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Healthtech: Fusion of Artificial Intelligence in Healthcare

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ABSTRACT:
The complexity and rise of data in healthcare means that artificial intelligence will be increasingly applied in that field. Several types of AI are already being used in the area and will flourish as soon as the world evolves. The key categories of applications involve diagnosis and treatment recommendations, patient engagement and adherence, and administrative activities. Although there are many instances in which AI can perform healthcare tasks as well or better than humans, implementation factors will prevent large-scale automation of healthcare professional jobs for a considerable period. Ethical issues in the application of AI to healthcare are also discussed.At the end the paper also concludes the limitations of AI and also the challenges faced in the making of this paper.

1. INTRODUCTION:

The phrase artificial intelligence (AI) in healthcare refers to the use of machine learning (ML) algorithms and other cognitive technologies in medical contexts. Artificial Intelligence (AI) can be defined as the ability of computers and other technologies that mimic human cognition, including learning, thinking, and acting. AI in healthcare,is the application of computers to evaluate and respond to medical data, typically with the intention of predicting a specific result. Artificial Intelligence (AI) is the ability of computers and other devices to carry out activities that would typically need human intelligence. These tasks involve things like pattern recognition and prediction.A computer with artificial intelligence is one that can learn, decide, and act, even in situations that it has never encountered before. The process of giving or receiving medical care is known as health care. Getting medical care contributes to the prevention and treatment of illnesses that can shorten a person's life expectancy and lower their quality of life. Although it may appear that healthcare is a modern invention, human health care has a much longer history.

A healthy, productive society depends greatly on the healthcare industry, making it one of the most important industries in the larger big data environment. Applying AI to medical data may actually be the difference between life and death. AI can support healthcare professionals in their day-to-day job, including physicians and nurses. As a result, AI has the potential to be a very useful weapon in the fight against pandemics and epidemics in global public health. Applications of AI were originally used for biomedical issues in the 1970s. From then, AI-powered applications have grown and changed the course of the healthcare sector by cutting costs, enhancing patient outcomes, and raising overall productivity.AI has a wide range of applications in healthcare and is expanding quickly. Healthcare providers may find it easier to handle patient data and administrative tasks with the usage of AI. According to some scientists, AI in healthcare can function just as effectively as humans. Let's examine artificial intelligence's rapid rise in healthcare, its use, and other topics.

The main motive of this study has been towards promoting the new methods which are available in the market and also help utilise them to the maximum in order to improve the established services. Here , we have specifically used (AI) as many people have heard about AI but do not know about the applications and also the benefits of using this technology. AI has huge scope and advantages in the Healthcare sector. In this study we have focused more towards the radiology, pharmaceutical sector , Robots assisted surgeries and apps and devices made for self regulation.

AI in Healthcare

Artificial intelligence is a group of technologies rather than a single one. Although the precise jobs and processes that these technologies assist vary greatly, the majority of them have immediate significance to the healthcare industry. The following lists and describes a few specific AI technologies that are very significant to the healthcare industry.

Diagnosis and treatment applications

Algorithms for oncology (*a branch of medicine that specialises in the diagnosis and treatment of cancer*). AI has been applied to pathology images of tumours in order to find patterns related to various cancer kinds. Pathologists can use this information to make more precise diagnoses and choose the best course of action for each patient. Artificial intelligence (AI) has been applied to the field of cardiology *(is the study and treatment of the disorders of the heart and blood vessels*)to analyse electrocardiograms (ECGs) and identify patterns that may indicate cardiac disorders. Cardiologists can use this information to identify individuals who may experience significant cardiac events and to take preventative measures. Artificial intelligence algorithms in the field of dermatology (*study and treatment of diseases related to skin*) have been utilised to examine pictures of skin cancers and detect trends linked to various forms of skin cancer. This can assist dermatologists in diagnosing patients more accurately and choosing the most appropriate course of action for each individual patient.

Benefits of using AI in Medical Diagnoses and Treatment Decisions

AI's contribution to early disease identification and prevention is one of the most significant effects on the healthcare industry. To find tiny patterns suggestive of illness risk, machine learning algorithms examine large datasets containing patient histories, genetic predispositions, and environmental factors. Proactive therapies are made possible by these algorithms, which can anticipate the risk of diseases like diabetes, cancer, and cardiovascular ailments before symptoms appear. Additionally, a number of businesses concentrate exclusively on the diagnosis and therapy suggestions for particular tumours according to their genetic profiles. Human clinicians have found it more difficult to fully understand all genetic variations of cancer and how they respond to new medications and treatments because many tumours have a genetic basis.

Wearable Biosensors

Real-time monitoring of the wearer's health and surroundings is possible using wearable health sensors. As hardware for sensors and operating systems has advanced, wearable gadget capabilities have progressively expanded to include a wider range of forms and more precise physiological indicators. High precision, continuity, and comfort are becoming priorities for these sensors, which will significantly enhance individualised healthcare.

What is the purpose of these Biosensors?

These sensor's primary functions are to help users keep an eye on their own health and to promptly alert clients who are unwell. The primary benefit of wearable sensors is that they enable consumers to monitor their health scientifically at any time and from any location. If the portable sensor is worn, the user can save a great deal of time since they visit the clinic for a diagnostic and the doctor uses the external sensor to make a diagnosis in a specific location. Users are increasingly reaping the benefits of wearable sensors, particularly those that utilise a variety of portable sensors. Wearable technology can lower hospitalisation rates for patients with chronic illnesses by enabling them to make timely dietary and lifestyle adjustments based on data displayed on the device, thus saving costly treatment expenses. By accurately tracking body temperature and heart condition, wearables can replace medical equipment like defibrillators and ECG devices, saving hospitals money on equipments

How do the Biosensors work?

Sensors can be physically affixed to the body through wearables, watches, cell phones, and other everyday objects that can have sensors integrated into them. These kinds of sensors are flexible ones, and because of developments in printed electronics and materials, certain minuscule sensors may now be worn as skin patches. These biosensors detect changes in the human body's pH, glucose, and salt levels in addition to measuring skin conductance, heart rate, and body temperature.

Prognosis Evaluation

Deterioration assessment (DA) and remaining useful life (RUL) estimation are two terms used to describe prognostications that attempt to analyse the equipment's current condition and forecast its future failure time, respectively, in order to serve as the foundation for predictive maintenance that comes after. The industry places a great deal of importance on the vital equipment's operational state because a sudden shutdown or failure would result in significant financial losses and possibly jeopardise the operators lives. The prognostic-based maintenance strategy, in contrast to the conventional scheduled maintenance strategy, offers proactive decision-making capabilities that can successfully reduce costs and downtime, boost manufacturing output, and above all an early warning system for serious system failure.

Present status?

Despite the fact that a great deal of image-based prognostic models have been created and published in recent years, these models still have a lot of flaws when it comes to clinical application procedures. For

instance, a few of them lacked external validation and only had a small sample size . While some other research has used external validation, its applicability to patients in different nations or continents is limited because the sample size consisted only of patients with a comparable distribution . Therefore, in order to create and validate novel models that actually meet the needs of the therapeutic application, more research with a sizable sample size from a variety of races should be taken into consideration.

Case study of Cancer Prognosis.

Early cancer diagnosis can be challenging, and treatment-induced relapses are common. Moreover, it is exceedingly challenging to make highly confident forecasts about the prognosis of an illness. Certain cancers have ill-defined symptoms and hazy warning signals on mammograms and scans, making them challenging to identify in their early stages. Therefore, it is critical that clinical cancer research develops more accurate predictive models by utilising multivariate data and high-resolution diagnostic techniques. A cursory review of the literature reveals an exponential growth in the number of studies on cancer analysis, particularly those incorporating AI tools and sizable data sets with historical clinical cases for AI model training. Furthermore, research indicates that AI is more accurate than conventional analysis techniques like statistical and multivariate analysis. This is especially true when advanced bioinformatics tools are used with AI, as this can greatly increase the accuracy of diagnosis, prognosis, and prediction.For medical professionals who treat cancer patients in particular, prognostication is a critical therapeutic competency.

Physicians are also concerned about the possibility of a patient developing the illness, having a tumour reappear, or passing away following therapy. These factors have a significant impact on the treatment option and its outcomes. Actually, the majority of contemporary clinical cancer research is on prognostication, or forecasting the appropriate response to treatment. More exact and appropriate treatments can be given to patients whose prognoses can be anticipated with greater accuracy; in fact, these treatments are typically tailored or custom made for each patient. As of right now, it is quite challenging to administer precise, patient-specific treatment. AI, on the other hand, may more precisely estimate a patient's cancer prognosis, survival duration, and pace of disease progression by processing and analysing multi-factor data from several patient examinations.

Breast Cancer prognosis prediction.

One of the most prevalent malignant tumours in women, breast cancer is characterised by a wide range of molecular alterations, cellular makeup, therapeutic response, and clinical consequences.The phrase "prognostic model" describes the application of statistical techniques to ascertain the quantitative link, depending on the patient's disease condition, between the risk variables and the probability of clinical outcomes. Clinicians and healthcare professionals can make better medical decisions regarding chemotherapy exemption with the use of breast cancer prognostic models. The earliest and most popular models are those that are based on clinical data, like the Nottingham Prognostic Index (NPI), Adjuvant! Online, and PREDICT.

Model Construction

Prognosis factors and long-term clinical outcomes from the development cohorts were combined to train prognosis models. Three categories exist for mathematical prediction models: parametric, semi-parametric, and non-parametric models.The most popular approach for developing models among them

was Cox proportional hazards regression(is *an important multivariable model when the outcome is the length of time to reach a discrete event*), which was followed by decision trees, artificial neural networks, Bayesian networks, and logistic regression . These prognostic models, which measure the chance or risk of the clinical outcome and categorise patients into various risk categories, can be presented as formulas, nomograms, web calculators, or scoring systems after parameter estimation and model fitting.

Robotic Process Automation

With the use of this technology, administratively structured digital tasks involving information systems are completed as if by a human user adhering to a set of guidelines or scripts. They are less expensive, simpler to program, and behave transparently when compared to other types of AI. Robots aren't actually involved in robotic process automation (RPA); instead, computer applications running on servers are. To function as a semi-intelligent user of the systems, it depends on workflow, business rules, and "presentation layer" connection with the information systems. They are employed in the medical field for routine duties like billing, prior authorization, and patient record updates. They can be used to extract data when paired with other technologies, such as image recognition.

Real Life examples of RPA in Healthtech.

Max HealthCare is the largest hospital chain in North India, Max Healthcare, has streamlined claims administration throughout all of its divisions by implementing RPA. Today, an UiPath-designed robot extracts customer data from PDF files and emails, converting it into CSV format.

Additionally, the bot is able to access portals for government-run healthcare programs, record patient transactions, and confirm the status of such data. When data validation is completed, the robot automatically sends an email to the appropriate departments. Consequently, the healthcare provider has experienced a 50% reduction in turnaround time and saved 65-75% of the time formerly spent on government healthcare program processing.

Medical Robots Making a Difference in Healthcare

1. *The da Vinci® Surgical Robot*- Surgeons can perform a variety of treatments with greater precision thanks to the da Vinci Surgical System. with the aid of controls that are strapped to a surgeon's hands and wrists and amplified 3D high definition vision

2. *The Xenex Germ-Zapping Robot*- Using pulsed, full-spectrum UV rays that kill a variety of infectious bacteria, the automated and portable robot Xenex uses full hospital rooms in a matter of minutes to address this fundamental issue.
3. *The PARO Therapeutic Robot*- This robot, in contrast to the previous two, is intended to enhance patient care during surgical recovery or treatment for depression or other mental health conditions rather than to actually save lives.
4. *The CyberKnife*- It may target a tumour from all sides without requiring the patient to move by positioning itself at numerous minutely diverse angles to deliver radiation to a tumour, whether it is benign or malignant.
5. *The TUG*- The solution is TUG, an autonomous mobile robot created by Aethon Inc. that delivers supplies to the desired location, relieving staff members of strenuous physical labour and enabling them to concentrate on patient care.

AI in Radiology

Examples of clinical application areas of artificial intelligence in oncology

a. IMAGING:

1. Thoracic imaging : One of the most prevalent and lethal tumours is lung cancer. Pulmonary nodules can be found with lung cancer screening, and for many individuals, early detection can save their lives. These nodules can be automatically detected and classified as benign or cancerous with the aid of artificial intelligence (AI).
2. Abdominal and pelvic imaging: Liver lesions are among the many unintentional results that are discovered as a result of the quick development of medical imaging, particularly computed tomography (CT) and magnetic resonance imaging (MRI). AI may be useful in classifying these lesions as benign or malignant and in determining which patients with these lesions should receive follow-up care first.
3. Brain imaging: Brain tumours can be benign, malignant, primary, or metastatic, and they are defined by aberrant tissue growth. Artificial intelligence may be used to predict the diagnosis of brain tumours.

b. NON- IMAGING:

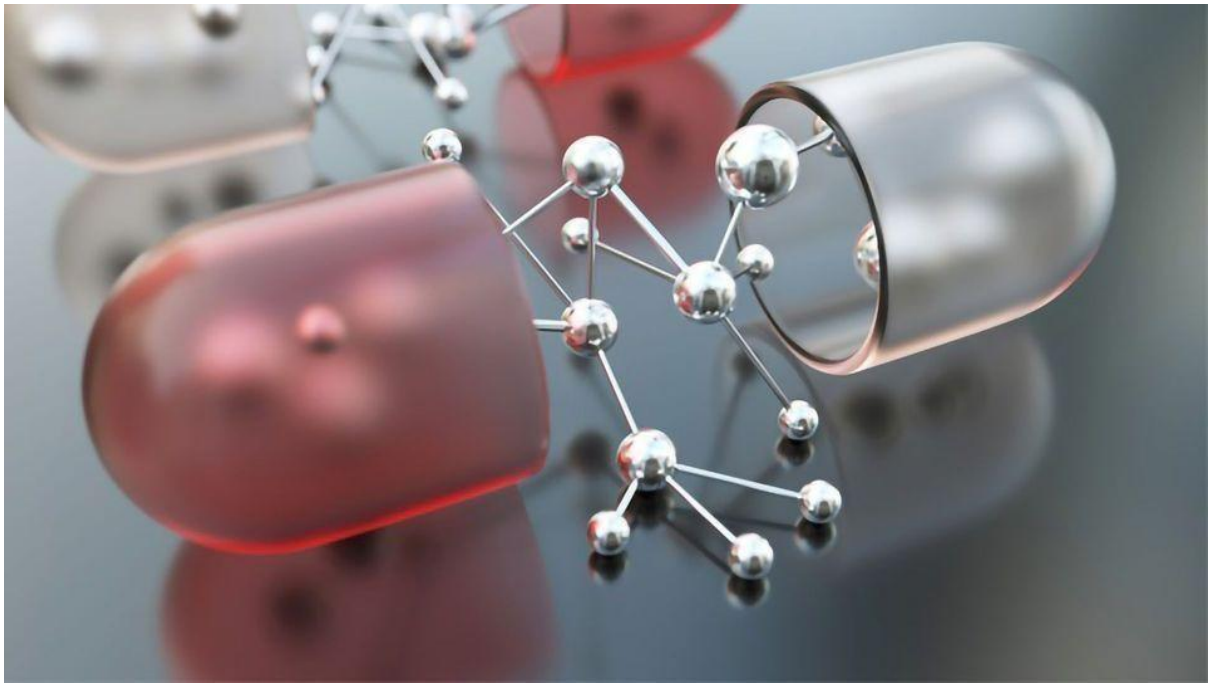
1. DNA AND RNA Sequencing: There are more and more chances to use genomic end points in cancer diagnosis and treatment thanks to the growing amount of sequencing data that is now available. AI-based methods can forecast the impact of mutations on the sequence specificities of RNA-binding and DNA-binding proteins as well as identify and extract high-level characteristics connecting somatic point mutations and cancer types.

Drug discovery

The necessity for innovative drug discovery methods has been highlighted by the COVID-19 pandemic. However, there are several opportunities for failure throughout the lengthy, intricate, and costly path from the inception of a medicine to its final deployment in clinical settings.Numerous pharmacological compounds are developed as a result of the enormous chemical space. But the lack of cutting-edge technologies makes the process of developing new drugs more difficult and costly, a problem that artificial intelligence (AI) can help with. Artificial intelligence (AI) has the ability to identify hit and lead compounds, expedite the confirmation of the drug target, and optimise the design of the drug structure.

How AI Is Being Used in Drug Discovery?

1. *Target identification:* AI is trained on massive datasets, such as genomics datasets, morphological and expression data, disease connections, patents, publications, clinical trials, research grants, during the target identification stage of drug discovery.
2. *Prediction of pharmacological features:* By anticipating important properties like toxicity, bioactivity, and the physicochemical characteristics of compounds, some AI systems are being utilised to avoid simulated testing of drug candidates.
3. *De novo drug design:* AI is also changing the paradigm of traditional drug development, which has traditionally included screening vast libraries of candidate compounds. Certain systems have the ability to completely create novel and intriguing pharmacological compounds from scratch.



Some AI drug discovery companies that are currently making great strides with their technology.

1. *ATOMWISE*- With Atomwise's method, the process of finding new drugs becomes more logical, successful, and efficient by moving away from chance discovery and toward search based on structure.
2. CRADLE - Using generative AI, the Dutch firm Cradle helps biologists design better proteins and speeds up research and development, making it simpler, faster, and more affordable to produce bio-based products for the health of people and the earth.
3. EXSCIENTIA- Exscientia, a precision medicine firm driven by artificial intelligence, is regarded as a pioneer in the biopharma industry. The company's mission is to use AI technology to identify, design, and manufacture the greatest treatments possible as quickly and effectively as feasible. In order to successfully guide treatment selection, enhance patient outcomes in a prospective interventional clinical study, and advance AI-designed small molecules into the clinical setting, the business created the first-ever functional precision oncology platform.

Mistakes in Healthcare?

AI systems will surely make mistakes while diagnosing and treating patients, and it might be challenging

to hold them accountable. Additionally, there will probably be instances where patients receive medical information from AI systems that they would much rather get from a sympathetic physician. Healthcare machine learning systems might also be prone to algorithmic bias, which could lead to the prediction of increased disease risk based on racial or gender characteristics that aren't true causes.

With AI in healthcare, there will probably be a lot of ethical, technological, medicinal, and occupational changes. Healthcare organisations, along with governmental and regulatory agencies, should set up systems to keep an eye on crucial issues, respond responsibly when necessary, and implement governance procedures to minimise unfavourable effects. Since this is one of the more potent and significant technologies to affect human society, it will take years of careful policymaking and ongoing attention.

CHALLENGES AND LIMITATION

One of the main problems faced by me during this research paper is choosing the right topic for the research. The topic is the main foundation of the research paper and it is always vital to take time to come to a decision and finalise a topic. Another issue was on how to conduct the research appropriately and formulate the research problems. I unfortunately did not have access to the appropriate equipment so that also added up to the problem. Selecting an appropriate research method without the useful equipment was quite hard. Determining the sample size, designing instruments , collecting data and sorting out the necessary information , conducting results and acquiring knowledge of information resources was quite time consuming as well.The biggest challenge faced by me was finding reliable resources.With the vast amount of information available online,it can be difficult to know which sources to trust and which not to. Most of the researcher hindering section is the funding in the developing countries, plus the lack of tools and testing devices.

The application of AI in healthcare also raises a number of ethical questions. In the past, people have made practically all healthcare choices. Using smart computers to help or make judgments raises questions about privacy, permission, accountability, and openness. Transparency is maybe the hardest problem to solve in light of current technological advancements. It is nearly hard to understand or interpret many AI systems, especially deep learning techniques employed in picture analysis. A patient will probably want to know why they were diagnosed with cancer if they are told it was because of a picture. Even doctors who are usually knowledgeable about deep learning algorithms working might not be able to explain them.

RESULT & DISCUSSION

The study identifies several significant findings regarding the role of AI in healthcare . The study aims to understand the impact of AI on patient treatment, research, and operational processes within healthcare systems. Additionally, it seeks to address the challenges posed by the increasing volume of unorganised and unstructured data generated by AI technologies in healthcare. The results after conducting this research is that AI has a variety of applications which can be of use in healthtech including diagnosis, claims processing, clinical documentation , medical records management.Some healthcare organisations have also experimented with chatbots for patient interaction , mental health and wellness , and telehealth. The use of AI has great potential to enhance the quality of care , improve the learning process of doctors, and promote continuous improvement in the field.

The solution to the first problem that I faced is to decide a double topic. Determine what sources you have available - time , people, money etc and choose a topic that in general is of your interest. The most important strategy for a successful research paper is to find the right methodology. Once you have decided

a topic the next step is to find the right methods to conduct your research. Take time to conduct the research , write down the results and observations and then combine all information to add up to the paper. Further suggestion to my fellow researchers to have complete access to tools and equipment.

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