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ANALYSIS ON AI AND ML-BASED BIG DATA PLATFORM FOR THE DEVELOPMENT OF THE FIELD OF MEDICINE AND IMPROVE THE QUALITY AND TRANSITION OF HEALTHCARE

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ABSTRACT

With the advent of precision medicine, the traditional symptom-driven practice of medicine can be improved by using modern diagnostics earlier and creating more effective and cost-effective therapies. Due to healthcare's rising complexity and influx of data, artificial intelligence (AI) will become more widely used. Companies in the healthcare and life sciences sectors are already utilising various types of artificial intelligence (AI).Diagnostic and treatment suggestions, patient involvement and adherence, and administrative duties are all important application categories. The healthcare industry's information processing skills are being improved by new machine learning (ML) and artificial intelligence (AI) technologies. This study examines the present state of AI-based Machine Learning applications and their implications for the healthcare industry. This research included a comprehensive analysis of the literature as well as an examination of a number of real-world AI healthcare applications. Major hospitals are actively employing AI-enabled technology to support medical experts in patient diagnostic and treatment activities for a wide range of disorders.

1. INTRODUCTION

We've made enormous strides in the last few centuries because of our never-ending quest for knowledge. Antibiotics were only discovered in the last century and have since saved humanity from many of the world's most deadly diseases. In the context of recently published research, there are around 138 000 papers that disclose pharmacological errors and over 450 000 that contain delayed therapy (e.g. accessible via PubMed).Even so, the issue of people dying as a result of subpar medical care has gone mostly unnoticed. We're at the cusp of another, equally significant medical revolution right now. Most patients benefit from treating symptoms and carrying out learned trials based on those therapies, which reduces complications, improves survival odds, and works for most patients despite all of our scientific knowledge.

Disease relationships must be understood in order to gain new insights into disease taxonomy, aetiology, and pathophysiology. Advances in prescription drugs, surgery, and mental health interventions all contribute to our increased longevity. For patients who are aware of their current medications and drug allergies, creating an accurate in-time treatment plan has become a challenging and error-prone procedure [1]. As the number of people prescription and using medications increases, so does the demand for applications that help with medication reconciliation. Misdiagnosis, overtreatment, lost productivity, under-utilised clinical data processing, and significant cost and spending are all examples of living healthcare difficulties (Figure 1).

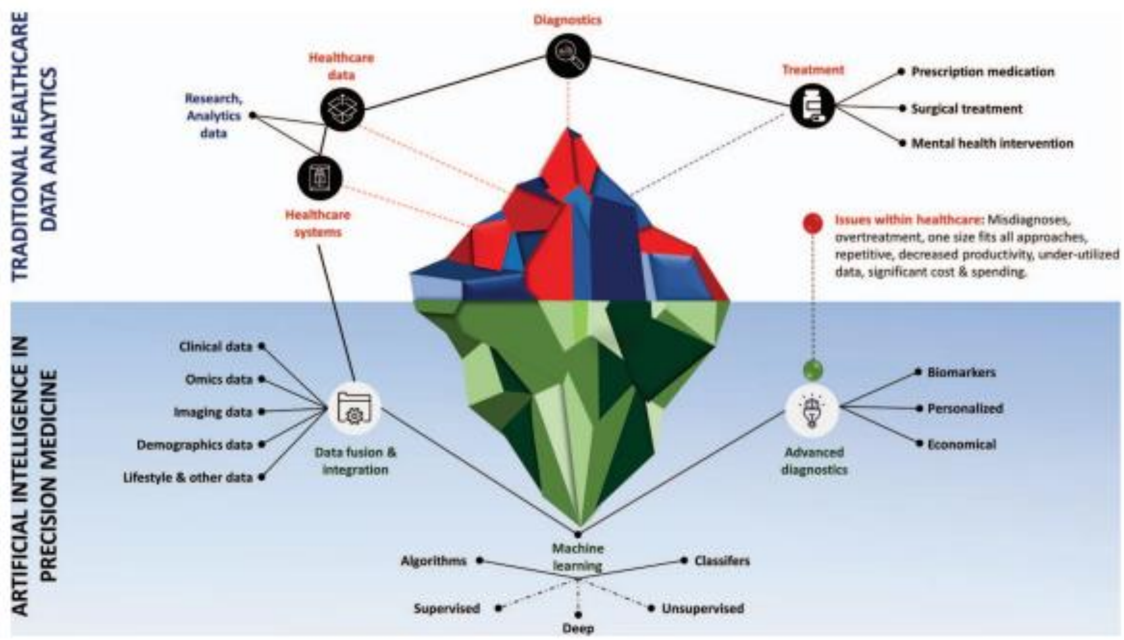

Figure 1. Artificial intelligence use in traditional data analytics in healthcare and precision medicine.

Information technology advances at all levels of care can help eliminate these errors to a significant extent. There is a growing use of artificial intelligence (AI) and associated technologies in the private sector as well as the general public sector, including in healthcare. Patients' care and administrative operations within provider, payer and pharmaceutical companies stand to benefit greatly from these new technology.

The term "big data" has exploded in popularity in recent years all around the world. Big data is being generated and analysed for a variety of reasons in almost every field of research, whether it is in industry or academia.The administration of this massive amount of data, which can be organised or not, is the most difficult challenge. Because standard software can't handle large data, we'll need cutting-edge applications and software that can use high-end computational power quickly and efficiently. To make sense of all of this data, artificial intelligence (AI) algorithms must be implemented, as well as new data fusion algorithms. It would be a major achievement to automate decision-making using machine learning (ML) approaches such as neural networks and other artificial intelligence (AI) techniques. The problem with large data is that it's difficult to make sense of without the right software and hardware.If we are to gain useful insights from this "endless sea" of data, we will need better methods for dealing with it, as well as innovative internet programs for rapid analysis. The information and insights gained by big data, when properly stored and analysed, can improve the awareness, interaction, and efficiency of important social infrastructure components and services (such as healthcare, safety, and transportation) [3]. Large amounts of data must be presented in an understandable way for society to progress.

2. LITERATURE REVIEW

Artificial Intelligence (AI) is the simulation of human intelligence in technology such as computers and robots. These computers have been programmed to replicate cognitive functions that we identify with human minds, including as learning and problem-solving. Artificial intelligence (AI), machine learning (ML), and deep learning (DL) are all techniques that people seem to use these days. As seen in Figure 2, artificial intelligence (AI) encompasses a lot more than the other two disciplines. Regression, clustering, and other algorithms are all included in machine learning, and these algorithms should be trained using data. The better your algorithm gets, the more data you provide it. Artificial neural networks are at the heart of deep learning, a branch of artificial intelligence that is still developing. Additionally, data is required for deep learning algorithms in order to learn how to do tasks.

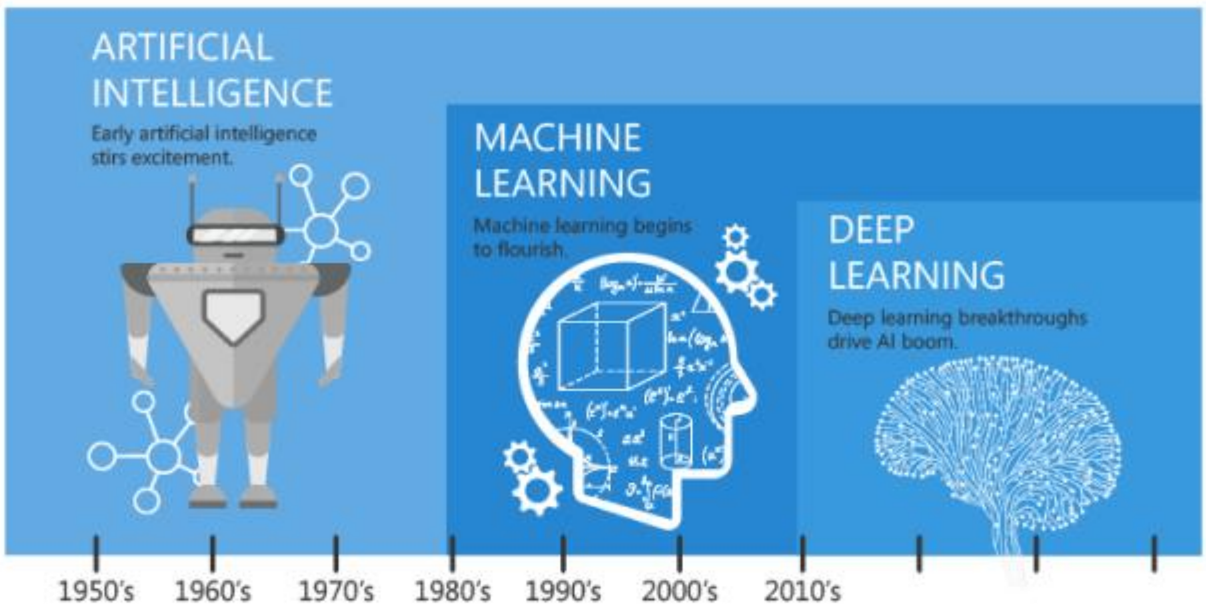

Figure 2. Artificial Intelligence Evolution.

Miyashita and Brady (2020),Patients released from hospitals in southeast England that serve 500,000 people were shown an example of a Wi-Fi-enabled armband that remotely monitors vital signs such as respiration rate, oxygen levels, and pulse, as well as blood pressure and body temperature. In this case, the readmission rate and number of visits to the emergency room were both drastically reduced due to AI programmes that analysed patient data in real time. There was also a 22% decrease in the number of time-consuming and expensive home visits.

Safavi, K.; , 2020,Some may believe that, as a result of AI's supporting/augmenting function in diagnosis, treatment, and operation procedures, physicians will become obsolete in the near future. While assessing the potential role of AI in healthcare, it's important to consider the opportunities and difficulties that come with it. Based on multiple real-world examples of AI use, it's evident that AI has enormous and far-reaching potential in a wide range of applications, ranging from simple process optimization to cutting-edge emergency patient treatments.

Yoon, S.; 2019,Privacy, cybersecurity, data integrity, data ownership, and data sharing across organisational silos are just a few of the major difficulties related with the growing use of AI and digital devices. Other major issues include the possibility of medical error and system malfunctions.

Doyle-Lindrud S, 2015, At each of these levels, health practitioners are responsible for patients' medical histories (diagnosis and prescription data), medical and clinical data (such as imaging and laboratory examination data), and other private or confidential medical data. Handwritten notes or typed reports were once the norm for archiving medical information of a patient.

Shameer K, 2017, This type of healthcare data is being managed and used by information technology. This technology has gained traction in the creation of real-time biomedical/health monitoring systems that can produce warnings and transmit patient health-related data with other health care providers as needed. All of these gadgets are creating a tonne of new data that can be evaluated in real time for clinical and medical purposes.

3. METHODOLOGY

3.1 AI & ML in health intelligence, precision medicine and resource management

Intelligent big data platforms are needed to improve the quality and transition of healthcare by accelerating the investigation of active hidden factors in clinical data using machine learning algorithms to obtain actionable gap-based patient information for early detection and prevention of constitutional disorders like cancer, as well as streamlining data sharing by developing efficient communication protocols. When used in healthcare, it has the potential to be a game-changer for guiding personalised and population therapy while also providing significant computational advantages. Predictive diagnosis has been made easier with recent AI and ML-based efforts to understand diseases, e.g. extracting disease correlations from clinical symptoms, EHR, and data collected by wearable technology.

3.2 Health intelligence approaches

An important part of clinical research and analytics is health intelligence, and it can help achieve important goals like providing more tailored and population healthcare. Academic and commercial sectors have both built operational and research-based healthcare data management and analytic systems in recent years. When it comes to healthcare data analytics, we're particularly interested in solutions that implement a comprehensive process; offer features for managing, analysing, visualising and sharing de-identified EHR; aid in automatically collecting data on patients' demographics; schedule appointments; answer pre-exam questionnaire results; consult with providers; conduct lab tests; diagnoses; treatment plans; medications; surgical procedures; and claims; and so on. Employ artificial intelligence (AI) techniques to assist in the creation of classifiers that can be trained on structured clinical data obtained from a variety of clinical activities and discover comparable groupings of individuals, as well as relationships between subject attributes and desired outcomes; Natural language processing (NLP) approaches are used to extract information from unstructured clinical data, such as narrative text from physical examinations, clinical laboratory reports, and other clinically relevant materials.

3.3 ML in medicine with better patient–provider interactions

To fully utilise machine learning in medicine, systemic changes in healthcare systems must be examined and implemented. According to this, medical ML concepts should be developed with the goal of personalising diagnosis and therapy based on all available patient data as well as collective experience. The authors explained their reasoning by citing tried-and-true proof-of-concept models, such as the difficulty in establishing a link between current ML models and traditional statistical models, the need for a massive amount of data to train ML classifiers for establishing general and complex associations, and the need for clinicians to be trained in AI for accurate data analysis. EHRs' enhanced administrative and billing features (e.g., check boxes) could prohibit physicians from giving the highest quality treatment to their patients, as they consume important physician time. When combined with EHRs, they said, machine learning may result in decreased vigilance and bias towards humans due to overreliance.

3.4 AI, ML and the evolution of healthcare

The overview and application of AI and ML in healthcare has recently been highlighted by authors for the extraction of vast volumes of data and to assist doctors in providing better treatment. They looked at how support vector machines (SVMs) and deep learning-based models may be used to segment and analyse physiological data, forecast illness development, and diagnose radiological problems. The authors looked at strategies including developing effective models to aid in diagnosis based on information that resembled specific diseases, as well as image processing and interpretation to improve clinical decision-making. ML has also generated ethical issues in the use of governance and management of massive data, as well as the future of work.

4. REAL-WORLD AI APPLICATION CASES IN HEALTHCARE

Lifestyle factors such as exercise, eating, sleep, stress reduction, substance and medication use, and/or recreation account for over 60% of the factors linked to health and quality of life. This information comes from the World Health Organization. Using artificial intelligence (AI)-assisted technologies and applications, people can now receive alerts and reminders throughout the day that are tailored to their specific vital signs. In healthcare companies, artificial intelligence (AI)-based technologies are expected to have a substantial impact on how healthcare systems run and interact with patients while also improving patient outcomes overall.

4.1. Diagnostic Assistance

AI is intended to make it easier for doctors to identify ailments in patients. Diagnostic errors account for 60 percent of all medical errors in the United States, killing between 40,000 and 80,000 people each year. As a result, applying AI-based technology in the healthcare industry may assist cut down on human judgement errors. Cervical cancer screening at the Mayo Clinic, a leading US healthcare facility known for its innovations in patient care and health technology, used AI to detect precancerous alterations in a woman's cervix. AI-based technology can detect precancerous changes in the cervix using over 60,000 photos obtained from the National Cancer Institute's database. Research shows algorithm is 91% more accurate than an expert trained by trial and error (69 percent).

The Moorfields Eye Institution, a specialised institution of the National Health Service Foundation (NHSF) in London, has unveiled an AI solution that can recognise eye ailment symptoms as well as world-renowned clinicians and experts in the field. The AI-based approach was able to diagnose eye abnormalities from optical coherence tomography after assimilating data from over 15,000 British patients. At least 94 percent of eye disorders were correctly diagnosed using this AI-based technology, according to the hospital's announcement. Observed Moorfield Eye Hospital's Dr. Pearse Keane, "the number of eye scanning is expanding at a rate far faster than human experts are able to understand them." Thus, the use of AI-based technologies can significantly shorten the time it takes to conduct a diagnosis.

4.2 Nursing and Managerial Assistance

In the course of providing care, healthcare providers are well-known to be swamped with paperwork. It is because of this increased workload that health care providers have begun implementing AI-based electronic systems that combine and digitise medical records. In addition, chatbots have been discovered as a potentially effective method for interacting with patients and family members in hospitals.

The Cleveland Clinic, a nonprofit academic medical centre in Cleveland, Ohio, began using Microsoft's AI digital assistant Cortana in 2016 to use predictive and advanced analytics to "identify possible at risk patients under ICU care." To keep an eye on "100 beds in 6 ICUs" overnight, Cortana is linked to the e-Hospital system at Cleveland Clinic. In hospital rooms, doctors and patients can speak, and an AI-assisted system at the University of Pittsburgh Medical Center can listen in and learn from it.

CONCLUSION

These days, a wide range of biomedical and healthcare tools, such as genomics, mobile biometric sensors, and smartphone apps, generate a vast amount of data. As a result, we must be aware of and appraise what may be accomplished with this data. Analyzing this data, for example, can provide additional insights into healthcare procedures, technical, medicinal, and other forms of changes. Based on an assessment of various medical treatments, it appears that personalised medicine is nearing its full potential. The aggregate big data analysis of EHRs, EMRs, and other medical data contributes to the development of a better prognostic framework on a continual basis. t Healthcare analytics and clinical transformation service providers do make a positive impact on patient outcomes.

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