ADVANCEMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN SMART HEALTHCARE SYSTEM

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ABSTRACT

One of the ways in which smart healthcare is distinct from traditional medicine is that it makes use of artificial intelligence to move the attention away from professionals and towards patients. This strategy organises medical services in accordance with the needs, experiences, and active engagement of patients. It does this by integrating cutting-edge, intelligent healthcare technology. A smart healthcare system is the final outcome of this process. The discipline of artificial intelligence (AI) is seeing enormous development in the realm of healthcare research, and there are potential applications being presented in a variety of different fields of medicine. AI applications in smart healthcare are essential for detecting and preventing diseases such as COVID-19, liver disease, and cancer. These applications make use of support vector machines (SVMs) as a machine learning technique and convolutional neural networks (CNNs) as a deep learning method. These AI systems analyse electronic health records and data on patients' lives in order to provide assistance to medical professionals in the interpretation of X-rays, MRIs, and CT scans.

INTRODUCTION

Within the context of our current digital era, a broad variety of sectors are constantly producing new data. Both the processing of massive data sets and the extraction of relevant insights have been made possible by developments in technology, which have simultaneously driven the rapid rise of artificial intelligence in a variety of disciplines. As a consequence of the growing need for treatment that is both effective and of high quality, as well as the concomitant pressure on healthcare resources brought on by an increase in the population, artificial intelligence has been used extensively in the healthcare industry. [1] This combination has resulted in the development of applications such as diagnostic imaging, individualised treatment planning, and the prediction and prevention of sickness. IBM's (Armonk, New York, United States) 2009 idea of "Smart Planet" gave rise to the concept of "smart healthcare," which allows for all of these applications to be used. On the basis of a similar fundamental idea, the many applications of AI in this field are as follows: Methods that use machine learning and deep learning provide predictive analytics after data has been collected. [2-4]One of the ways in which smart healthcare is distinct from traditional medicine is that it makes use of artificial intelligence to move the attention away from professionals and towards patients. This strategy organises medical services in accordance with the needs, experiences, and active engagement of patients. It does this by integrating cutting-edge,

intelligent healthcare technology. A smart healthcare system is the final outcome of this process.[3–6]

Smart health services and artificial intelligence

Artificial intelligence has found a place in smart health services in a variety of fields, including neurology, cardiology, cancer treatment, and robotic surgery, to name just a few. It is possible to obtain a wide variety of medical data and material from a variety of textbooks and journals. Additionally, patient records may be saved on the cloud for easy access. Additionally, drug research, patient monitoring, personalised medicine, and other related topics can be managed successfully. This article's goal is to advocate for the development of an AI-powered intelligent healthcare system that provides patients with 24/7 assistance. [7]. Everyone from emergency medical services to physicians, radiologists, clinical labs, chemists, and more will pitch in to provide this AI-powered support. Researchers' access to patient data and AI-based decision-making could also contribute to health care innovation. Unlike any previous study, this one will also detail how to automate the whole healthcare system using the latest advancements in artificial intelligence.

ML Approaches in Smart Health

In this section, we examine and contrast the different applications and systems that are used for s-Health and how they make use of machine learning. With the use of data obtained from Beijing Tongren Hospital in China, the authors Chai et al. demonstrated a CNN-based deep learning model for the identification of glaucoma. Within the collection, there are 3554 images of the retinal fundus, which were collected from a total of 2000 people who suffered from a broad variety of ocular conditions. In this collection, there are 1391 photographs that have been diagnosed with glaucoma, whereas the other 263 photographs do not have this diagnosis.8:00 to thirteen o'clock A level of accuracy of 81.69% is provided by the model that has been recommended. Zhang and colleagues developed a model that was able to predict. 190 healthy control cases, 331 instances of mild cognitive impairment, and 157 cases of Alzheimer's disease were included in the ADNI database, which was used in this study. The model that was presented is successful, as shown by its Area Under Curve (AUC) value of 0.554.

A model was developed by Liu and Choi with the purpose of identifying instances of bacterial sepsis in patients who were in a critical condition. A total of 185 inpatients from the Medical Intensive Care Unit (MICU) and the Intensive Care Unit (ICU) of the General Hospital in Guangzhou, China, contributed to the collection of the available data. According to the model that was proposed, the accuracy score is 90.8%. this span of time, 2014–2017.

Through the use of feature selection and fuzzy modelling, proposed the development of an ensemble model for the purpose of predicting readmissions to critical care units. We made use of the MIMIC II database, which is a library of information that is open to the public and contains information collected from more than 32,000 patients who were admitted to intensive care units between the years 2001 and 2008. The AUC is 0.79 when using the model that was provided..

The potential of artificial intelligence in healthcare

Some examples of the various uses of artificial intelligence that have been discovered in the expanding amount of academic research on healthcare include algorithms for analysing computer tomography pictures, diagnosing cancer in mammograms, and interpreting chest radiographs. These are just a few instances. using the use of positron emission tomography (PET) to predict the beginning of Alzheimer's disease and magnetic resonance imaging (MRI) to identify brain tumours Additional applications have been shown in the disciplines of pathology and retinal imaging, where they have been used to identify arrhythmias, detect hyperkalaemia from electrocardiograms, and even detect cancerous skin lesions for the purpose of detecting them. The use of artificial intelligence has also contributed to the enhancement of genomic interpretation, the detection of

polyps during colonoscopies, the diagnosis of genetic illnesses based on facial appearance, and the evaluation of embryo quality in order to improve the success rate of in vitro fertilisation.[18–21]

Opportunities

In this article, we will examine the potential ways in which artificial intelligence may enhance intelligent healthcare. single (1) For the purpose of sifting through mountains of data, such as electronic health records (EHRs), medical imaging scans, and genetic information, predictive healthcare modelling significantly depends on artificial intelligence's (AI) capabilities. Utilising advanced machine learning techniques such as deep learning and natural language processing, algorithms that are generated by artificial intelligence have the potential to identify both subtle irregularities and complex patterns that may be indicators of health issues. What is [22]? Because of their capacity to uncover hidden correlations and nonlinear interactions across a wide variety of data sources, they may be able to provide more accurate predictions and insights that are suited to specific situations. With the use of this capability, healthcare practitioners may be able to make more informed choices. This capability enables the dynamic prediction of outcomes such as the development of the illness and the rates of patient readmission. Through the process of continually learning from new data and offering individualised insights and treatment recommendations, predictive modelling that is driven by artificial intelligence (AI) improves patient outcomes and the operational efficiency of healthcare institutions..[23-25]

Application

In the field of intelligent healthcare, there has been a multitude of new recommendations for applications of artificial intelligence that are realistic. These applications are divided into ten distinct categories by us. Following this, the sections that follow will provide a comprehensive examination of these application areas.

Disease Prediction and Prevention

AI applications in smart healthcare are essential for detecting and preventing diseases such as COVID-19, liver disease, and cancer. These applications make use of support vector machines (SVMs) as a machine learning technique and convolutional neural networks (CNNs) as a deep learning method. Electronic health records and lifestyle data are analysed by artificial intelligence systems, which provide assistance to medical professionals in the interpretation of X-rays, MRIs, and CT scans. It is possible that the forecast of sickness will become more accurate and efficient with the help of this feature, which will ultimately lead to improved disease prevention. Artificial intelligence models were developed to predict the locations where the COVID-19 pandemic would break out. These models were produced by using data from social media, travel patterns, and healthcare records, for example. Early intervention and resource allocation were both facilitated by these models, which had a significant impact on the management of the epidemic.[26-28]

Diagnostic Imaging

Due to the large amount of imaging tests (X-rays account for sixty percent of all exams) and the high frequency of visits (almost eighty percent of visits contain an imaging exam), the healthcare system in the United States is under a great deal of pressure. Artificial intelligence systems in diagnostic imaging not only deliver more accurate results in a shorter amount of time, but they also do it in a more efficient manner. This is because they are able to recognise faults or characteristics that a human eye would miss. Some of the clinical applications that are now accessible for commercial usage include general radiography, computed tomography, magnetic resonance imaging (MRI), fluoroscopy, and radiation therapy.[29-32]

Possible roadblocks to expanding AI's role in healthcare delivery

Lack of trained personnel and expertise for AI

One of the most significant concerns that dampens excitement for the use of artificial intelligence in healthcare is the idea that it may one day replace people. One further significant barrier to the use of AI in the healthcare industry is the lack of staff who are adequately prepared. [33-35]

Awareness of AI and quicker deployment of AI innovations

In the field of healthcare delivery, there is a lack of understanding among many stakeholders about the potential benefits and opportunities that may be gained by using AI. In India, nobody, not even healthcare experts, patients, or owners of healthcare facilities, has any knowledge whatsoever about it. Even in this day and age, a significant number of individuals in the medical industry, particularly those who hold positions of power, as well as the general public, are unsure of what artificial intelligence is and how it may be used. The fact that there is a dearth of information that is shared among the numerous people involved is another significant impediment. As a result of the unfavourable publicity that it has received in the media over the implications that artificial intelligence would have on employment, start-ups in India are finding it more difficult to get financing. [36-38]

Ethical issues of AI in healthcare delivery

There is a male bias in technologies owing to the preponderance of men in the software business, and people with better incomes benefit more from technologies. As a result, minority groups are under-represented in the data that is utilised to build algorithms and solutions. These difficulties give rise to worries over the unequal adoption of artificial intelligence in the healthcare sector in India..[39-43]

Legal liability and attribution of negligence

A further significant issue that has to be resolved is the question of who is responsible for the actions of AI. At this time, the onus is on the doctor, not the technology. Ability to explain its thinking behind judgements is highly prized.

OBJECTIVES OF THE STUDY

1. To study on ML Approaches in Smart Health
2. To study on Opportunities & applications

Research method

For the purpose of gaining an understanding of the many aspects of healthcare information system project management, the qualitative research technique was considered. In order to uncover answers to research questions, it is a method of doing research that includes the use of material that is neither quantified nor arranged in a particular manner. In this particular case, we will make use of this strategy in order to acquire knowledge about the administration of healthcare information technology as well as all of its advantages, disadvantages, and current developments..[44]

Data Collection Methods

In spite of the fact that this study did not make use of any primary methods, such as interviews, questionnaires, or observations, qualitative research methodology was used. Conversely, the research relies on secondary data that has been collected from other sources, such as scientific publications and journals, which frequently have the necessary information first. [45]

The pulmonary, hilar, and pleural forms of tuberculosis may be identified by the use of qXR on chest X-rays. qXR is able to recognise both the typical and the atypical signs of TB in the lungs with the use of an artificial intelligence system. The materials that are included in this kind of secondary research are taken from prior research papers that have been published as well as publications that are similar. Public libraries, websites of academic institutions or businesses, surveys that have been carried out in the past, and other sources that are comparable may offer

access to these data. In addition, research may also make contact with government and non-government groups who maintain data with the intention of requesting their data, if this becomes required. The fact that all of the information required for this investigation could be found on the internet meant that it was not necessary to get in touch with any government or non-government organisations.

RESULTS

qXR for TB screening:

The pulmonary, hilar, and pleural forms of tuberculosis may be identified by the use of qXR on chest X-rays. qXR is able to recognise both the typical and the atypical signs of TB in the lungs with the use of an artificial intelligence system. Not only is it used for tuberculosis screening, but it may also be used for the simultaneous identification of lung cancer in high-risk populations, chronic obstructive pulmonary disease (COPD), and certain cardiac abnormalities**.**

Fig. 1. The qXR qER instrument for screening chest X-rays and head CT scans

This technology is able to diagnose, locate, and measure a broad variety of brain athologies, as seen in Figure 1. These athologies include intracerebral haemorrhage of different types, midline shift, mass effect, infarcts, and cranial fractures. Table 1 shows the correctness of the data.

Table 1. The accuracy of each algorithm

Abnormal finding	AUC (Confidence interval)	Specificity	Sensitivity
Intraparenchymal haemorrhage	0.91	0.96	0.95
Extradural hemorrhage	0.92	0.93	0.9
Intracranial haemorrhage	0.95	0.97	0.6
Subarachnoid hemorrhage	0.88	0.89	0.95
Subdural hemorrhage	0.96	0.89	0.9
Intraventricular haemorrhage	0.98	0.91	0.95
Cranial Fracture	0.96	0.9	0.9
Infarct	0.94	0.87	0.87
Midline Shift	0.97	0.93	0.93
Mass Effect	0.93	0.88	0.88
Atrophy	0.92	0.84	0.84

qScout-EMR for contact registration and tracing

It is possible to access this utility using any mobile device or PC. In the framework of COVID-19, its major applications consist of registration and contact communication. To make this app more useful for everyone, however, we will collaborate with the company to improve it so that people can monitor their symptoms on a daily basis. The graphical user interface of the utility may be shown in Figure 2..[46-50]

InMotion ARM

Over twenty nations utilise InMotion robots for neurorehabilitation purposes. The US is one among them. A wide range of motor impairments have been found to respond positively to InMotion robot therapy. These include, but are not limited to, cerebral palsy, hemiplegic shoulder discomfort, MS, PD, stroke, and muscular stiffness.[51]

Fig. 2. InMotion ARM

CONCLUSION

Beginning with the patient's visit to the emergency department, the suggested system that is driven by artificial intelligence offers assistance to patients around the clock. In a clinical environment, it is able to manage a large amount of patient data, recognise dangerous diseases, instantly understand complicated patterns, and assess detailed molecular data and genetic information. Through the development of AI-generated radiologist reports, clinical laboratory findings, and a number of other decision-support tools, it has the ability to simplify the decision-making process for early sickness detection and diagnosis while simultaneously minimising the likelihood of human error. Because it examines raw data from patients and offers results in a very short amount of time, it makes it possible for researchers, doctors, nurses, and other stakeholders to get the support they need in an effective manner. In addition, this research highlights the most recent developments in artificial intelligence's use in the medical field, which might be included into the architecture that has been recommended. Among these achievements include the early detection of cancer, the finding of genetic code linkages, the development of medicines, and many more. To put it another way, the strategy that has been presented would enhance the capability of healthcare personnel to grasp the essential wants of their patients. This would allow them to give greater assistance and advice to their patients, while also reducing costs and making the most effective use of staff time. Artificial intelligence (AI) healthcare has the potential to bring about significant benefits for the healthcare industry, and hospitals and healthcare providers all over the globe should start integrating these technologies as soon as possible.

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