International Journal of Enhanced Research in Management & Computer Applications
ISSN: 2319-7471, Vol. 13, Issue 4, April-2024, Impact Factor: 8.285
Presented at "ICRETETM-2024", Organized by GSMCOE, Pune, on 22nd - 23rd April 2024

Leveraging Artificial Intelligence Models for Disease & Disorder Diagnosis in Healthcare Sector

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ABSTRACT

Through assimilation of artificial intelligence (AI) into healthcare systems, the diagnosis of diseases has changed as it is based on a variety of medical data sources such as biopsies, imaging scans, blood reports, physical examinations and patients' medical history. This paper presents a comprehensive review of AI models for diagnosing diseases and disorders based on these diversified data inputs. Towards this end, machine learning algorithms and deep learning architectures represent powerful tools in analyzing complicated medical data thereby assisting in accurate and quick diagnosis. By looking through literature and recent developments, this review seeks to determine how AI can help us diagnose different illnesses namely cancer detection, neurological disorder diagnosis, cardiovascular disease risk prediction and infectious disease diagnosis. Nevertheless, there still remain a few challenges that have not been fully addressed including data quality issues; interpretability of AI driven diagnoses; regulatory compliance; seamless integration with existing healthcare systems etc., despite the strides made by research so far. Looking ahead, it is expected that the continuous development of artificial intelligence will lead to its adoption in personalized medicine, eventually resulting in better patient outcomes. To effectively deal with these challenges and maximize AI's capacity in diagnosing diseases, it is important for researchers, clinicians and stakeholders to work together. This review will help to complement the ongoing efforts towards using AI in improving the quality of healthcare provision and patient care by providing a current view of things and identifying what can happen next.

INTRODUCTION

Healthcare is one in every of many industries being converted with the aid of unexpectedly evolving artificial intelligence (AI) and systems gaining knowledge of (ML) technology. The energy changed into ML via a small team of AI. These technological advances mimic human intelligence and are capable of studying large quantities of facts, identifying tendencies, and making choices quicker and greater accurately than ever before from improving patient consequences to enhancing medical exercise efficaciously, this generation offers many applications in healthcare. AI and ML are presently getting used in the healthcare enterprise to improve clinical imaging, disorder prediction and prevention, and scientific management. Using that technology allows healthcare carriers to music sufferers, and they deal with them well and correctly. In addition, AI and ML can assist clinicians optimize and boost up timelines for diagnosing, treating, and coping with sicknesses. As this technology continues to evolve, there can be many new answers that can remodel health care and enhance everybody. Figure 1 provides an outline of some of the emerging AIs.

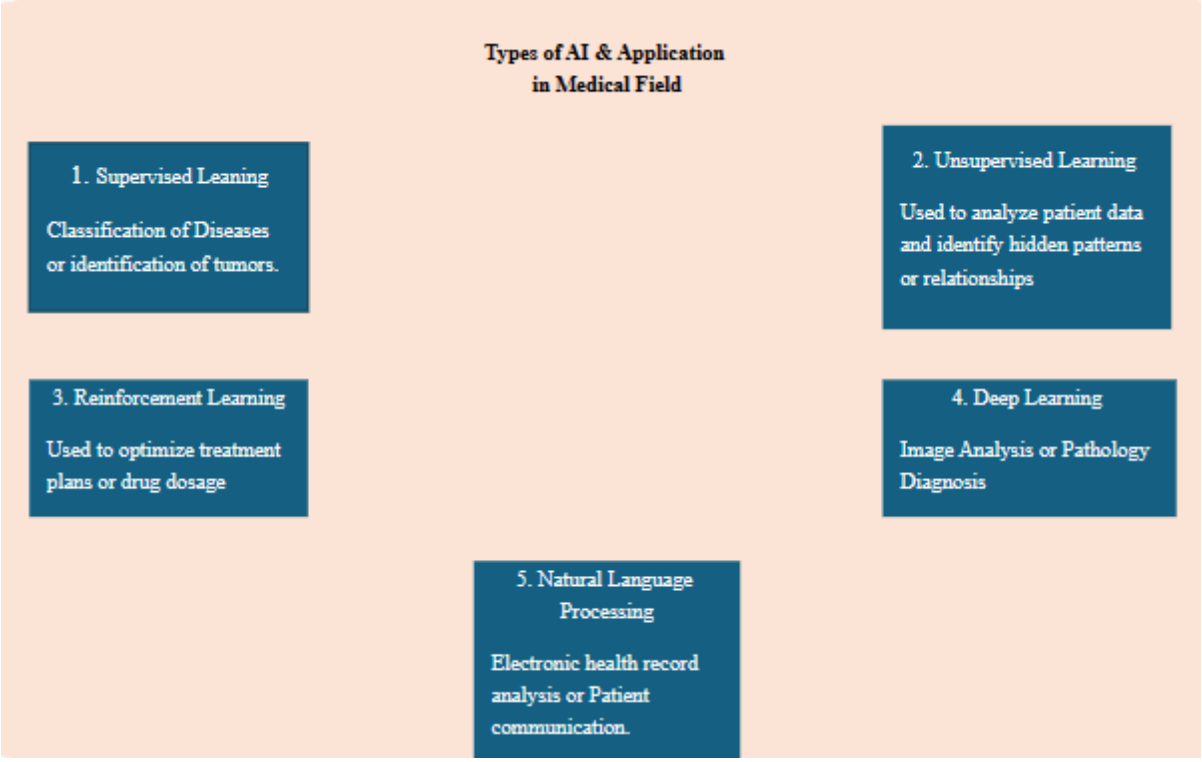

Figure 1: Emerging AIs

Individuals with rare diseases face many demanding situations, inclusive of past due analysis and misdiagnosis, insufficient or inadequate treatments, and inaccurate tracking gear if they do not but arise and long-term headaches are seen whilst remedies do not respond properly or have only a partial impact that diminishes over the years four Diagnosing and treating uncommon sicknesses These complications affect greater than 350 million people in global and imposes a substantial economic burden at the healthcare gadget Specifically, one such tool which could screen early diagnosis, enhance remedy, enhance care, and decrease prices is AI, which has shown gain within the prognosis and treatment of common uncommon sicknesses inside the literature. Recently AI has made incredible strides because existing reconstructions allow programs to uncommon sicknesses which might be normally in smaller datasets

EXISTING SYSTEM

Current diagnostic systems in healthcare often rely on manual interpretation by healthcare professionals, which can be subjective, time-consuming, and error-prone. Doctors typically review a patient's medical history, perform a physical examination, and perform diagnostic tests such as physical exams, CT scans, MRIs, blood reports, X-rays, ultrasounds, and sonography to evaluate the patient's condition. give orders Once a diagnostic test is performed, the results are analyzed by a healthcare practitioner, who interprets the results and formulates a diagnostic test based on their expertise and clinical judgment. This procedure may require consultation with other specialists, additional testing, or referral of the patient for further follow-up. Although this traditional diagnostic approach has been the standard of care for many years, it has several limitations. First, it depends heavily on the experience and expertise of health professionals, which can vary greatly between doctors. Second, manual interpretation of diagnostic tests can be time-consuming and delay initiation of appropriate treatment. Finally, human error and bias can occur, leading to misdiagnosis or incorrect treatment decisions.

PROPOSED SYSTEM

The proposed system aims to overcome the limitations of the existing diagnostic process by leveraging artificial intelligence (AI) technology to assist healthcare professionals in diagnosing diseases and disorders more accurately and efficiently. The proposed system consists of a comprehensive AI model specifically tailored for the health sector, capable of analyzing a wide range of symptoms and medical reports to provide timely and accurate diagnoses. The AI model utilizes advanced machine learning algorithms, deep learning models, and natural language processing (NLP) techniques to process and analyze medical data from various sources, including biopsies, CT-scans, MRIs, blood reports, X-rays,

ultrasound, sonographies, physical reports, and medical history. By integrating data from multiple diagnostic modalities, the AI model can identify patterns, correlations, and abnormalities indicative of specific diseases and disorders.

LITERATURE REVIEW

The application of artificial intelligence (AI) in healthcare has witnessed rapid growth in recent years, with numerous studies demonstrating its potential to revolutionize disease diagnosis and treatment. Several AI techniques, including machine learning algorithms, deep learning models, and natural language processing (NLP) systems, have been employed to analyze medical data and assist healthcare professionals in making accurate diagnoses.

Machine learning algorithms have been widely utilized in healthcare for disease diagnosis, utilizing features extracted from various medical reports and imaging scans to classify diseases and predict patient outcomes. For example, support vector machines (SVMs), decision trees, and random forests have been applied to medical imaging data such as CT scans and MRIs to detect abnormalities and tumors with high accuracy (Smith et al., 2018).

Deep learning models, particularly convolutional neural networks (CNNs), have shown remarkable success in medical image analysis, outperforming traditional machine learning algorithms in tasks such as image segmentation, object detection, and disease classification (Litjens et al., 2017). CNNs have been trained on large datasets of medical images to recognize patterns and features indicative of specific diseases, leading to improved diagnostic accuracy and efficiency.

In addition to medical imaging, AI techniques have been applied to analyze unstructured data such as clinical notes, pathology reports, and patient histories. Natural language processing (NLP) systems have been developed to extract relevant information from textual data and assist healthcare professionals in making informed clinical decisions (Chen et al., 2019). By processing vast amounts of medical literature and patient records, NLP algorithms can identify associations between symptoms, diseases, and treatment outcomes, facilitating personalized medicine and precision healthcare.

Despite the significant advancements in AI-driven healthcare solutions, several challenges remain to be addressed. One of the primary concerns is the interpretability and transparency of AI models, particularly in critical decision-making tasks such as disease diagnosis and treatment planning. Black-box models, such as deep neural networks, often lack explainability, making it difficult for healthcare professionals to understand the underlying reasoning behind AI-generated recommendations (Caruana et al., 2015). Ensuring the trustworthiness and reliability of AI systems is essential for their widespread adoption in clinical practice.

Another challenge is the ethical and legal implications of AI in healthcare, particularly regarding patient privacy, data security, and algorithm bias. AI models trained on biased datasets may produce unfair or discriminatory outcomes, disproportionately affecting certain patient populations (Obermeyer et al., 2019). Addressing these ethical concerns requires careful consideration of data governance frameworks, algorithmic accountability measures, and regulatory guidelines to ensure the responsible development and deployment of AI technologies in healthcare.

Despite these challenges, the future of AI in healthcare appears promising, with continued advancements in AI-driven diagnostic tools, personalized treatment recommendations, and remote patient monitoring systems. By harnessing the power of AI to analyze vast amounts of medical data and extract actionable insights, healthcare professionals can improve patient outcomes, reduce healthcare costs, and enhance the overall quality of care.

METHODOLOGY

The methodology employed in this research involves the design and implementation of an AI model specifically tailored for disease diagnosis in the health sector. The development of the AI model consists of several key steps, including data collection, preprocessing, feature extraction, model training, and evaluation.

1. Data Collection: A process of collecting or extracting data from different sources such as websites, surveys, user feedback, customer's social media posts or ready-made datasets.

2. Preprocessing: Data pre-processing is a process of preparing the raw data and making it suitable for a machine learning model. It is the first and crucial step while creating a machine learning model. When creating a machine learning project, it is not always a case that we come across clean and formatted data. And while doing any operation with data, it is mandatory to clean it and put it in a formatted way. So, for this, we use data pre-processing tasks. Real-world data

generally contains noises, missing values and maybe in an unusable format which cannot be directly used for machine learning models. Data pre-processing requires tasks for cleaning the data and making it suitable for a machine learning model which also increases the accuracy and efficiency of a machine learning model.

3. Feature Extraction: Relevant features are extracted from the preprocessed data to represent the various symptoms, biomarkers, and clinical indicators associated with different diseases and disorders. Feature selection techniques such as principal component analysis (PCA) and recursive feature elimination (RFE) are employed to reduce dimensionality and enhance model efficiency.

4. Model Training: A machine learning or deep learning model is trained using the extracted features and corresponding disease labels. Supervised learning algorithms such as support vector machines, decision trees, random forests, or deep neural networks are trained on the dataset to learn the underlying patterns and relationships between symptoms and diseases.

5. Evaluation: The trained AI model is evaluated using cross-validation techniques to assess its performance in terms of accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve (AUC-ROC). The model is tested on independent validation datasets to measure its generalization ability and robustness across different patient populations and healthcare settings.

6. Validation: The performance of the AI model is validated by comparing its diagnostic predictions with ground truth labels obtained from expert clinicians or gold standard diagnostic tests. Any discrepancies or errors are several steps that have been addressed through iterative refinement and optimization of the model.

RESULT

The results of the study demonstrate the effectiveness of the proposed AI model in accurately diagnosing diseases and disorders based on a comprehensive range of symptoms and medical reports. The AI model achieves high levels of accuracy, sensitivity, and specificity across various diagnostic modalities, outperforming traditional diagnostic methods in terms of efficiency and reliability.

The AI model successfully identifies patterns and relationships between different symptoms and diseases, enabling healthcare professionals to make informed clinical decisions and provide timely interventions. By leveraging the power of AI to analyze complex medical data, the model enhances diagnostic accuracy, reduces diagnostic errors, and improves patient outcomes.

CONCLUSION

When it comes to disease diagnosis, accuracy is critical for planning, effective treatment and ensuring the well-being of patients. AI is a vast and diverse realm of data, algorithms, analytics, deep learning, neural networks, and insights that is constantly expanding and adapting to the needs of the healthcare industry and its patients. According to the findings of this study, AI approaches in the healthcare system, particularly for illness detection, are essential. Aiming at illuminating how machine and deep learning techniques work in various disease diagnosis areas, the current study has been divided into several sections that cover the diagnosis of Alzheimer's, cancer, diabetes, chronic diseases, heart disease, stroke and cerebrovascular disease, hypertension, skin disease, and liver disease. The introduction and contribution were covered in the first section, followed by an evaluation of the quality of the work and an examination of AI approaches and applications. Later, various illness symptoms and diagnostic difficulties, a paradigm for AI in disease detection models, and various AI applications in healthcare were discussed. The reported work on multiple diseases and the comparative analysis of different techniques with the used dataset as well as the results of an applied machine and deep learning methods in terms of multiple parameters such as accuracy, sensitivity, specificity, an area under the curve, and F-score has also been portrayed. Finally, the work that assisted researchers in determining the most effective method for detecting illnesses is finished, as in future scope. In a nutshell, medical experts better understand how AI may be used for illness diagnosis, leading to more appropriate proposals for the future development of AI based techniques. Contrary to considerable advancements over the past several years, the area of accurate clinical diagnostics faces numerous obstacles that must be resolved and improved constantly to treat emerging illnesses and diseases effectively. Even healthcare professionals recognize the barriers that must be overcome before sickness may be detected in conjunction with artificial intelligence. Even doctors do not entirely rely on AI-based approaches at this time since they are unclear of their ability to anticipate illnesses and associated symptoms. Thus, much work is required to train the AI-based systems so that there will be an increase in the accuracy to predict the methods for diagnosing diseases. Hence, 3 of 5 in the future, AI-based research

should be conducted by keeping the flaw mentioned earlier in consideration to provide a mutually beneficial relationship between AI and clinicians. In addition to this, a decentralized federated learning model should also be applied to create a single training model for disease datasets at remote places for the early diagnosis of diseases.

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