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STUDYING HOW TO USE AI FOR DIAGNOSTIC IMAGING IN THE MEDICAL FIELD

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Abstract-

First, the article explains the current state of AI research in medical imaging diagnosis and uses examples to show how important computer-aided diagnosis is; Additionally, a thorough analysis is conducted on the present obstacles to the advancement of computer-aided diagnostic technology from a technological, industrial, and application perspective; The study concludes with several recommendations for improving the use of AI technology in medical imaging diagnostics, based on the prior analysis and taking into account the present real circumstances.

Keywords-Artificial intelligence; Medical imaging; Computer-aided diagnosis

INTRODUCTION

In terms of global mortality rates, the World Health Organization (WHO) reports that cancer is the leading cause, accounting for 22.32% of all deaths. Cardiovascular disease, diabetes, and chronic respiratory diseases round out the list. From 17.2 million in 2016 to 19.3 million in 2020 and projected to reach 20.2 million in 2022, the number of diagnosed patients with cancer has been steadily rising, reflecting the increasing trend in cancer incidence in recent years. On a more serious note, younger and younger people are being diagnosed with cancer in my nation [2]. The uneven social and economic development of different locations is a major factor, particularly in rural areas with less advanced medical infrastructure and higher treatment expenses. There is a high percentage of long-term mortality because many cancers, despite being evaluated and dealt with, were not treated at the optimal time. In order for imaging equipment to identify the affected portion, it is crucial to do routine checks for linked disorders. To improve survival rates, standard medical imaging may be performed and the appropriate therapy can be administered. As a whole, people's lifestyles are being transformed by IT and other forms of technical advancement, but society is also benefiting from the integration of IT with other sectors. Screening for a range of disorders has made extensive use of medical imaging technologies [3] in this setting. Medical imaging technology has been used in over 70% of clinical diagnoses, according to data [4]. It primarily pertains to the technological means and procedure of

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directly acquiring pictures of inside tissues using non-penetrating methods for a specific area of the body. In clinical practice, it primarily serves three purposes: aiding in auxiliary medical clinical examinations (e.g., 3D visualization), determining injection processing methods (e.g., cutting, stroking, sizing, and evaluation), and guiding interventional therapy. There is a wide variety of medical imaging detection technologies available today [5]. Some examples include computerized cross-sectional imaging (CT), computer X-ray photography (CR), magnetic resonance imaging (MRI), positron emission tomography (PET-CT), direct spinal analysis (DSA), ultrasound, endoscopy, etc. Changes in human physiology are a common byproduct of illness pathogenesis, and these changes will manifest in various imaging findings from various imaging exams. In order to decide the next steps in diagnosis and therapy, doctors need to be able to effectively analyze this data in order to pinpoint possible causes and track the progress of associated disorders.

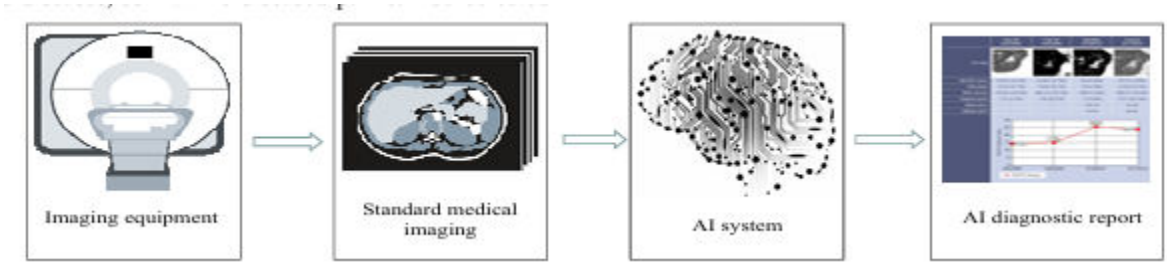

Figure 1. The overall process of AI-based computer-aided diagnosis.

There is a growing disparity between the demand for and supply of medical image analysis, which is problematic given the rising number of hospital patients. Furthermore, primary-level doctors sometimes have less expertise with diagnosis and treatment, which may lead to manual reading being inefficient. Because of this, the development of computer-aided diagnosis (CAD) [6] may assist in the finalization of illness diagnoses and treatments, as well as in the acquisition of picture data and the execution of specific quantitative and qualitative analyses. Its use in intelligent medicine has been very beneficial, enhancing the precision and efficacy of medical professionals' diagnostic abilities. The general procedure of AI-based CAD is shown in Fig. 1. A large number of researchers, both domestic and international, place a premium on the computer-aided design (CAD) system design process and work tirelessly to find ways to use this technology to clinical diagnostics. Using a computer-aided design (CAD) technology, the primary goal is to aid physicians in accurately dividing up the lesion area. This technology is well-suited for clinical illness diagnosis because of the time-saving and efficient detection it provides, which aids

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patients in discovering their own ailments in a timely manner. In order to improve the efficiency and accuracy of lesion diagnosis, it is vital to combine computer technology with diagnostic analysis of medical images. Traditional algorithms for medical image analysis have seen extensive application in CAD systems up until recently, but these approaches have serious procedural and technological limitations. For instance, conventional segmentation algorithms provide subpar diagnostic findings because they are built on foundational low-level data and do not fully use high-level semantic information; as a consequence, they are unable to extract rich texture and edge properties of pictures. Figure 2 shows that when compared to traditional approaches, AI-based solutions for illness detection are quicker and more efficient.

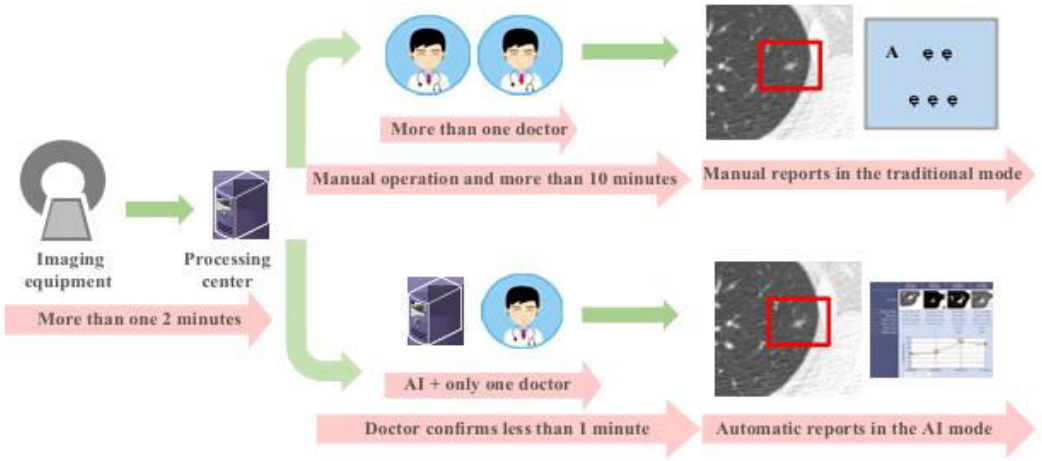

Figure 2. Comparison between traditional and AI-based methods for disease diagnosis.

Artificial intelligence (AI) medical imaging images surpass target detection and image retrieval with the rapid development of software and hardware delineation of target areas and 3D reconstruction of medical technology [7]. The aforementioned deficiencies are its primary areas of application. Recent years have seen significant advancements in the phases of illness screening, diagnosis, and therapy. technological advancements in education have been very effective. So, AI is a boon to medical imaging computer vision, especially for analysis. AI has many uses, but its primary strength is in its speed and accuracy in picture processing, classification, segmentation, and object recognition. Timely outcomes from auxiliary judgments given in; As a second point, convolutional neural networks (CNNs) have excellent diagnostic sensitivity, which means they may lessen the incidence of missed diagnoses and more correctly pinpoint the site of lesions; Finally, it can improve the quality of quantitative diagnostics for primary diseases and screenings for subsequent treatments by combining deep learning analysis with medical imaging knowledge to provide doctors with accurate data information about lesions. The findings

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of patient-specific deep learning-based CAD are shown in Figure 3. It is able to recognize lesion locations by automatically extracting visual elements from a variety of medical pictures, including those with color-labeled sections, thanks to ongoing image training. Figure 3 shows the results of several medical imaging tests that use artificial intelligence for illness detection. These tests include MRI screenings for stroke and prostate, liver tumor pictures, and nodule examinations of the lungs. Automatic lesion recognition and labeling, screening using mammography and chest X-rays, and other similar activities are now within the capabilities of AI.

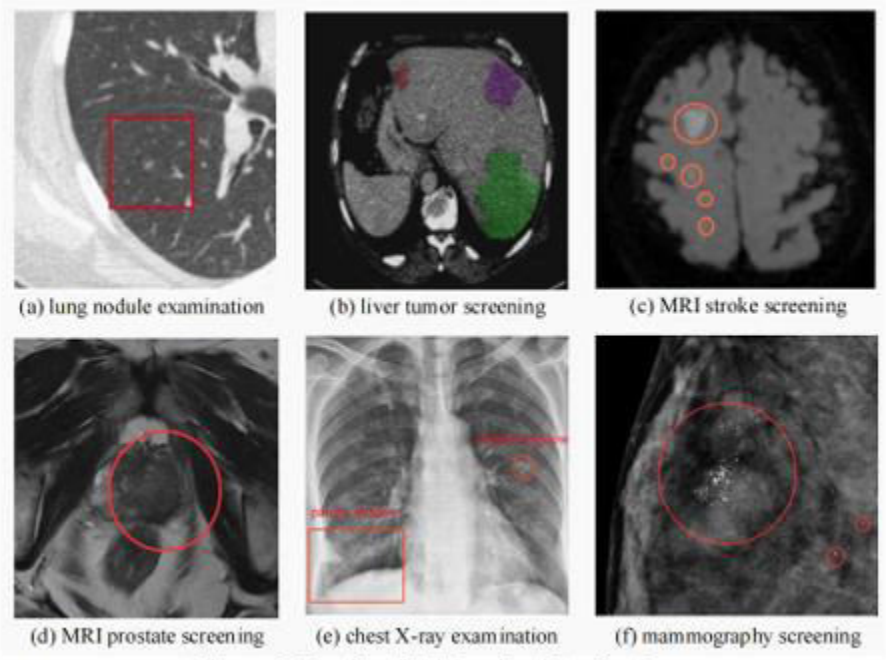

Figure 3. Results of CAD using AI technology

CHALLENGES FACED BY AI MEDICAL IMAGING

pertaining to oversight, registration, and access. has not yet taken shape. Regardless of the size of the Chinese market Although deep learning technology has made considerable strides in software optimization—on par with Western nations—in hardware follow-up, the pace of legislative development has been somewhat sluggish. Consider the effectiveness of medical imaging in making diagnoses. Additionally, there is a growing number of institutions and businesses entering the artificial intelligence software product space, but there are no established standards or evaluation methodologies for these products. Additionally, market investment is ongoing, which is a major obstacle to advancement. Nonetheless, a significant distance remains between connected businesses in terms of achieving product optimization. Technological and practical use of medical

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imaging diagnostics based on artificial intelligence [8], particularly in the following three areas: A. Acquiring annotated datasets for training models is technically challenging. A large training dataset is mostly responsible for the predictive performance of medical picture diagnostic models based on deep learning, according to studies. The basic rule is that a model's predictive power increases as the number of samples used to train it grows. Nonetheless, the following issues persist, making it hard to get high-quality datasets: First, digital imaging data is hard to get by and medical imaging data isn't really standardized; second, data sets are notoriously tough to classify. Furthermore, many issues in clinical medicine remain poorly defined, and the bar for participation in labeling is quite high due to the professionalism of medicine. Lastly, the quality of the labeling cannot be guaranteed. B. Industry-wide assessment criteria for AI-assisted diagnostic outcomes are lacking. In order to prevent misunderstandings or the inappropriate use of indicators, it is important that the assessment indicators used for screening or diagnosing various illnesses adhere to their respective uniform criteria. On a second point, the system of laws and regulations 239 C. Artificial intelligence (AI) still has a ways to go before it can effectively address real-world issues in medical imaging. To get better picture features for illness detection, deep learning has to learn a lot from a big dataset since it is self-adaptive and has its own unique traits [9]. Secondly, training pictures with various structures and forms (such as organs and dynamic images) and minute informational changes might be challenging in the complicated medical image information processing process, leading to disappointing outcomes.

SEVERAL SUGGESTIONS FOR AI MEDICAL IMAGING

A pressing need for the establishment of smart medical care, as shown in the preceding thorough study, is the rapid application of computer-aided diagnostic technology based on deep learning to clinical diagnosis [l O]. In light of this, the article offers some situationally appropriate recommendations for using AI in medical imaging diagnosis: Helpful Hints Technically optimizing the model of the deep learning algorithm and building a high-quality data set are of paramount importance [11]. This primarily involves: (1) conducting more research on the combined rules and deep learning model; (2) creating a variety of sources and standardized data sets to enhance the training data's quality; and (3) establishing a high-quality data set. Moreover, to increase annotation efficiency, transfer learning may be used to decrease annotations during model training. B. Industry recommendation for AI The industrial sector should prioritize the study and establishment of registration standards for AI software. The primary points include the following: the model's specifications for the beginning, middle, and end of the process; indicators for evaluating the model's performance and safety; a system for grading diagnostic recommendations; and a mechanism for gaining access to medical institutions.

Following this, the appropriate institutions should form a new professional team to study the evaluation framework and indicators for medical artificial intelligence applications. Lastly, groups of experts in the field, such as imaging medicine's expert alliances, should research and develop medical imaging using artificial intelligence (AI), as well as a professional consensus on the topic, and then provide businesses and consumers expert medical counsel and direction. C. Suggestions for AI implementation Medical picture application requirements call for more standardized training and standardization of digital annotation to enhance data output compatibility in the CAD system, which is crucial for clinical diagnosis and treatment. Medical imaging diagnostic models trained with deep learning should do more than just recognize and categorize image signals; they should also draw thorough conclusions from the patient's symptoms, medical history, and other test findings. The shift from auxiliary examination to predictive diagnosis and auxiliary judgment may be accomplished by significantly improving the general degree of artificial intelligence in medicine.

CONCLUSION

From a technological, industrial, and practical standpoint, the article proposes solutions to the problems plaguing the present state of medical image analysis technologies based on deep learning. Overall, there is still a lot of room for improvement and investigation into how best to use AI in medical imaging for computer-assisted diagnosis, even though this mode can alleviate some of the workload for front-line clinical imaging doctors. Consequently, future research will primarily focus on improving the accuracy of lesion area detection, ensuring the 240 detection quality of the auxiliary diagnosis system, and providing accurate disease diagnosis information. This will ultimately lead to a more effective and reliable diagnosis process overall. NOTICES OF GRANT The Natural Science Foundation of Ningxia Province provided financial assistance for this study (Grant No. 2022AAC03347).

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