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Substantial Influence of Machine Learning Techniques in Healthcare Industries

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ABSTRACT: The process of repurposing drugs is beneficial for quickly responding to new disease outbreaks, as well as for rare diseases, for which it is difficult to conduct large-scale clinical trials. It is possible to make use of machine learning technologies in order to increase the efficiency of drug repurposing. These technologies work by making it easier to find potentially useful new applications for existing medications. When it comes to maintaining medical records, utilising technology to do so makes the information contained within them more readily available. Even at this late stage, there is still a significant obstacle that needs to be overcome in order for data collection to be successful. The provision of tools for the effective processing of data is a potential contribution that learning machines could make in this regard.

KEYWORDS: Machine learning; Healthcare; Medicine; drug discovery.

I. INTRODUCTION

Machine learning is a subfield of computer science that simulates how the human brain learns new information by using data and algorithms to model the process. The more time that passes, the more accurate the simulation becomes. When it comes to the subject of medicine, there is a relatively large number of different software programmes that have the potential to be utilised [1]. At the beginning of the 1990s, the widespread availability of personal computers and the Internet led to an increase in the number of hospitals that began actively employing electronic medical record software. This resulted in an increase in the overall quality of patient care. The widespread availability of personal computers was a contributing factor in this development. According to the Centers for Disease Control and Prevention[2,3] approximately 85 percent of office-based physicians make use of electronic medical record and health record systems. [4-6].

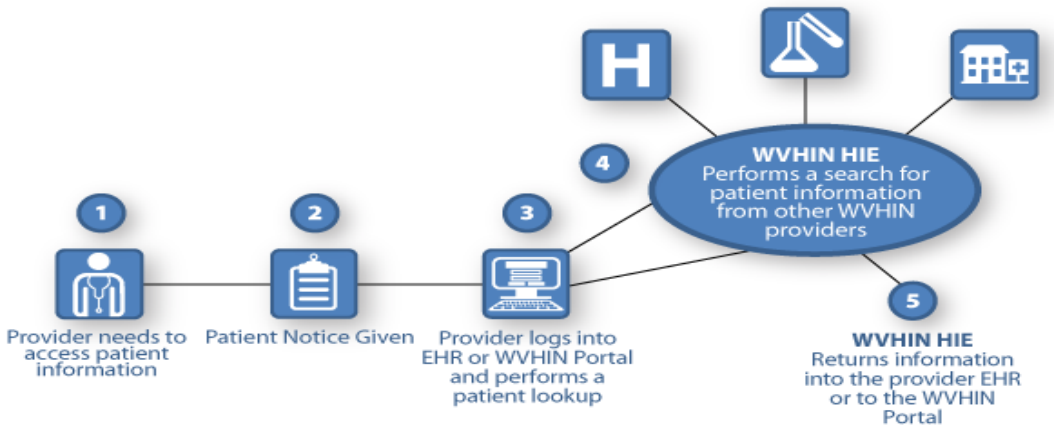

Fig. 1. Representation diagram of WVHIN providers

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The abbreviation "EHR" stands for "Electronic Health Record," which describes a piece of software that can be downloaded onto a computer and then utilised to compile, store, and exchange arranged medical data[7]. It is now possible for all authorised parties involved in a patient's care, such as physicians, labs, pharmacies, emergency rooms, nursing homes, state registries, and patients themselves, to communicate medical information with one another thanks to an electronic health record, also known as an EHR[8].The automatic algorithms of electronic health records (EHRs) compare the demographic data and ensure that records from multiple authorities pertain to the same patient by confirming that the same patient is listed in each of those records. This process ensures that records from multiple authorities pertain to the same patient[8-10].Because of the myriad of different ways in which various systems format patient demographic information, accurate matching may be difficult to achieve. As a direct result of this fact, the ONC advises that demographic data be standardised and requires that matching take into account the following elements: address, name, birthday, phone number, and gender[11].

II. LITERATURE SURVEY

The examination of data pertaining to the expression of genes offers a method that is not only objective but also effective in the subclassification of leukaemia. In order to classify the information regarding gene expression associated with leukaemia, the purpose of this study was to develop a classification scheme predicated on neural networks[12]. During the course of the research, a method known as binary classification was utilised to differentiate between acute lymphoblastic leukaemia and acute myeloid leukaemia[13]. A ternary classification system was also developed by the researchers. This system categorises leukaemia expression data into three subclasses: acute myeloid leukaemia, B-cell acute lymphoblastic leukaemia, and T-cell acute lymphoblastic leukaemia[14]. When the gene expression patterns of leukaemia patients were first brought into each categorization system, they were put through a series of fundamental pre-processing procedures. Because of this, approximately 95% of the genes that did not contribute any useful information were eliminated[15].

Machine learning has the potential to improve administrative processes in both the medical and manufacturing industries. There is already sufficient evidence to show that when it comes to illness diagnosis, machine learning routinely performs better than humans[16]. Already, algorithms are outperforming radiologists when it comes to the detection of cancerous tumours. Machine Learning is used in healthcare technology to improve the quality of treatment by analysing external data such as a patient's condition, X-rays, CT scans, and the results of a variety of other tests and screenings. These algorithms improve treatment quality through the use of self-learning neural networks[17].

Consider the circumstance surrounding Ciox as an illustration. For the purpose of managing their patient data, more than 700,000 healthcare professionals in the United States use a piece of software called Ciox. Ciox is a programme that manages the data associated with healthcare. To be able to provide its customers with data that was compatible with that of other customers, the company established the HealthSource data platform[18]. It is made much easier to manage unstructured records and obtain access to data all over the country by making use of techniques that are based on artificial intelligence and machine learning. In addition to that, the system is equipped with features for the processing of natural language as well as handwriting recognition, both of which are designed to aid in the process of data collection[19]. Ciox offers healthcare decision makers a method that is both simple and secure for gaining access to the information and insights that are buried within the medical records of patients[20].

Connect - Ciox manages all aspects of health data requests, retrieval, and delivery, which results in an improvement in financial performance, a reduction in data backlogs, and an ease in the strain of workforce shortages[21]. Because of this, your company will be able to make better use of health data, and Ciox will be able to relieve some of the strain caused by workforce shortages[22]. Control The technology that was developed by Ciox gives users complete control and transparency over the manner in which data from medical records is distributed to third parties as well as the timing of those distributions[23].Ciox is able to achieve its unparalleled level of compliance quality by placing an intense focus on health data interchange, in addition to customising both its technology and its operating procedures. This allows Ciox to meet the requirements of a wide variety of regulations[24]. Ciox places an emphasis on quality in all aspects of its business, including its workforce, operational procedures, and technological advancements. This commitment to quality extends even to the company's technological innovations[25].

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III. PROPOSED MACHINE LEARNING BASED TREATMENT PROTOCOL

In many instances, the process of formulating a treatment plan calls for a significant amount of time, effort, and medical knowledge. When it comes to the treatment of cancer, coming up with a treatment strategy can be a very difficult and time-consuming endeavour[25]. The treatment protocols that therapists use should be balanced, and they should be based on the characteristics of both the patient's body type and the tumour. Because of this, the therapists will be able to direct the appropriate quantity of radiation to the tumour while simultaneously reducing the quantity of radiation that is delivered to healthy organs[26].

The medical data are able to be analysed by machine learning algorithms, which can then produce individualised treatment plans based on databases that contain information about treatment programmes that have been successful in the past. According to the findings of the study, when radiation therapy was used to treat prostate cancer, machine learning-based treatment plans were chosen more frequently than human-made treatment plans 88% of the time[27].

RaySearch Laboratories is one of the most well-known software developers in the field of radiation oncology due to the fact that more than 2,600 distinct clinics from all over the world have placed their trust in the company. An optimization system for treatment plans is included in one of their offerings, which they refer to as RayStation. [28] The programme heavily relies on various machine learning algorithms in order to develop individualised treatment plans for patients. These algorithms take into consideration a variety of factors, including the patient's geometry, dosages, and treatment history. Because the system does not save any personal information about patients, it is also very easy to access. This makes it possible for different medical facilities to work together to provide better care for patients and enhances overall therapeutic procedures[27,29].

1.1. Procedures on various medical images

The process of diagnosing and treating patients based on photographs taken of their bodies is referred to as "medical imaging." This term is commonly used in the field of medicine. Imaging is another tool that therapists use to monitor their patients' progress and modify their treatment plans for patients who have chronic health conditions[30]. There are thousands of photographs, each one containing essential patient information, that can be found in today's medical imaging systems. These systems store these images digitally. On the other hand, getting these data out of the system requires a significant investment of both time and labour. By processing visual data, image analysis algorithms can be of assistance to clinicians in assisting them in making better-informed medical decisions as well as improving their workflow. As a result of the increased precision of the decisions, [clinicians] can also reap the benefits[30].

For an illustration of how machine learning can improve the interpretation of medical images, take a look at PathAI. Because the PathAI platform is able to differentiate between a large number of cellular subtypes, it provides pathologists with a useful tool for the identification of cells that could cause harm[31].From a photograph of a tissue sample, a human can make a more accurate and timely diagnosis of cancer, but machine learning algorithms can do it more accurately and more quickly[32].Developing innovative therapies and new pharmaceutical products

The method that is typically utilised in the production of brand-new medications is one that is laborious and time consuming. Bringing a new medicine to market can be a very time-consuming and expensive process that can take a significant amount of money. There is a possibility that the development of a new treatment will take longer than ten years and will cost more than two billion dollars[33].

With the assistance of chemists and pharmacists who utilise machine learning, the process of developing new drugs can be sped up significantly. Machine learning algorithms are utilised throughout the entirety of the drug development process, beginning with target validation and continuing all the way through the processing of digital data collected during clinical trials. The application of machine learning in the pharmaceutical industry has as its primary objective the optimization of both the processes involved in the procedures and the outcomes of those processes[34]. For example, the pharmaceutical industry at Pfizer utilised Al technology to speed up the process of conducting clinical trials in order to develop the Covid-19 vaccine. This was accomplished by reducing the number of participants in each trial. The data of patients were cleaned up in less than 24 hours by the algorithms, in contrast to the up to 30 days that could be required when using human datasets[35]. Increasing one's capacity for analysis is a worthy endeavour.In the field of medicine, the objective of analytics is to contribute to an improvement in the quality of care provided to patients. The gathering of evidence to back up medical conclusions by evaluating patient data through measurement

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and analysis is a significant contribution to the process of decision-making because it provides evidence to support those conclusions. There are several distinct stages that can be broken down to make up the process of developing analytical capability[36]. Traditional methods, such as descriptive and diagnostic analytics, work with data from the past to produce statistical reports, such as a comparison of the percentage of patients who are sick with the flu in the current month to those from previous months. These reports can be used to make decisions about how to treat patients[37]. The following stages of analytics are cognitive analytics, predictive analytics, and prescriptive analytics. In order to accomplish their goals of forecasting, making recommendations in real time, and making decisions automatically, these kinds of systems require complicated computer algorithms. The healthcare industry stands to gain from the information that is made available by machine learning methods, which also facilitates the formation of well-informed decisions. The accurate processing of analytical outputs has the potential to improve the overall treatment process, speed up the patient's recovery, lower the risk of future relapses, and save money, among other benefits[38].

The field of analytics is undergoing rapid development as a whole, particularly in relation to the application of AI. By enhancing the level of medical care provided and accelerating the healing process, for example, ConcertAI, which utilises data from the real world and machine learning algorithms, improves the quality of care provided. ConcertAI increases the efficiency of cancer treatment by providing on-demand access to data repositories from the real world and AI-driven oncology treatments. The company has only just recently started working together with the FDA to incorporate evidence from the real world into decision-making processes[39].

1.2. Providing data security

The incorporation of technology into the field of healthcare has resulted in an increase in the quantity of data that is considered confidential. Cybercriminals have the ability to manipulate data pertaining to patients, as well as personal information, diagnostic reports, and test results. This includes all of the patient's data. The process of responding to the repercussions of data breaches is one that requires a significant investment of both time and resources. The research that was carried out by Bitglass into the topic of data breaches in the healthcare industry revealed that the average cost of a compromised record in the year 2020 was $499. Due to the theft of a combined total of 26.4 million patient records, healthcare organisations have incurred costs amounting to $13.2 billion as a result of data breaches. As a direct result of this reality, the safeguarding of patient information is an indispensable component of the healthcare sector[40].When combined with predictive analytics, the algorithms that make up machine learning have the potential to make fraud detection more accurate and to thwart cyberattacks. The acronym SIEM, which stands for "Security Information and Event Management," refers to software that generates compliance security reports, monitors security alarms in real time that originate from a healthcare organization's network, and manages security information[41]. There is some evidence that security information and event management systems (SIEMs) that are powered by machine learning models may have the ability to improve attack detection. The programme monitors the actions of users in order to identify regular patterns of use, and it then identifies any unusual behaviour that may be occurring within the system. This is done in order to prevent any security breaches from occurring. If the system detects questionable activity on the part of a user, it will either label the activity as fraudulent or deny the user access to the network, depending on what it determines to be the most likely outcome[42].

Darktrace is a piece of software that employs artificial intelligence (AI) to identify potential cybersecurity risks in corporate networks and cloud environments that are utilised by healthcare organisations. These networks and environments are used by businesses. The 'life patterns' of programme participants are analysed so that researchers can gain a better understanding of the users' typical behaviours and locate potentially risky behaviour.According to one of Darktrace's case studies, the healthcare organisation experienced a positive return on investment (ROI) as a direct result of the automation that was provided by the software. Even the most skilled security analysts can't match the level of accuracy that can be achieved by learning machines when it comes to handling cyber threats. These days, information security is a primary concern for a diverse range of industries and types of businesses[40].

1.3. Personalizing patient care

Diagnostic testing is utilised in the practise of personalised medicine in order to determine which medical treatment will be the most beneficial for each individual patient[41]. A patient's medical history, as well as their

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circumstances and risk factors, are evaluated by a doctor so that an individualised treatment plan can be developed for the patient, or so that the patient's illness can be prevented from recurring in the future.

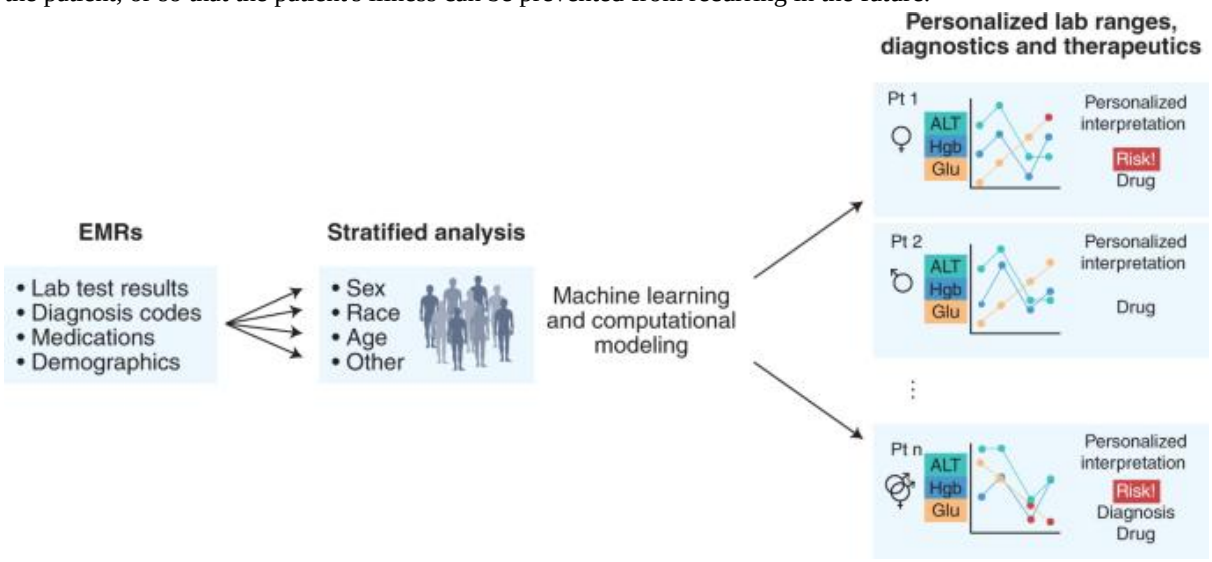

Figure 2. personalised interpretation of Machine learning model

EMRs are used to collect clinical data on a patient population, such as demographics, diagnostic codes, prescription order, and lab test results. This process generates billions of data points for millions of patients, which are then stored in electronic medical records. These details are contained within the patient's electronic medical records (EMRs). Even though electronic medical records are collected with the goal of providing individualised care to patients, the data contained within those records can be anonymized in order to protect patient privacy[42].The use of personalised medicine is gaining popularity as diagnostic information regarding diseases becomes more precise and as new analytics methods that are supported by AI become available. There are opportunities for machine learning to assist in healthcare, particularly in light of the continuing growth in the volume of medical data:

The implementation of computerised diagnostic and prescription processes can help healthcare organisations bring down their overall cost of providing care.Patients who receive personalised medical care report higher levels of overall satisfaction. Patients who receive early disease detection have a lower risk of passing away from their condition. Artificial intelligence-assisted real-time therapy has the potential to save lives.The delivery of individualised medical care is one area that stands to gain in a variety of different respects from the implementation of machine learning.For example, GNS Healthcare is working to improve machine learning algorithms in order to record the medication reactions of patients and advise them on the best course of treatment. This will allow GNS Healthcare to record and advise patients on the best course of treatment. In 2019, the business received a combined contribution of $23 million from the pharmaceutical industry as well as medical insurance providers[43].

The prospects that lie ahead for the application of machine learning in the field of medicine[44][45].There is a possibility that the way in which doctors practise medicine will change as a result of advances in machine learning. It will no longer be necessary for caregivers to focus their attention on completing tasks that are repetitive because automation and predictive analytics will allow them to do so. Instead, caregivers will be able to concentrate on providing superior care to patients. This will make it possible for a significant improvement to be made in the level of care that is provided to patients. There is a possibility that AI-based technology will one day be able to take over a variety of the practitioner's responsibilities, such as performing administrative tasks, making prompt and accurate diagnoses, and providing remote real-time therapy. The approaches that are taken in medical education are going to go through significant revision as a direct consequence of this paradigm shift. The future practitioners will need to demonstrate advanced skills in dealing with data and inventions, a commitment to learning throughout their entire lives, and the capability to work effectively with the knowledge gained from other fields.

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In the field of medicine, artificial intelligence is making progress toward hybrid models that can assist medical professionals in diagnosing illnesses, formulating treatment plans, monitoring patients, and evaluating risk factors while still allowing humans to make informed decisions. These hybrid models will be able to assist medical professionals in diagnosing illnesses, formulating treatment plans, monitoring patients, and evaluating risk factors. According to the results of a survey that was carried out by Intel, only 37 percent of those in the healthcare industry who are responsible for making decisions are currently utilising AI technologies. The medical industry can benefit from the application of technology that makes use of artificial intelligence, such as machine learning, which can assist in the improvement of a large number of the operational procedures that are currently in place. As a direct result of this, the demand for the development of AI-powered healthcare applications is currently experiencing a significant uptick at this time. We are moving toward a culture that is more high-tech, in which the medical field is developing new tools for interacting with patient data in order to improve the quality of care that is provided to patients. This is being done in an effort to improve the overall health of patients.

IV. CONCLUSION

When applied to electronic health records (EHRs), machine learning has the potential to provide meaningful insights in a number of different areas. Some of these areas include improving patient risk score systems, predicting the onset of illness, and improving hospital operations. Statistical models that make use of the variety and richness of EHR-derived data are currently uncommon; however, they present an intriguing topic for the purpose of future research because they offer a potentially useful perspective. This article provides an overview of how machine learning has been used in therapeutic contexts, as well as a summary of the benefits it provides over traditional analytic approaches. This information is presented in the context of the current research. A discussion is held regarding the methodological and practical challenges associated with applying machine learning in research and practise. In the final part of this article, we discuss potential application areas for machine learning that will have a significant impact both on health and the delivery of healthcare.

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