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A Review of the Application and Prospect of Medical Diagnosis System in the Context of Artificial Intelligence

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Abstract: Artificial intelligence (AI) has become a major force for change in the healthcare industry, especially in diagnostic systems, where AI plays a key role in improving the accuracy, speed, and efficiency of diagnosis. The deep integration of AI with internet-based platforms has revolutionized the way healthcare is delivered, especially in low-resource settings, where AI provides a scalable solution for healthcare systems. This article explores the application of artificial intelligence in medical diagnosis, focusing on how AI technologies such as machine learning and deep learning can be integrated into areas such as medical imaging, disease prediction, and telemedicine. The article also discusses the rapid development of the internet-based healthcare system, emphasizing the role of AI in improving diagnostic models through real-time data collection and analysis. At the same time, the article also analyzes current challenges, such as data privacy, ethical issues, and regulatory challenges, which limit the widespread application of AI in clinical practice. Through a comprehensive review of existing research, this article outlines the potential and limitations of AI in medical diagnostics and provides insights into its future development trends. The findings show that although AI has great potential to improve the quality and accessibility of healthcare, its application in clinical practice still needs to carefully consider many factors such as ethics, technology, and regulation.

Keywords: Artificial Intelligence, Medical diagnosis, Machine learning, Deep learning, Medical Imaging.

1. Introduction

This research focuses on the application of artificial intelligence technology in Internet-assisted medical diagnosis system and its future development prospects. By using the literature analysis method, this paper systematically reviews the existing research results and explores the key issues in this field from different perspectives. Specifically, the study first analyzes the current situation of the combination of artificial intelligence and Internet technology, and discusses the typical application scenarios of AI in medical image analysis, disease prediction, and telemedicine, as well as the contribution of these technologies to improving medical efficiency and diagnostic quality. Secondly, the research focuses on the analysis of the main problems and challenges, including data privacy protection, ethical issues, and insufficient technical standardization, which limit the wide application of AI in the medical field to a certain extent. Finally, the article looks ahead to the future and discusses the deep integration of AI and the Internet of Things (IoT) and the potential of smart healthcare

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systems to improve access to healthcare services and personalized care. Based on the above analysis, this paper aims to provide theoretical support for the further development of artificial intelligence in the medical field and provide a practical reference for the optimization of future medical systems.

2. Deep Integration of Artificial Intelligence with the Healthcare Industry

Machine learning has reached a state in which its interconnection with the medicine industry is changing the way health care works, how diseases are diagnosed, how the individual patient is treated, and even how health care functions. Machine learning, deep learning, and Natural Language processing Algorithms need in the enormous amount of healthcare data and enhance diagnostic accuracy and decision making. As much as using AI technology in health care there are several problems among them include the following: Ethical concern, Data security and the need to ensure that outcomes from the AI technology are accounted for.

Kassebaum et al. have established that AI diagnosis has efficiency and accuracy in analysing medical images and detecting diseases. Besides, it has not only enhanced the precision of medical diagnosis; it has also enhanced the speed of diagnosis. For example, analysing the results of medical images, it was also possible to identify not only more detailed information about the image itself but also patterns related to diseases [1,2]. On the treatment side, it can help in early screening of stage diseases, generate treatment protocols based on EHR and wearables data for patients and thereby give them proper treatment which they require [1,3].

AI also improves health care resources, transportation and supply chain, documentation, as well as evidence-based decisions. This process optimisation makes the patient's healthcare experience better while also trying to minimise costs [1,4]. Moreover, new technologies like natural language processing inside the frameworks of chatbots and applications, ready to give medical advice and disease predictions based on user's symptoms, can enhance the accessibility of healthcare [4].

In medicine AI boosts the process of scientific inquiry by creating methods for drug development, patient surveillance, and sensitive data analysis. Such integration has accelerated the rate of coming up with heath breakthroughs, as well as enhancing the general wellbeing of individuals [2]. AI use in the fields of biomedical engineering, especially health diagnostics and medical imaging technologies, has shown it is highly relevant in creating non-invasive and highly accurate patient care solutions [3].

3. State of the Artificial Intelligence in Medical Imaging Aided Diagnosis

3.1. Artificial Intelligence in Radiology and Oncology

Radiology operations could benefit from Artificial Intelligence (AI) in scheduling, billing, staffing and workforce, as well as in image quality, and radiation dose. In image interpretation, AI can assist the radiologist in finding patterns and features that cannot be easily seen by the naked eyes and hence increase the chance of an accurate diagnosis and faster time [5]. Yousefirizi discusses how AI can be applied in medical terms and the use of AI in radiology. According to the report, AI has the potential use in healthcare by; register patient, manage patient records, use in disease processes, using in diagnosis, using in surgery, using in mental health treatment. In radiology, the use of Artificial intelligence enhances various main aspects. These cover such areas as patient scheduling, staff allocation, diagnostics algorithms, and the evaluation of image quality and radiation dose legibility. AI can also help in the interpretation of medical imaging and support the radiologists in their diagnosed work to make the work more efficient and accurate. In oncology AI has found extensive application for the detection and classification of tumours. Technique of radiomics that extract quantitative features from medical image has enabled non-invasive characterization of tumours used in diagnosis as well as monitoring treatment processes [6]. In particular, the integration of AI with ultrasonography has good prospects when diagnosing liver tumours. For instance, the systems based

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on artificial intelligence distinguish between different liver diseases, including HCC, malignant tumours, and benign diseases that include cysts and hemangiomas. Besides, together with AI support, when creating radiomics, it can point to the further fate of the patient after therapy, which plays an essential role in the creation of a patient-specific treatment plan [7].

3.2. Artificial intelligence in COVID-19 diagnosis

AI was instrumental in the diagnosis of the COVID-19 virus especially due to the utilisation of medical imaging that includes x-ray and CT scan. First, these AI methods helped in enhancing diagnostic performances while at the same time cutting down the decision-making time, which was useful in outbreak management [8]. Nevertheless, Soomro's analysis clearly notes that the development and use of models have some limitations because there are often no ground-truthing datasets available to train AI models. Computer-based solutions are the best at performing the screening activities; from the identification of the location of the patient to determining the best settings to use while conducting a scan to allow for the best results and lowest amounts of radiation to be used. Particularly, accuracy of the image segmentation is crucial for COVID-19 diagnosis especially with CT images as opposed to X-rays due to the level of detail provided. However, segmentation of the X-rays is comparatively more difficult because of low contrast and overlapping parts of the body and examines the outcomes of accuracy and sensitivity of AI and indicating their enormous potential for application in outbreak diagnosis. The successful implementation of these approaches is beneficial not only to ease the healthcare load but also to show technical contribution to early identification and better containment of similar outbreaks that affect the health of the public [8].

3.3. Artificial Intelligence in Gastrointestinal and Abdominal Imaging

AI utilisation has been high in gastrointestinal imaging and has tremendous advances in determining and differentiating the lesion types in the oesophagus, stomach, and colon. For instance, with the help of deep learning models, radiology, endoscopy and pathology images interpretation has advanced notably. In abdominal imaging AI is useful for the diagnosis of organ diseases by identifying diseases with imaging technology such as Computed Tomography (CT) scans Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET). These technologies allow for capturing multidimensional data pertaining to abdominal lesions; therefore, they contribute to better diagnosis and treatment of the ongoing fast development of this integration, especially in the radiomics and medical image analysis for the detection and diagnosis of abdominal diseases. By applying machine learning, this AI-based diagnosis not only brings higher accuracy for healthcare workers themselves but is also advances the innovative concept of precision medicine [9].

4. Current Status of the Application of Artificial Intelligence in Disease Prediction

Machine learning and deep learning are essential in disease prediction based on the various AI techniques. These methods involve use of big data where some data is analysed to find the likelihood of occurrence of an event. For instance, deep learning allows analysis of such data as medical images to diagnose cancer and heart diseases, and many others [10,11]. Muddana revolves around the Innovation of AI with the incidence focus on the health sector. Artificial Intelligence is useful in diagnosing diseases as well as predicting which contributes in decreasing suffering and death [10]. It can also improve the management of hospitals and fraudulent schemes in relation to health insurance. With the development in image capturing devices and the availability of cheap personal wearable devices, a large volume of data is produced. Engaging big data, deep learning techniques can harness such a big data using powerful GPU based systems to analyse and detect the hidden patterns to help

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the physicians for early as well as better diagnosis and treatment Muddana also listed few challenges occurred in medical data analysis some of them are Data constraints because of privacy issues There is always a challenge of unbalanced datasets for diseases like cancer and rare diseases A specialist may not be very good at adding labels. Regarding the opinions of the experts, it also varies In addition, there are variations in the genes, environment, and lifestyle of people. Muddana further presented the early diagnostics and forecasting of different diseases such as one or the other types of cancer, diabetes, heart disease, and other ailments can be forecasted using artificial intelligence [10]. These techniques incorporate data of diverse data types and forms including clinical data, gene expression data and medical images.

5. Technology Development

AI brought enhancements in increased efficiency of the diagnosis in using deep learning and machine learning algorithms in lesion and the prediction of diseases in medical images. This has not only altered the conventional way of using medical imaging but also expanded the use of AI in arranging treatments and foreseeing the progression of disease [12]. But, as it was mentioned, such aspects as data quality, data privacy, and non-transparency of the AI systems remain a challenge for wider clinical use. Possible solutions to these problems include enhancing data management, enhancing interpretability of the model and enhancing security of the data [12]. Efforts on intelligent diagnostic systems are increasing, particularly those that utilise conversational AI that address the scarcity of healthcare resources by means of taking down the symptoms and by inferring the diseases through discussion. In these systems, reinforcement working is adopted to improve the conversational process; however, there are limitations to obtaining high diagnostic accuracy and minimising dependency on data [13]. The Embedding AI in Pathology with Artificial Intelligence Assistance (EMPAIA) programme's goal is to work towards embedding AI structures into pathology by determining compatibility standards and methods that can be explained. Several AI-based Image analysis applications have been smoothly implemented in the programme implying that the standardised AI application has great potential for clinical applications. However, technical and regulatory complexities or requirements for universal interfaces hence continue to be key factors that slow the process through which AI technologies can be easily deployed in ordinary clinical practise [14]. Artificial intelligence has also been helpful in diagnosing neurodegenerative diseases especially through the identification of pattern from the biomarker data to give enriched diagnosis [15]. Nevertheless, there are still unresolved issues that concern data fusion and model verification, but these approaches are already providing a growing contribution to precision diagnosis.not only increases the speed of diagnostics but is also an advantage over its counterparts in reducing the cost of health care [16].

6. Problems and Risks

The integration of artificial intelligence (AI) in internet-aided medical diagnostic systems requires for facing several challenges and risks that apply on the technical, ethical, and operational levels and impact directly the pertinent stakeholders' interests, namely, healthcare providers and patients. The given nature of healthcare AI systems is that due to its complex and independent character sufficient oversight and regulation must be provided for its safety and efficiency.

Such failures stem from AI's dependency on high quality fair data for training and biased data collection methodology that results in under representation of some groups thereby causing discrimination and reduced performance [17,18]. Moreover, most current AI models, especially such types as deep learning models, are usually considered as 'black boxes,' and thus the way of their work is rather opaque. Lack of such transparency may create distrust and lack of accountability with the

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identification and diagnosis of diseases by professional doctors [17,19]. Due to data inputs or changes in the environment, the performance of AI systems could be unpredictable, and in that way, there could be arising patient safety risks [20].

The use of health care AI incorporates patient-related data, and therefore has issues to do with data leak and privacy breach. When developing and deploying the model, it is crucial to protect data [20]. Besides, decision-making by such AI systems could affect patient choice making, thereby reducing degrees of patient's autonomy and informed consent; technicalities might also act as barriers to patient comprehension of available treatment choices [21].

On the cost side, they remain expensive inputs to deploy meaning they increase the disparity premium for advanced healthcare technology between the developing and the developed world [1,21] However, the overuse of applications driven by artificial intelligence may minimise supervision and functioning of reason in a medical field, leading to the deterioration of health care [21].

Today, the creation of new possibilities with healthcare AI is growing much quicker than the regulation of standards that can guide its ethical and legal use. New and better rules have to be formulated and enacted to close these gaps [17,19]. Furthermore, defining legal liability for complications resulting from improper AI diagnosis or mistakes is still challenging, put a focus on more demands accountability and deserved reparation process [19].

7. Application Prospects

Internet-assisted diagnosis may be viewed, therefore as one of the most significant and a revolutionising use of the application of Artificial Intelligence (AI), in what has been widely noted to already offer significant progress in the process of medical diagnosis all over the world.

Computer algorithms have been shown to be very effective in the diagnosis of certain diseases through resolution of medical images such as X- rays and MRI among others. They have also enhanced initial disease diagnosis and patient outcomes significantly. Moreover, AI is capable to analyse vast amount of medical information, and to find correlation patterns which can be hardly recognised by a human doctor, which helps in making a correct diagnose and treatment plan. With the integration of, AI and IoT, has contributed to more effective collection and analysis of health data and improvement of their prognosis, patient monitoring and tele-diagnosis Telemedicine based on artificial intelligence can offer diagnostics in underserved areas by augmenting the deficit of healthcare resources and unequal access to medicine. For instance, diagnosis of retinopathy of diabetics is a relatively good example of how this technology will be used [22].

Medical conversational robots are capable of gathering disease information from the users through dialogue and helping doctors with the diagnosis process and alleviating the burden of the health care workforce [13]. Special conversational AI frameworks help the Internet hospitals minimise the time patients have to wait and the number of patients who have been diagnosed incorrectly, which ultimately enhances the effectiveness of online diagnosis services [22].

Artificial intelligence in genomic medicine especially in analysing genomics is increasingly becoming common. Whereas traditional computing only focuses its lens on patient populations, deep learning is able to look at patient DNA information to determine genetic patterns common to diseases. This precise analysis can give information about patients' predisposition to a risk of the specific diseases, which gives a strong evidence to the notion of the early prediction of a disease. Using such genetic information, AI can arise or assist the physician in designing specific therapies for the situation. For instance, in regard to some types of cancer, information about gene mutation can be processed by AI systems and then find out which drug or treatment will be effective in the particular case and increase the rate of recovery among patients. Thus the major advantage of this approach is that it allows one to better adapt treatment strategies to the genetic profile of each patient.

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Smart technologies of artificial intelligence in decision-making practises have been widely incorporated in clinical domains to be of assistance to healthcare providers. These systems can also give knowledgeable advice to help the doctors decide in diagnosing and treat different conditions as they take into account information from patient's records, tests, images. AI can process large volumes of data and can easily detect possible complications in a certain condition, and can also recommend the most suitable treatment procedure for a certain patient, among others. In this way, AI is not just enhancing medical effectiveness, but also decreasing the possibility of erroneous diagnoses while guaranteeing patients obtain more concise and exact medical treatment.

Moreover, AI also applies the big medical data through the model of the predictive probability of a disease and the probability of a patient's response to the treatment. This one relies on records of previous episodes, a patient's physiologic, genetic and other factors, as well as actuaries that help to forecast epidemic trends, treatment prognosis. By such predictions, then the healthcare teams can then be able to institute early interventions when a disease is just budding; this is essential in modifying certain aspects of treatment programmes with the aim of increasing the client's overall life expectancy and improving prognosis. For instance, patient with heart disease or diabetes, AI can figure out his or her reaction towards a particular treatment regimen and assist doctors decide when and how to undertake procedures that may be dangerous to the patient's life. Combined, this proactive prediction approach enriches the medical science and the decision making for a precise treatment, as well as provides the necessary intervention during the early phase of certain diseases to improve treatment results and ultimately, decrease patient's suffering before their critical conditions worsen.

8. Conclusion

In general, the introduction of artificial intelligence (AI) and application of the Internet in diagnosing is rapidly evolving the medical industry, which brings unimaginable opportunities for improvements of diagnostic accuracy, efficiency, and popularity. With the help of such areas of artificial intelligence as machine learning and deep learning, healthcare systems have been able to analyse large medical data sets, detect a disease at an earlier stage, and design an individual treatment plan. Moreover, given the AI programmes, common to solve various problems in the field of radiology, particularly in such areas as X-ray and magnetic resonance imaging diagnosis, it has become possible to improve the accuracy of diagnoses. Besides increasing the patient's quality of life, technological enhancements discern finer points overlooked by the human practitioners and hence enhance the diagnosis as well. There is evidence that its integration with the 'Internet of Things' is changing the possibilities of real time monitoring and analysis of health data. It also contributes even to the enhanced patient health besides reaching out and expanding the coverage of healthcare services through remote patient monitoring and telephone consultations. AI integrated telemedicine solutions can directly solve the problem of maldistribution of medical specialists and medical equipment, by supplying quality diagnosis with remote and needy population groups. This technology is best illustrated in the diagnosis of diabetic retinopathy.

Moreover, the conversational AI technology and Intelligent diagnostic systems have actually lightened the load of medical staffs. Now it is possible to speak about the increasing role of artificial intelligence in the form of chatbots and virtual assistants for quick data about the patient's condition, symptom collection and even preliminary diagnosis. Such technologies have enhanced the medical services offered through the internet since they kill two birds; shortening the time patients spend waiting to get a diagnosis and the rates of incorrect diagnosis.

With the continuous development of artificial intelligence technology, its potential in the medical field is huge. However, it must also pay attention to data privacy and security issues, as well as the ethical challenges of relying on artificial intelligence to make medical decisions. Despite this, the future of artificial intelligence in the field of diagnosis is still very bright. It is expected to significantly

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improve the quality of medical care, reduce medical costs, and make medical services more accessible to more people around the world. In the future, artificial intelligence-powered diagnostic tools will continue to drive reform in the medical industry and promote more accurate, personalized, and efficient medical services.

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