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Unlocking New Aspects Of Healthcare Through Artificial Intelligence

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ABSTRACT

Artificial Intelligence (AI) is a branch of computer science which focuses on creating algorithms or machines that can mimic human intelligence. AI has become an indispensable tool across various fields, including corporate, research, education and medicine. The most likely use of AI in healthcare is transforming diagnosis of diseases like diabetes, cancer and mental health, to the early stages and medical visualization very easily. Artificial intelligence can give information about CT scans, X-rays and MRIs with more accurately leading to the plans for more effective treatment. This ability of AI has led to the important advances in discoveries of drugs and preventive medicine. There are number of diseases which are causing millions of deaths in the world but in this paper, we are focusing on the role of AI in major three diseases: Diabetes, Cancer and mental health. Diabetes care in patients has been improved by development of AI based blood glucose management plans, regular glucose monitoring and predictive control. Cancer is a chronic disease which cannot be diagnosed at early stages without regular monitoring. AI has been utilized in dose optimization, radiotherapy, tumor contouring and personalized chemotherapy at particular site to minimize the opposing effects. Mental health disorders like anxiety depression etc. have been increased due lifestyle changes. AI tools guide us how mental health and psychology of mind are important for physical health of a person. It helps us to analyze speech, expression of face and to diagnose mental problem. This paper will focus on how the development of AI in healthcare can be a life-saving advancement. We will explore the interrelationship between cancer, mental health, and diabetes and examine how powerful AI technologies are being used for the diagnosis, treatment, and management of these and other diseases.

Keywords: *Healthcare, Diabetes, Cancer, Artificial intelligence, anxiety, diagnosis, medicine*

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1. INTRODUCTION

In this era, Artificial Intelligence (AI) is the most powerful technology that can make things possible anywhere and anytime. AI is achieved by reviewing how humans learn and how human brain thinks, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

There has been a rapid enhancement that includes the impacts on healthcare sector where machine learning (ML) and deep learning (DL) are some of the essential ways to advancing research, patient care and diagnostics. It uses algorithms to investigate vast amounts of patient data, targeting to improve diagnosis, identify treatments, improve drug development, and rationalize different tasks, resulting in a well-organized, available, and equitable patient care.

Existing AI applications in healthcare can be broadly categorized into different kinds like modeling, analysis of medical images, recognition pattern and automated documentation, reducing costs and providing decision support systems and improved patient outcomes. Machine learning (ML) has proved to be effective in identifying the risk factors, predicting the disease progression and classify the data for easy access for the health professionals (Fig. 1). While it being effective in structured data environments, these models usually struggle with the complexities associated with large scale unstructured medical datasets. NLP (Natural Processing Language) has also gained some importance within healthcare mainly in the maintaining medical records that involves literature and also electronic health records (EHRs). Transformer based architectures, such as BERT (Bidirectional Encoder Representations from Transformers) and GPT (Generative Pre-trained Transformer) focus on the processing and extraction of critically important points from the vast amounts of textual data. These enhance personalized treatments bringing challenges related to interpretation, generalizability and data privacy

of the model (Santiago et al,. 2025) [1].

Current trends in AI research in the case of healthcare focuses on the development of explainable AI frameworks. AI focuses on bridging the gap between model interpretation and complexity, so that the healthcare professionals can understand how AI works in these cases and therefore helps in enhancing the transparency.

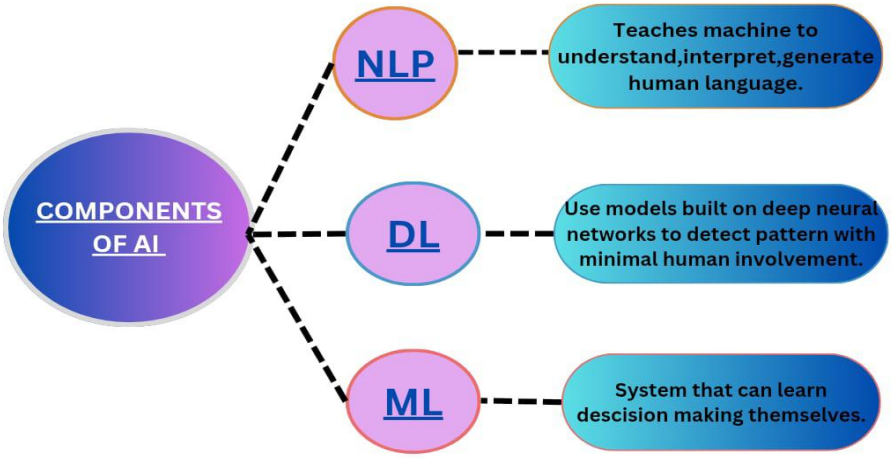

Fig 1- Components of AI

2. ROLE OF AI IN HEALTHCARE

There are many benefits of using AI in healthcare like accuracy of diagnosis, cost-effective and less invasive treatments. It reduces cost within the healthcare system and gives personalized treatments, and enhanced preventive care; all contributing to better patient outcomes and an improved quality of life.

Ali (2025) explored the role of AI in infectious disease monitoring, optimization of public health [2]. The study highlights AI- driven techniques such as DL (Deep Learning) and also useful for real time outbreak forecasting, genomic surveillance and vaccine development. By merging AI with large scale data, the study demonstrates the AI is capable of detecting the emergence of public health threats. Grothen et al. (2020) provided a systematic review of AI methods that applies to pharmacy data for cancer monitoring and epidemiological research. This study focuses on the investigation that clearly looks into the integration of machine learning and Natural Processing Language in analyzing electronic health records to improve treatment [3]. Kraemer et al. (2025) presented a detailed perspective on the use of AI in infectious disease modeling, discussion on the basis on how deep learning, probabilistic modeling and AI driven computational epidemiology can improve disease surveillance. This study relies on historical datasets to evaluate AI's role in stroke care monitoring, although it provides valuable insights into healthcare system disruptions during the pandemic [4].

AI may deal with the ideas towards diagnosis, intervention in medicines and therapeutic visions and approaches for justifying health detoriation and supporting strategies to prevent worsening of patient's conditions. Hospitals are now exploring the use of AI technologies which help in improving the accuracy of practice and reduce the cost of operations. The advancements in data science and AI have advanced the effect on different fields of study that may include business, healthcare or any such profession. Continued collaborations between researchers will lead to harnessing of full potential of AI that will ensure innovations in healthcare. (Fig 2)

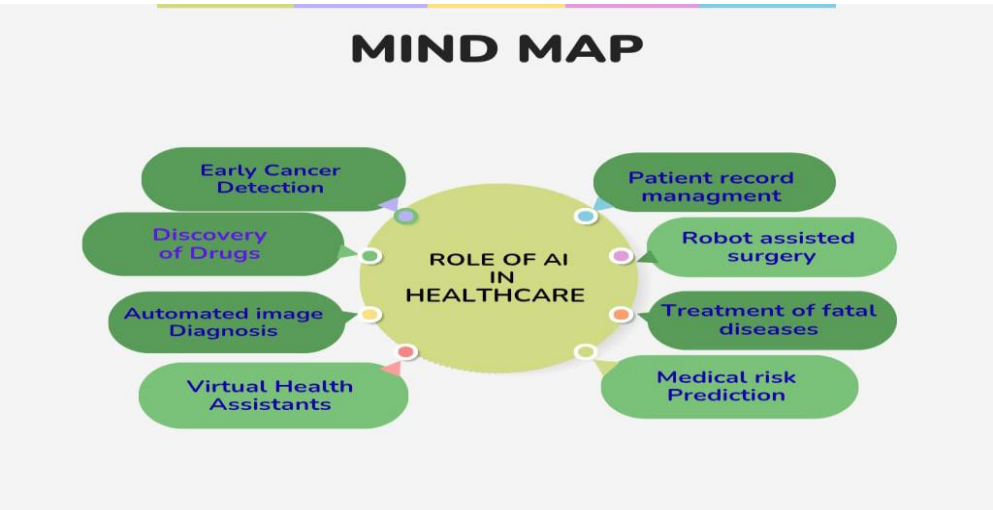

Fig 2- Role of AI in healthcare

AI IN DIABETES

The integration of DHTs (digital Health technologies) like AI in healthcare helps to resolve problems like rough dispersal of medical resources, lack of high quality human capitals and an unsatisfactory size of primary healthcare. Devices like continuous glucose monitoring (CGMs), insulin pumps and Smartphone provides real insights into blood glucose levels, insulin dosages and carbohydrates intake. These tools are complemented by smartphone applications by tracking meal composition, while clinical data sources contribute lab results; electronic health records (EHRs) and physician notes.

Some AI generative methods increase patient care and medical research with the precise modelling of patient data and physiological response [5 and 6].

2.1 AI in prevention of diabetes

In today's era many new technologies have been introduced for the early diagnosis which helps in primary care setting and gives us preventive strategies for high risk population. AI based solutions may provide real time health and metabolic information. In some cases the condition is asymptomatic so diabetes remains undiagnosed for years in individual. Early diagnosis can help in managing the condition and preventing microvascular and macro vascular outcomes.

AI in prevention, lifestyle and dietary management represents a significant development in personalized healthcare where artificial intelligence is programmed to tailored dietary and lifestyle interventions to individual patient needs and preferences. It's role in analysing vast amount of data from dietary pattern to get microbiome composition that allows the creation of highly dietary preferences. Additionally, studies like those of Seethaler et al., 2022 illustrated how AI can help in understanding the complex interactions between diet, metabolic health and individual physiological responses [7].

Thanks to many new technologies, by which we can detect abnormalities present in our body. Interdisciplinary collaboration is essential as it involves healthcare professionals, AI researchers and policy makers in developing AI tools that are user friendly, has clinical relevance and aligned with healthcare policies. AI helps us in primary care setting and gives us preventive strategies for high risk population. Continuous monitoring and evaluation of AI applications are necessary to identify areas for improvement, understand long-term impact and to adjust strategies in response to emerging data and technology. In some cases the condition is asymptomatic so diabetes remains undiagnosed for years in individual. Early diagnosis can help in managing the condition and preventing microvascular and macrovascular outcomes [8].

2.2 Diabetes prediction using ML and AI techniques

AI and machine learning techniques helps us to gain knowledge about the preliminary disease so that treatment can be done at the earliest. Improvement in the early detection and analysis of diabetes that affects a significant portion of a global

population is the primary objective of this research. Because of the application of the algorithms life Logistic Regression(LR) Random forest (RF), Support Vector Machine(SVM), K-Nearest Neighbours (KNN), Gradient Boosting (GB)and Decision tree(DT) (Fig 3); the researchers were able to improve a prediction model that would be able derecognize individuals who are at risk of developing diabetes based on relevant clinical data. The researchers have also emphasized how important it is to a erestigate and find out different gadget learning algorithm further improve precision and accuracy of diabetes prediction models. Kumar et al.(2020) used the random forest algorithm to form a system that can predict diabetes quickly and accurately Dataset used in this was collected from UCI learning repository [9].

Mohan and jain (2022) used the SVM algorithms to analyse and predict diabetes with the help of Pima Indian Diabetes dataset. Kumari et.al (2022) attempted to apply a soft voting classifier based ensemble approach for diabetes prediction .Mujumdar A (2024) had a look at objectives to broaden a sturdy diabetes prediction version through the usage of gadgets studying algorithm and massive information analytics .There are several other methods also which helps us to predict the disease.

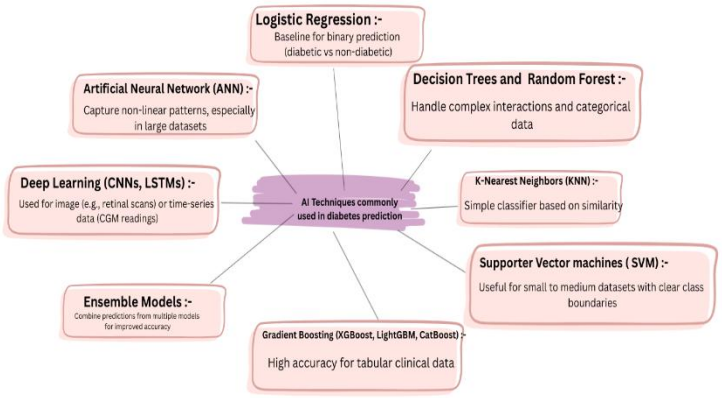

Fig 3: AI techniques used in prediction of Diabetes

2.3 Therapies and diet recommendations by AI in diabetes

Automatic techniques like diet monitoring (DM) powered by AI are developed. Dietary monitoring is crucial part in the patients having diabetes, particularly when intake of food is not balanced and often impractical therefore it's important to develop a self-regulatory answer for dietary monitoring

There are two categories of diet monitoring system based on degree of automation: In semi-automatic systems users required to mark the approximate position of food in picture. In automated DMS, server receives the food picture by the user which examines the nutritional features of food. Based on food images recent research has shown increasing precision in estimating energy intake. Vasiloglou et al. (2018) designed smartphone system (GoCARB) which can estimate carbohydrates content in meals and it is designed for patients with T1D [10]. Zhang et.al (2015) established a mobile FID (food identification system) that automatically recognizes food and evaluates it's nutritional and caloric content without human interference [11]. Fang et.al (2019) introduced new concept of food energy distribution. Food energy was estimated from image (the energy distribution image) predicted by generative adversial network [12].

Guan et al, 2023 reviewed the recent growth in the use of AI in the management of diabetes and then discussed the challenges faced in clinical practice. They also explored the probability of merging the existing digital health technologies in the management of diabetes. Mackenzie1 et al 2024 provided an overview of AI techniques and explored the usage and data-driven systems covering all types of diabetes about educating patients, self-management and decision supports regarding diagnosis and treatment plan. This review also provided a viewpoint on how AI-driven systems could convert

diabetes care in the coming years and how they could be utilized into daily clinical practice [13].

2.4 Case study on diabetes

In Bandipora district (North Kashmir, India) clinical data were collected by authors from doctor's clinic from April 2021 to Feb2022. Different ML algorithms were used to predict which individual would have diabetes (or be at risk) based on features of dataset. Different ML algorithms (Decision trees, random forests, Support vector machines) were compared using standard metrics (accuracy, sensitivity, specificity etc.) to see which model works best in that local population. The study showed ML models gave good prediction in that setting. Study also showed the capability of ML in early prediction and intervention. It's useful because it's localized with data from local population, which is different from Western datasets in risk factors and patterns. It shows feasibility of ML for early prediction of diabetes in resources limited setting [14].

2.5 Opportunities and challenges of AI in clinical practice of diabetes care

Kalman- filter- based models have shown clinically significant ability to reduce hypoglycemic events by suspending insulin delivery 30-70 minutes prior to predicted lows. A radiomics based ML approach from optical coherence tomography (OCT) was developed to predict anti VEGF treatment response in diabetic patients with macular edema recently.

AI based decision support systems can guide with customized insulin titration and dysglycemia prediction There are many applications of AI but it possess critical challenges that need to be resolved There are many ethical challenges like privacy, data security, bias, and limited demographic dataset. The regulatory challenges include patient safety and privacy Laws, Data protection laws, approval standards, compliance laws. There are integration challenges like data quality, system integration, system interoperability, variable performance of models [15].

3. AI IN CANCER RESEARCH

Cancer is a disorder characterized by unregulated cellular growth that has potential to destroy the normal tissues. Genetic mutation and environmental triggers cause this condition and impacting many body parts.

3.1 AI in Cancer Diagnosis and Early Detection, Staging and Grading:

Cancer diagnosis and early detection is one of the most significant challenges in the field of medicine over the years. AI has been implemented; significantly improving the outcome in patients and by detecting the tumor at a more treatable stage makes survival easy. AI helps the early detection of cancer in many ways as mentioned in (Fig 4). According to the studies, screening can increase early cancer detection and decrease mortality by using AI based computational models and bioinformatics based algorithms and present medical imaging technologies. AI assistant MIT had a significant influence on neuro-radiography, Positron Emission Tomography (PET) reveals tumor metabolism and help to define does escalation volume especially in head and neck cancers. Various AI model have demonstrated strong performance in Cancer diagnosis [16].

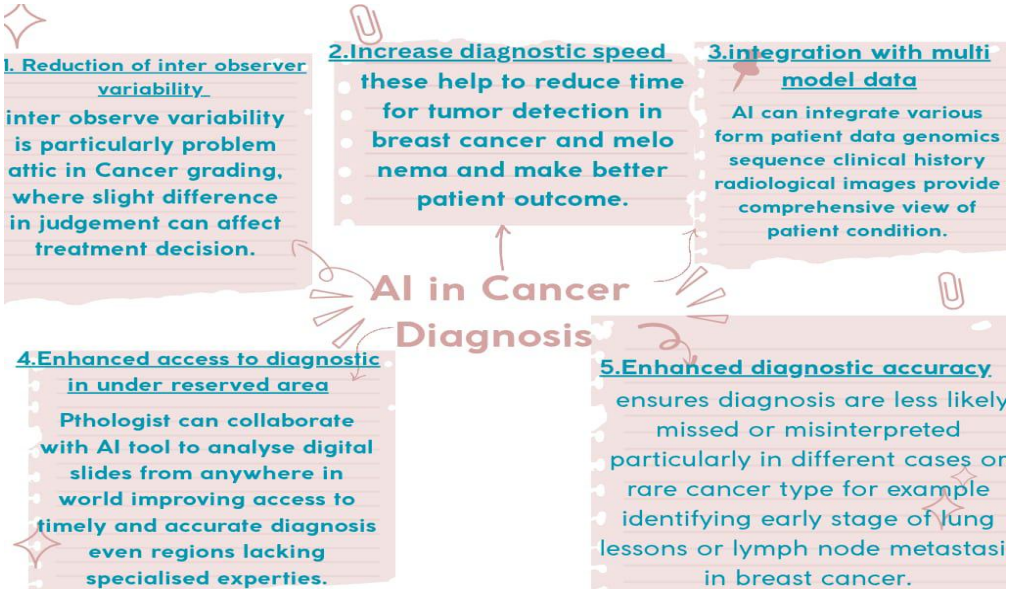

Fig 4: AI in Diagnosis of Cancer

3.1(a) Genomics and personalized medicine

By the identification of bio makers associated with different cancer subtypes, AI became essential for analyzing genomic data to enable personalize treatment. AI can rapidly match the patient genetic profile to suitable targeted therapies. Multi-model AI system of recent trend combine imaging and genetic data show promise for providing comprehensive insights into cancer biology [1].

3.1(b) Staging and Grading in Cancer

Cancer grading and staging are used to predict the clinical behavior of malignancy established appropriate therapies and facilitate exchange of precise information. Staging and Grading are two different ways to access cancer. Staging evaluate the size of tumor and its location and how far or aggressively the cancer spread whereas grading access the makeup of Cancer cells and help the pathologist to examine the tumor cell and compare with looks of healthy cells.

3.2 AI in various treatment methods of cancer in modern oncology:

Due to presence of high-dimensional datasets and developments in computing and DL, AI has made significant contributions to oncology. Therapeutic outcomes have been aimed by cancer precision medicine and side effects for even single cancer patients have been reduced. Wang et al. (2025) described the effect of AI on cancer precision medicine is missing hence required. Many clinical studies demonstrated the involvement of artificial intelligence in cancer precision medicine and have the power to optimize conventional therapies, emerging targeted therapies, individual immunotherapies and benefitting cancer healthcare [17]. Wang et al. (2025) provided valuable assets to researchers, clinicians and encouraged more study in this arena [17].

3.2(a) AI in chemotherapy:

AI in the field of Cancer chemotherapy focuses on the response between drugs and patient it helps in the management of chemotherapy drug used and prediction of tolerance of the drug, it also increase the optimization of combined drug therapy. Researchers successfully show that CURATE.AI an artificial intelligence platform is used to determine the optimal dose of ZEN-3694 and enzalutamide which helps to improve the efficiency and tolerance of combined treatment for patients [18].

3.2(b) AI in Radiotherapy:

Technology and AI has large contribution in the development of radiotherapy. After the X-ray and radioactivity continuous discoveries are going on towards modern high-tech radiation oncology. This kind of cancer treatment calls for interdisciplinary knowledge from fields such as biology, physics, engineering and medicine as the standard work flow of radiotherapy comprises CT stimulation, target controlling, medical imaging, diagnosis.

3.2(c) Account on Robotic Surgery:

This is developing field and has potential to completely transform surgery.AI improves performance by reducing errors through motion; energy and force analyze evaluating, automated and quantitative skill assessments. Cone-beam CT (CBCT) based online adaptors radiation therapy postoperative esophageal cancer patients incorporates DL and AI into radiation therapy to improve treatment precision and flexibility. Robotic lung surgery using AI -assisted augmented reality (AR) to improve thoracic treatment, accuracy and visualisation. Robotic arms provide superior stability and dexterity compared to human hands, allow more accurate surgical techniques.AI helps in 3D visualisation of images which enhance a surgeons ability to navigate complex anatomical structures [19].

4. AI IN MENTAL HEALTH

4.1 Studies of AI and mental health

The way AI was introduced into mental healthcare has created a huge impact, changing the ways the mental disorders can be treated or detected. The use of AI in mental health not only allows improvement in early diagnosis but also treatment personally and improves patient participation. AI analyzes data of patients and utilizes chatbots particularly in areas as compared to old methods or traditional processes .However, along with using AI, there is a question of data privacy, which has to be discussed while executing these methods in mental health. Even though we know AI can be helpful clinically, there has always been some questions raised by several professionals regarding the integration of AI into mental health. Transparency of AI algorithms and data privacy is critical issues that are being addressed till date.

4.2 NLP (NATURAL LANGUAGE PROCESSING)

NLP is an AI technique that allows computers to possess and also analyze human language, holding a great responsibility

in managing the raw data that was collected regarding patient's data in form of a message. As Graham et al note in their review of AI in mental healthcare, supervised learning and NLP are the most common AI techniques in mental health studies. Depression was and is one of the most talked-about topics in today's world.

4.3 How AI can benefit current healthcare for individuals with mental illnesses?

Digital health, has grown in popularity across the medical field over the past few years has accelerated by the COVID-19 pandemic. It is especially relevant to mental healthcare where is known as digital psychiatry. Launching more clinical trials with technology companies to test new interventions and solve ethical issues like data privacy. There has been a recent review by Torous et al 2021 identified a growing number of studies which revolves around how smartphones, Virtual reality, social media and chatbots can be useful in digital psychiatry [20].

4.4 Ethical considerations of AI in mental health practice

Psychiatry has long relied on statistical results over prediction and has experienced problems with methodology translation. Even though, Machine Learning is well-suited to psychiatric applications, studies have reported varying degrees of accuracy which has raised concerns about the accuracy of findings. Several reviews have called for a closer look at the ethical issues underpinning the uncertainty around incorporating AI in mental healthcare [21].

4.5 Effects of individualized virtual reality (VR) on self-compassion and depression

There are many VR tools like chatbots and assistants that have been powered by AI and hence performs many functions like preliminary diagnosis, assess symptoms, schedule of appointments, reminders for prescriptions etc. before forwarding it to the healthcare departments [22].

4.6 Acceptance of mental health

AI tools are especially essential in student populations where they address mental health challenges; particularly in sports education contexts, advanced AI models and focus on improving the accuracy of emotion recognition and essential component in mental health interventions. It has been emphasized that user driven data input such as voluntary mental health surveys, aligns with AI's non-invasive monitoring applications. These findings tell us about the high acceptability and potential efficacy of AI-based mental health interventions across various populations and applications [23].

4.7 Future research directions and recommendations

The directions for future research for AI in healthcare include ethical, bias-mitigated algorithms and adopting association between clinicians and AI developers. The challenges are to make sure data privacy and security, organizational capacity technical infrastructure, ethical and responsible practices in addition to aspects related to safety and regulation. Some of these issues have been studied but others need more research.

Interrelationship among Cancer, Mental health, Diabetes and AI

Artificial intelligence (AI) is transforming the understanding, management, and treatment of the complex interrelationships among diseases. These conditions impact each other through common pathways in biological systems, risk factors and psychological effects. Artificial Intelligence is uncovering patterns; processing complex and vast datasets which was not detectable previously leading to more personalized and integrated care.

5. CONCLUSION

AI has the capability to revolutionize healthcare management and provide incredible benefits to healthcare organizations and Patient alike. AI is revolutionizing the pharmaceutical sector across the entire lifecycle of medicine from medicinal product discovery, development to pharmacokinetics, evaluation, manufacturing, marketing, approval, and pharmacy vigilance. AI driven prediction help determine optimal dosing, while in clinical trials, AI assists with patient stratification, digital twins and trial simulation

The data which are difficult to obtain AI help to gain insights into data by providing real time decision support and recommendations, automate mundane tasks, improved diagnosis and treatment accuracy, monitor patient health, predict future health outcomes and improve communication between professionals and patient. Although AI has many limitations also like privacy, security, and even legal problems so people prefer professional interference instead of AI technologies therefore there is more need to improve the ethical use of AI in healthcare to get patient's trust

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