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THE ADVENT OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE

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Abstract

Technological advancements are the boon of the 21st century and it has helped the modern man in every aspect especially the most precious of them all, our health. Artificial intelligence is one such advancement and it has the potential to yield great outcomes if used appropriately. With news that ChatGPT , an artificial intelligence chatbot used to create content in a conversational format successfully "passed" the U.S. Medical Licensing Exam, provoked thoughts like will artificial intelligence replace doctors among many technology enthusiasts. This research is aimed at highlighting the benefits of artificial intelligence in healthcare, while also discussing the drawbacks that come with its use. A survey questionnaire aimed at approximately 100 medical practitioners was conducted to determine the awareness and applications of artificial intelligence in health care. The objective of this research is to spread awareness and promote the use of artificial intelligence in clinical practise as well as to understand the reasons for the unwillingness of its use so as to devise appropriate solutions to create a positive impact on healthcare.

Key words- artificial intelligence, healthcare, medicine, technology

1.INTRODUCTION

Artificial intelligence (AI) is intelligence—perceiving, synthesizing, and inferring information—demonstrated by machines, as opposed to intelligence displayed by humans or by other animals. It is the simulation of human intelligence processes by machines, especially computer systems. At its simplest form, **artificial intelligence** is a field, which combines computer science and robust datasets, to enable problem-solving. The journey of AI started in the 1950s with the pioneering work of Alan Turing, who proposed the Turing Test to determine if a machine could mimic human intelligence, since then there have been continuous evolutions in the field.

In the 2000s, AI research expanded into new areas, including natural language processing, computer vision, and robotics, paving the way for today's AI revolution. The recent explosion of AI is largely attributed to the development of deep learning techniques and the emergence of large-scale neural networks, such as the Generative Pre-trained Transformer (GPT) series by OpenAI. AI has permeated every aspect of our lives, revolutionizing numerous industries along the way such as healthcare, finance, manufacturing, logistics, agriculture to name a few.

Healthcare: AI-powered diagnostic tools have improved disease detection, enabling more accurate and timely diagnoses, while AI-driven drug discovery accelerates the development of new treatments. Robotics and AI also play a vital role in precision surgery, enhancing patient outcomes and reducing recovery times.

Even though artificial intelligence has many advantages in healthcare, it's usage is relatively low in medical practitioners, neither does it come without its drawbacks. This research is aimed at promoting the judicial use of artificial intelligence in healthcare while also pointing out its shortcomings so that medical practitioners can make informed decisions while using artificial intelligence in their clinical practise.

2.METHODS

In order to evaluate the usage of artificial intelligence in clinical practise, a questionnaire was prepared for members of the Indian Medical Association (IMA) a national voluntary organisation of physicians in India. The survey was also distributed among Physicians practising in the United Kingdom. The responses to the questionnaire were thoroughly assessed to derive conclusions to the subject of this research.

An extensive interview was conducted with Dr. Varsha Barot a family physician practising in Mumbai, India for the last 25 years asking detailed questions related to the use of artificial intelligence technologies in her clinical practise.

It is further backed up by evidences and researches from other institutions that further support the hypothesis.

3.RESULTS AND DISCUSSION

We're witnessing a revolution in healthcare. Artificial intelligence (AI) is giving us the ability to discover new treatments and techniques faster than we would've thought possible just a decade ago. Massive investments are being made for extensive research and development in the field of artificial intelligence specialising in healthcare. Big companies like Johnson & Johnson, Google Deep Mind, IBM Watson Health, Babylon Health, Komodo Health, Inc to name a few are combining their scientific expertise with the power of AI and machine learning to create new drugs, innovative surgical techniques and ground-breaking next-generation solutions.

3.1Some of the important developments in the field-

Monitoring health through wearables and personal devices

Almost all consumers now have access to devices with sensors that can collect valuable data about their health. From smartphones with step trackers to wearables that can track a heartbeat around the clock, a growing proportion of health-related data is generated on the go.

1. A.I. can support the early detection of atrial fibrillation

Atrial fibrillation (AFib) is one of the conditions that can increase the risk of stroke, heart failure, and other heart-related complications. Until recently, it was overwhelmingly difficult to deal with AFib, as it needs continuous electrocardiogram (ECG) monitoring to provide data about heart rate and rhythm.

That has changed with the appearance of digital health devices. For example, AliveCor's Kardia is an FDA-approved, medical-grade ECG recorder – and the latest model is literally the size of a credit card. It can tell you within a minute whether your ECG is normal, whether you possibly have AFib or experience some "unclassified" risks. The Kardia algorithm runs pretty much invisibly in the background, analysing readings on the go.

2. A.I. reduced hospital deaths in sepsis

Artificial Intelligence (A.I.) has the potential to highly optimise processes in hospitals and even eliminate problematic alarm fatigue. By enhancing efficiency, A.I. will immensely benefit nurses.

Duke University researchers demonstrated such an application of A.I. in nursing. Their Sepsis Watch deep learning algorithm helps assess a patient's risk for developing sepsis. It automatically alerts the hospital's rapid response team in case of a high-risk patient and guides them through the first 3 hours of care administration. This is critical in preventing complications.

Hospital chain HCA Healthcare also developed a predictive algorithm called Sepsis Prediction and Optimisation of Therapy. It continuously monitors patient data to identify potentially impending sepsis cases. The algorithm is able to detect sepsis six hours earlier—and more accurately—than clinicians, enabling the health care system to cut sepsis mortality rates across 160 hospitals by nearly 30%.

3. Pediatric seizure-detecting smart bands

Epilepsy is the 4th most common neurological problem, following migraine, stroke and Alzheimer's disease in the frequency of occurrence in the United States.

Wearable devices, like the Empatica's Embrace wristbands, are designed to notify the user and/or relatives and caretakers about a seizure or the risk of seizure.

Clinical testing of Embrace on 141 patients diagnosed with epilepsy, including 80 pediatric patients, yielded a 98% accuracy rate for detecting generalised tonic-clonic seizures.

4. Skin-checking algorithms help out dermatologists

Skin-checking applications allow users to take pictures of their suspicious skin lesions, upload these pictures to a server, the images are first evaluated by an A.I. algorithm and the results will be later validated by a dermatologist.

These algorithms work by comparing user images to the vast database in the background, coming up with a preliminary diagnosis in just a few seconds.

We could even conclude that if such a system provides follow-up and access to doctors and treatments should the need arise, these are close to the optimal setup – they filter out non-existing cases and let dermatologists focus on the real issues.

5. A.I. detects stroke on CT scans and helps clinicians win the race against time

Viz.ai's flagship solution, Viz LVO, uses A.I. to automatically detect suspected large vessel occlusion (LVO) strokes on computed tomography angiography (CTA) imaging and directly alert on-call stroke specialists about potentially treatable patients in a standalone or multi-hospital network.

In the study, containing the largest health A.I. data set to date, Viz LVO achieved 96 percent sensitivity and 94 percent specificity in identifying LVOs in 2,544 consecutive patients from 139 hospitals using scanners from multiple manufacturers. Faster triage with Viz LVO enables the identification and treatment of more patients who are eligible for thrombectomy, which improves patient outcomes and reduces the chances of long-term disability.

6. A.I. autonomously detects diabetic retinopathy using retinal images

Artificial intelligence (AI) screening algorithms are a promising solution to the growing global diabetic retinopathy (DR) screening burden. Many AI algorithms have been shown to perform at or above the level of human experts on DR classification tasks when evaluated on their internal datasets.

Researchers examined seven commercially available algorithms – two of which have FDA clearance – and found significant differences between their performance.

Their findings stress that although automated diabetic retinopathy (DR) screening systems can greatly expand access, they do not replace routine eye examinations. Current commercial DR screening systems are approved only to diagnose referrable DR using specific devices and protocols. Sole reliance on automated screening systems may miss additional important features, such as undiagnosed glaucoma, macular degeneration, retinal detachments, or choroidal melanomas. DR screening systems should supplement traditional eye examinations to expand screening access, while also upholding a high standard of care.

7. A.I. helps pathologists identify metastatic breast cancer

Breast cancer is the most prevalent cancer diagnosis for women.

Deep learning models aiming to find early signs of the disease are around for a good number of years. Although we have not yet arrived at an omnipotent solution as of yet, studies show that combining deep learning systems' predictions with human pathologists' diagnoses improves patient outcomes.

There is still a long way to go, as this study points out "DL-based computerized image analysis has obtained impressive achievements in breast cancer pathology diagnosis, classification, grading, staging, and prognostic prediction, providing powerful methods for faster, more reproducible, and more precise diagnoses. However, all artificial intelligence (AI)-assisted pathology diagnostic models are still in the experimental stage. Improving their economic efficiency and clinical adaptability are still required to be developed as the focus of further research."

8. A.I. builds complex and consolidated platforms for drug discovery

Time and efficiency are key in the operation of the pharmaceutical supply chain. Its main objective is to deliver the right medication to the person in need as fast as possible – to aid the healing process in the best way possible. While the drug designing, manufacturing, and distribution supply chains have been changing constantly due to new technologies, the scope and quality of the recent transformation are much more profound.

A.I. solutions could fundamentally alter the traditional process of designing drugs. It could make drug development much cheaper and more effective; remarkably shorten the drug production circle, and help out pharma in finding new drugs. All this without burdening clinical trials and accumulating costs.

According to estimates, it takes about 12 years and $2.9 billion for an experimental drug to advance from concept to market. In 2019, A.I. pharma startup Insilico Medicine identified a potential new drug in only 46 days. This is the difference A.I. is capable of.

San Francisco-based Atomwise uses supercomputers that root out therapies from a database of molecular structures. During the Ebola epidemic in 2015, Atomwise used its A.I. algorithm to identify two drugs with significant potential to reduce Ebola infectivity. This analysis which typically would have taken months or years was completed in less than one day.

9.Reducing the burdens of electronic health record use

EHRs have played an instrumental role in the healthcare industry's journey towards digitalization, but the switch has brought myriad problems associated with cognitive overload, endless documentation, and user burnout.

EHR developers are now using artificial intelligence overload, to create more intuitive interfaces and automate some of the routine processes that consume so much of a user's time.

Voice recognition and dictation are helping to improve the clinical documentation process, using natural language processing (NLP) tools.

10. Detecting and treating Parkinson's disease

Researchers have developed an artificial intelligence (AI) model that detects the presence and severity of Parkinson's disease (PD) using nocturnal breathing patterns, which occur while a patient is sleeping, according to a study in *Nature Medicine*.

At Duke, researchers are using artificial intelligence to build an anatomical brain map for each individual patient, which will allow more neurosurgeons to be able to offer deep brain stimulation treatments to people with Parkinson's disease.

11.AI assistance through surgical robotics

Designed to assist during operations with surgical instruments' manipulation and positioning, AI-driven surgical robots are computer-manipulated devices that allow surgeons to focus on the complex aspects of a surgery. Their use decreases surgeons' fluctuations during surgery and helps them improve their skills and perform better during interventions, hence obtaining superior patient outcomes and decreasing overall healthcare expenditures.

With the help of ML techniques, surgical robots help identify critical insights and state-of-the-art practices by browsing through millions of data sets. Asensus Surgical has a performance-guided laparoscopic AI robot that provides information back to surgeons, such as size of tissue, rather than requiring a physical measuring tape. At the same time, human skills are used for programming these robots by demonstration – and for teaching them by imitating operations conducted by surgeons

3.2 Application of AI in clinical practise

Despite all the great tasks that artificial intelligence can achieve it's use in actual clinical practise is still sparse. According to the responses by medical practitioners in India, members of the Indian Medical Association (IMA) as well as medical practitioners from the United Kingdom of the questionnaire that was conducted for this study, that while 83.3% (Figure 1) were aware of the use of artificial intelligence in healthcare only 25% (Figure 2) were using AI technologies in clinical practise. This conveys that the implementation of artificial intelligence in healthcare still has a long way to go.

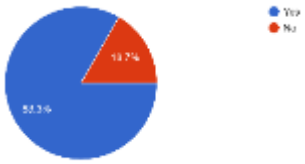

Figure 1: Are you aware about the use of

Artificial Intelligence (AI) in healthcare?

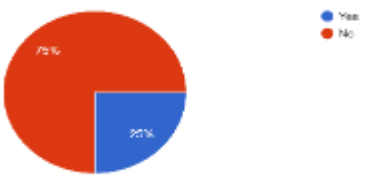

Figure 2: Do you use AI technologies in your clinical practise?

In the interview with a practising family physician, when asked about the reason for not using artificial intelligence despite being aware of it, inadequate financial resources for setting up new technologies was a big factor, she also stated that she was under confident about using new technologies as she had no specialised training to do so but she was willing to learn if the course for such a training was appropriately priced, another reason for the unwillingness to use artificial intelligence was that if there was an error on the technology's part she would be held responsible and was scared about the potential legal complications.

There is an evident lack of awareness among the general population about new technologies in healthcare, as about 83.3% (Figure 4) of the participant doctors stated that they often face issues of non-compliance and hesitancy when it comes to use of new technologies in treatments. In the interview it was derived that patients are often unwilling to try new treatment regimes as they are doubtful about its accuracy as it is something they have never heard of before. On further questioning it was noted that the younger and more educated patients were willing to the use of new technologies in their treatment.

Figure 3: Do your patients fail to follow treatment plan properly (due to forgetfulness/misunderstanding the plan)?

Figure 4: Do you face issues of non-compliance/hesitancy in patients with regard to trying new technologies for treatments?

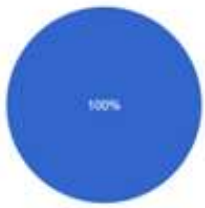

Figure 5: Do you believe that earlier detection of diseases can lead to better prognosis?

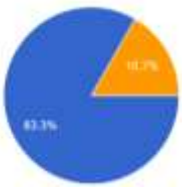

Figure 6: Would you be willing to learn about AI technologies for use in clinical practise?

When asked if their patients failed to follow treatment plans like taking medicines at the right time due to either forgetfulness or misunderstanding and if they believed that earlier detection would lead to a better prognosis 100% (Figure 3 and Figure 5) of the participants agreed, both of these issues can be rectified to a great extent by the use of artificial intelligence hence proving that there

is room for artificial intelligence in healthcare, and the willingness of doctors to learn more about Artificial intelligence is evident as 83.3% (Figure 6)of the survey participants were willing to learn about it.

4.CONCLUSION

The future of using artificial intelligence in healthcare is undoubtedly bright and filled with possibilities for further innovation. As we move forward into a more connected digital world, using AI in the healthcare industry will become an invaluable asset that could potentially reshape how doctors treat patients and deliver care. With such great potential, it is clear that using artificial intelligence in healthcare holds the promise of a future filled with advancements, improved health outcomes and better patient experiences. Yet, artificial intelligence in healthcare remains to be a double-edged sword, its accuracy is not yet absolute and if used by patients without consulting a doctor at all may lead to misdiagnosis or neglect, when used by doctors, errors by the system may also lead to confusion and could potentially put the patient's lives at stake and result in legal complications for the doctor.

We need these steps to avoid the pitfalls of the utilization of A.I.:

1. creation of ethical standards which are applicable to and obligatory for the whole healthcare sector.
2. the gradual development of A.I. in order to give some time for mapping of the possible downsides.
3. for medical professionals: get basic knowledge about how A.I. works in a medical setting to understand how such solutions might help them in their everyday job.
4. for patients: getting accustomed to artificial intelligence and discovering its benefits for themselves.
5. for companies developing A.I. solutions (such as IBM): even more communication towards the general public about the potential advantages and risks of using A.I. in medicine.
6. for decision-makers at healthcare institutions: doing all the necessary steps to be able to measure the success and the effectiveness of the system. It is also important to push companies towards offering affordable A.I.-solutions since it is the only way to bring the promise of science fiction into reality and turn A.I. into the stethoscope of the 21st century.
7. Training programmes for the proper use of the AI technology must be provided to ensure good outcomes while using AI.

Even though the implementation of artificial intelligence in healthcare can get expensive, it makes for a great investment as at the end of the day health is wealth. And countries across the world should make collaborative efforts by sharing their achievements and governments should aim to make it cost effective and freely available to use among all medical practitioners.

The greatest challenge to AI in healthcare is not whether the technologies will be capable enough to be useful, but rather ensuring its adoption in daily clinical practice.

The use of artificial intelligence in healthcare can enhance the quality of clinical decision-making, but it will not replace doctors as "codes cannot cure" and human touch is needed for holistic patient care, doctors who use artificial intelligence (AI) may replace doctors who do not.

In time, medical professionals may migrate toward tasks that require unique human skills, tasks that require the highest level of cognitive function. Perhaps the only healthcare providers who will lose out on the full potential of AI in healthcare may be those who refuse to work alongside it.

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