted, multidimensional, and diversified set of data kinds that are collected at a rapid pace in the life sciences and healthcare. The phrase big data was created because these data sets are seen as being too massive and complex for standard data processing techniques.

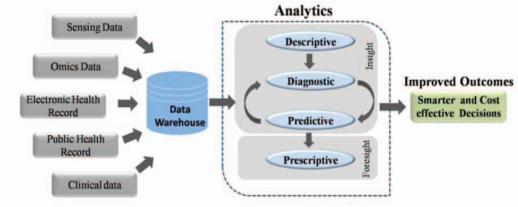

Fig. 1. Shows work flow of data analytics [4]

Big data analytics (BDA) is the process of analyzing huge volume, high velocity data streams to enable personalized medicine, which gives doctors a more thorough (in-depth) understanding of a patient's health. This has encouraged researchers to create solutions to deal with the problems listed above. Nonetheless, during the past ten years, BDA has caused problems in a number of commercial areas. Big data technologies are not widely used because of a number of issues, including a lack of standards, a quickly changing technological stack, complex architectural design, a difficult-to-learn skill set, and high resource and expense requirements. The absence of a standard communication protocol between the business side and the BDA team is another problem. Indeed, according to a 2019 Gartner estimate, the aforementioned problems were the reason behind 85% of big data and BDA project failures. These problems afflict BDA applications in healthcare as well (at present). The study's findings confirm that data may be a very valuable resource for the healthcare sector, and that the advantages of using medical data and analysis in various healthcare settings have contributed to the field of HCI&A receiving significant attention. The multidisciplinary approaches to HCI&A fosters many creative ideas while posing some difficult problems. Still, there isn't a comprehensive, well-organized study of HCI&A advancements to date. Conducting a comprehensive study of

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HCI&A is essential to gain a clear understanding of the state-of-the-art technologies.

II. Literature Review

Sabyasachi Dash [4] proposed that healthcare professionals must have all the tools necessary to create and analyze big data in a systematic manner, together with the right infrastructure, in order to offer pertinent solutions for enhancing public health. For this reason, a number of sectors, including the healthcare sector, are working hard to realize this potential in the form of improved services and monetary benefits. Personalized medicine and medical therapy may be revolutionized by modern healthcare organizations through a robust integration of biological and healthcare data.

Harshit Kumar [5] said that Big data has mostly emerged as a result of the quick rise in computing power, the proliferation of internet-enabled data-generating gadgets, and the declining cost of data storage, which makes data available to everyone for essentially free. One of the main industries where big data analytics is being used extensively to produce more productive results than traditional methods is the health care sector. Big data is primarily concerned with the processing and storing of massive, intricate data collections for which conventional techniques are inadequate. The survey's findings will be helpful to academics, researchers, and businesses with an interest in big data in general and healthcare in particular.

Kazi Md Shahiduzzaman [6] said that The phrase "health informatics" refers to the vast amount of data that is gathered from many sources in the medical field. Health informatics can be categorized as Big Data due to its diverse nature, large number of attributes, and copious amounts of data. As a result, many Big Data analysis methods can likewise be applied to health informatics. The use of data mining in health informatics has produced many positive results in recent years, enhancing the healthcare system as a whole by reducing costs and improving healthcare services and illness analysis. In-depth exploration of the various sources of health informatics will be included in this paper's definition of the term. Lastly, a few case studies will be provided as illustrations of how data mining techniques are used to analyze disease more thoroughly and efficiently.

Sohail Imran [7] said that since the introduction of healthcare information management systems (HIMSs), a significant amount of healthcare data has been produced globally for patient care, compliance, and regulatory obligations. Knowledge can be discovered in countless ways through the analysis of this large data. But BDA implementations, regardless of the domain, are typically difficult and resource-intensive, with a high failure rate, and practitioners lack a success strategy or road map. Before reviewing BDA applications to healthcare in scholarly research, with a special focus on NoSQL databases, we first identify big data features for the healthcare industry. Together, the aforementioned contributions of our work are singular and give clinical administrators, practitioners, and other professionals a clear road map for implementing BDA efforts in their organizations.

Matthew Herland [8] said that Health informatics currently generates enormous amounts of data, and the study of this Big Data offers essentially endless opportunities for knowledge acquisition. Furthermore, this information can raise the standard of care that patients receive. But dealing with such massive amounts of data raises a number of challenges, not the least of which is how to reliably assess this data. This paper will describe current research on the analysis of Health Informatics data collected at various levels, such as the molecular, utilizing Big Data tools and methodologies. They also look at potential directions for future research in each of these categories and how integrating data from all levels could be the most fruitful way to learn as much as possible about health informatics.

III. Discussion

In order to create a big data-driven healthcare system that can interchange large data and give us reliable, fast, and useful information, we must overcome each of the aforementioned obstacles. To overcome these obstacles, time, money, and dedication would all need to be committed to. However, the success of these bold measures would seem to lessen the current strains on healthcare, particularly in terms of prices, similar to previous technical advancements. It's estimated that in the upcoming years, healthcare businesses using big data analytics might save over 25% on yearly expenses. By lowering the hospital readmission rate, big data analytics can help reduce costs through improved diagnosis and disease prediction. It is not clear enough from the healthcare companies what factors lead to readmissions. By accurately identifying these links, healthcare companies would find it easier to enhance their patient care protocols and reduce the risk of readmission. Additionally, big data analytics can aid in the improvement of the pharmaceutical supply chain, workforce optimization, demand forecasts for operating rooms, and patient care simplification. In the end, all of these elements will cause the businesses' healthcare expenses to decrease. Therefore reducing the need for human involvement and improving the precision of particle-collision data analysis.

Another instance used the quantum support vector machine for both classification and training. Such quantum methods may find use in numerous scientific domains. Indeed, to improve signal separability in electroencephalogram (EEG) signals, recurrent quantum neural networks (RQNNs) were used. We can see that this topic of research is relatively new for the "Real-Time Predictions Using Data Streams" segment because technology has only lately been able to manage the high-throughput processing required from the Big Velocity of data streams. Future research along these lines will also need to develop and evaluate a variety of classification strategies in order to determine which is optimal for prognosis and acute problem identification (keeping in mind that different conditions may require different solutions). To determine the optimal combination of sensors for each illness prediction, it could also be helpful to test a variety of sensors.

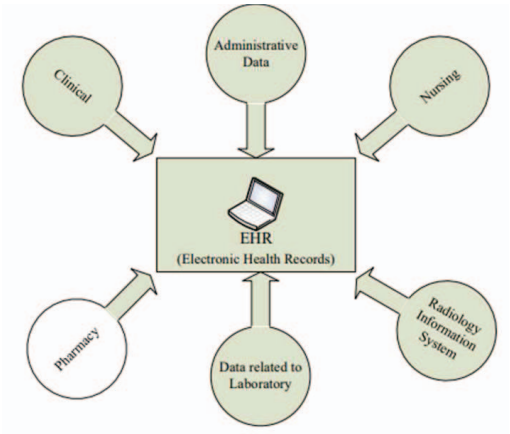

Fig. 2. Shows several components of EHR [5]

The majority of the data that is available in the healthcare sector is presented in an unstructured manner, such as graphs, prescription notes, and photos. Aside from this, structured data is generally heterogeneous in nature. utilizing longitudinal record correlations between patients and data. There is a serious issue in comprehending unstructured clinical notes in the appropriate setting. Certain formats used to store data are incompatible with certain applications and technology. The conveyance of such data is hampered by this lack of standards. Data Transmission and Storage: Creating data is less expensive than storing it. The true challenge lies in effectively storing the data so that various techniques and technologies may be used with ease to successfully extract the required information. The costs of protecting and keeping data remain high once it is generated. Both the analysis and the moving of data from one location to another have associated costs. Data scientists are still having difficulty coming up with more effective ways to store and transfer unstructured and heterogeneous data, despite the fact that many technologies have been developed to do so for structured data. Big data analytics, or BDA, challenges come in many forms in the healthcare industry. The application procedure for each application is specified in the roadmap, and Med-BDA offers the specifics of its implementation. Put another way, the technology stack that we have suggested for Med-BDA will be the same for any kind of healthcare BDA application. But as every domain has different data management dynamics and needs a customized architecture, we are unable to generalize this to other domains (banking, telecommunications, retail, agricultural, etc.). The study's findings confirm that data may be a very valuable resource for the healthcare sector, and that the advantages of using medical data and analytics across various healthcare organizations have contributed to a notable increase in interest in HCI&A (Healthcare informatics and analytics). Still, there isn't a comprehensive, well-organized study of HCI&A advancements to date. It is essential to carry out an extensive analysis of the HCI&A in order to obtain a good understanding of the cutting-edge technology.

The healthcare industry is currently dealing with an abundance of big data from various heterogeneous sources. Therefore, BDA is a fundamental necessity for providing patients with appropriate care and managing all data-related clinical operations. However, because of its high complexity, hard to acquire skill set, quickly growing technological stack, and increased management overhead, the BDA process has suffered a great deal of failure in a variety of industrial sectors. Big Data analytics and data mining can be used to improve patient care, workflow in clinics, fleet planning, resource management, demand analysis and dynamic deployment strategies, readmission preventive analysis in hospitals, and more. All of these will raise the standard of treatment, lower the cost of healthcare, and boost patient satisfaction.

IV. Conclusion

There are a lot of other avenues to be investigated regarding different aspects of healthcare data, such as the quality, privacy, timeliness, and so forth, despite the numerous potential and methodologies for big data analytics in healthcare that are described in this work. In the era of big data, computational health informatics is a rapidly developing and crucial topic of study that could have a huge influence on the traditional healthcare sector. Big data analytics are predicted to move closer to a predictive system. These studies merely scratch the surface of what data mining and big data analysis for health informatics could do in the future. Methods that are more accurate and efficient will be developed as computing power grows. This may result in the availability of data for analysis at hitherto unimaginable levels of human existence, such as below the molecular level (atomic scale, for example), where the information collected from each patient would constitute RBD.

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