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The Role of Big Data in Personalized Healthcare: Integrating Genomic, Clinical, and Behavioral Data

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Abstract
Precision medicine is becoming a crucial part of the healthcare system's care delivery, improving patient diagnostic and treatment outcomes. This expansion can be attributed to the new data science technologies that have made it possible to simulate complicated illnesses. The foundation of precision medicine is genomics and omics capabilities, which offer data on molecular proteins and biomarkers that may result in new treatments for patients with a variety of illnesses. However, the ability to evaluate, interpret, and integrate data is one of the primary issues with precision medicine. As a result, the shift from traditional to precision medicine is not seamless. Thus, this study examines the drawbacks of big data and talks about the advantages of overcoming them. The implementation of Big Data Analytics (BDA) in healthcare will enable the application of new technologies for patient treatment as well as health management.

Keywords: Big data, challenges, benefits, medicine, clinical data, strategy, personalized healthcare.

Introduction

Big data is revolutionizing several sectors throughout the globe, including healthcare. Data acquired from many sources, such as electronic health records, medical image analysis, wearables and medical devices, and more, is accessible in large quantities in the healthcare industry and contains information on human health problems and activities. The capabilities of big data are expanding in tandem with the advancements in health and technology. This study will discuss the role of big data in healthcare in providing personalized medicine along with the challenges in implementation. Some recommendations will be highlighted for the healthcare industry to adopt for better implementation of big data.

Role of big data in personalized healthcare

By considering aspects including genetics, environment, and lifestyle, precision medicine seeks to personalize medical treatment to individual traits. In order to fulfil the potential of precision medicine, big data analytics is essential for mining large and varied datasets for useful insights. One of the most important tools for precision medicine is big data analytics, which can handle and make sense of very complicated information [1]. Big data has affected the whole health care industry by offering innovative and technology advancements which ultimately has increased and developed the need for personalized care for patients in the industry. Electronic health records, genetics, and various variable technologies for patient care are some of the data that can be considered as sources of the big data frameworks on the

basis of which big data utilizes the need for the treatment and results of the patients for further medical treatments.

Here big data plays a very important role and medical professionals are using big data in order to analyse all the existing data in a very short time period without any hurdle so that they can easily predict the treatment and measure the result as per the analysis. There are where you stream works that are in knowledge of health care professionals that are making the whole process possible to consider genetics and lifestyle factors as data. Besides, big data has the ability to offer a continuous and better decision and can easily detect the illness early. For personalized medicine it is very important to analyse the lifestyle clinical and genetic factors along with the behavior factors. It is not always possible for health care professionals to analyse the personal as well as the lifestyle of a patient so big data can easily analyse such data as per the existing medical records of the patient. It is clearly evident that in healthcare big data allows doctors to create and develop a personalized treatment and medicines for each and every patient for the treatment by evaluating the results and data.

Genomic data

Using a patient's unique genetic profile is at the heart of personalized medicine, which aims to improve healthcare by preventing and treating disease. Biomarkers and a patient's genetic composition may show which therapies work best, which medications are safest and most effective, and how much of each to provide. The expanding understanding of genetics in medicine has allowed for better prevention measures, more accurate diagnoses, and more effective treatments. Genetic data actually help in analyzing the disease to provide prevention treatment on the basis of health records only for the original purpose [2]. For any diagnosis healthcare professionals always aim to discuss the genetic problem as many illness patients can easily get it from their elders or parents due to which analyzing the genes data is very essential for treatment. Data analytics made this process easier and effective by easily analyzing the data thoroughly and provide treatment based on such analysis and result. Doctors can easily provide precise and personalized medicine to the patient after knowing the issues in genes.

Clinical data

Modern medicine has made great strides in meeting the unique demands of each patient by allowing doctors to provide individualized treatment plans. Clinical researchers across the world are using the power of real-world data to aid doctors in this area. For example, traditional clinical trials are not likely to collect enough data from patients with uncommon disorders or cancer to conduct in-depth analyses. We can fill this gap by looking at real-world data that points us in the direction of testing a certain medicine for a specific set of patients. However, it's not as simple as it seems to use the existing real-world data to provide patients with personalized therapy. Before the data can be used to enhance patient outcomes, its accuracy must be confirmed [3]. Clinical trials of the future will rely more heavily on real-world data collected from electronic health records and other self-reported patient data sources, making them data driven. Predicting the comparative efficacy of pharmaceuticals using real-world data is a huge step towards providing individualized treatment. The aim of clinical research is to collect sufficient real-world data to classify and compare various patient groupings. Clinical research and the field of personalized medicine stand to benefit greatly from such data sets. Finding patterns and correlations in massive amounts of genetic and clinical data requires data analysis tools and methods developed by

electrical engineers. These tools and techniques include artificial intelligence (AI), machine learning (ML), and the operation of electrical equipment and systems.

Behavioral data

Developing a comprehensive understanding of patients is crucial for developing customized healthcare experiences. When health systems have access to data on clinical, financial, consumer, and behavioral aspects, they may craft an engagement plan that is more tailored to each individual's needs. Using this information in particular, healthcare marketers may craft more precise and effective marketing efforts that disseminate accurate health information to the appropriate people via the proper channels. The problem is that it's hard to get a complete picture of any customer or patient with all the data coming in from all the many sources. The role of health analytics is relevant here. Organizations may make the most of patient data with the help of a health analytics engine, which can take in data from many sources and analyze it to draw conclusions. It is critical to integrate and understand all available patient data sets in order to improve patient experiences. This procedure is much simplified by this technology. Businesses, governments, and individuals might all benefit from better decision-making if behavioral data were collected and analyzed [4].

Challenges

Big data can be considered as a promise to the healthcare industry for better effective and personalized treatment but there are some challenges that healthcare professionals and doctors are facing while implementing big data. One of the biggest challenges that the healthcare industry is facing is to protect the personal and important information about the patient which includes their address, phone numbers, names, and the illness. This is a major drawback and a challenge that can be faced during the implementation of big data. This can be a threat to the industry as well as each and every patient and hackers can easily get all the personal information of patients by hacking the system and such breeches needs to be considered and prevention should be the first priority of any organization.

The next challenge is making the all data work together and integrating the big data effectively. This is because the data has been saved in various formats in different computers and systems which are quite difficult for the big data technology to analyse together. Furthermore, every industry faces issues in meeting legal standards and the health care industry is not exceptional, so the industry has faced issues in meeting legal standards in the field of Big data analytics such as health insurance portability and accountability act and different ethical issues regarding the patient data and personal information.

Strategy

The following are some things that healthcare organizations should think about in order to make good use of big data analytics:

Electronic health records, wearables, and biometric devices are just a few examples of the types of data that healthcare organization’s should be sure to efficiently and securely gather, store, and integrate.

In order to analyse and analyse complicated and big information quickly, healthcare organization’s need strong analytics tools and infrastructure.

Data privacy and security must be organization’s top priority in order to safeguard patient information and meet regulatory standards, considering the delicate nature of healthcare data.

Future

When it comes to healthcare, big data involves gathering, analyzing, and using information that is too large or complicated for conventional data processing methods to comprehend. This includes consumer, patient, physical, and clinical data. Big data will be increasingly important for healthcare organization's future performance, thus they will employ it more often. Smarter and more integrated marketing touchpoints are another area that healthcare big data will keep helping with. The proliferation of wearable gear and the IoT will also increase the quantity of data accessible. As ubiquitous as wearable electronics and the Internet of Things (IoT) are becoming for patient monitoring, they will flood giant data repositories with massive volumes of information. In order to identify and keep patients with the greatest propensity for services, healthcare marketers may use this data to combine a significant amount of healthcare knowledge. As a result of the coronavirus epidemic, healthcare digitization has accelerated, and several healthcare systems are collaborating with data scientists to create digital tools and models that will revolutionize healthcare. Health care practitioners will have access to data that is even more insightful and accurate than what is already accessible due to the development of new data sources, the use of new technologies like AI, and the greater emphasis on predictive analytics. Leaders in the nursing field may be able to use this information to create better plans.

Conclusion

The field of data analytics and healthcare has just entered a new frontier with precision medicine, often known as personalized medicine. Clinical care providers' treatment delivery and diagnostic processes have been transformed by new datasets made possible by groundbreaking developments in genetic analytics and data science. The analysis of existing data, clinical data, genomic data, and behavioral data with lifestyle data are some of the major parts of big data analytics to offer personalized treatment. Many industries are using big data analytics in their business operations but health care is one of the top industries in which the use and implementation of big data has increased due to this individualized and personalized treatment approach which aims to improve and enhance the patient care and outcomes. Lastly, the study also highlights some challenges that healthcare professionals and the industry faced during the implementation of big data in their business process which needs to be considered for effective patient care and personalized treatment. The future of the healthcare industry will be on rise and big data will play a very important and significant role by making the healthcare industry a data drive and decision-making business process.

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