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Artificial Neural Networks in Medical Diagnosis

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ABSTRACT:

Artificial Neural Networks (ANNs) have become a transformative tool in the field of medical diagnosis, offering the potential to improve accuracy, efficiency, and early detection of diseases. This paper explores the application of ANNs in medical diagnostics, presenting a comprehensive survey of the literature, a detailed description of the proposed diagnosis model, and the experimental results. The discussion extends to future enhancements and potential improvements in this domain. The results of applying the artificial neural networks methodology to acute nephritis diagnosis based upon selected symptoms show abilities of the network to learn the patterns corresponding to symptoms of the person. In this study, the data were obtained from UCI machine learning repository in order to diagnosed diseases. The data is separated into inputs and targets. The targets for the neural network will be identified with 1's as infected and will be identified with 0's as non-infected..

Keywords: *Pattern recognition, Medical diagnosis, Medical diagnostic imaging, Medical services, Decision making, Area measurement, Testing, Cardiology, Cardiac disease, Cardiovascular diseases.*

INTRODUCTION:

The process of making medical diagnoses has been completely transformed by the introduction of artificial intelligence (AI) into the healthcare industry. Artificial Neural Networks (ANNs) are a class of AI approaches that have showed great promise because of their capacity to learn from data, adapt, and generalise patterns. In order to improve diagnostic accuracy, this paper proposes a new model, reviews recent research, and provides a thorough analysis of ANNs in medical diagnosis. Moein, Monadjemi, and Moallem examined the actual medical diagnosis process, which is often used by doctors, and transformed it into a format that can be used by a machine. Following the selection of a few symptoms from eight distinct diseases, a data set including the details of several hundred cases was put up and fed into an MLP neural network. There was also discussion of the experiment's outcomes and the benefits of employing a fuzzy strategy. Results point to the importance of selecting symptoms wisely and the benefits of data fuzzification in an automatic medical diagnosis system based on neural networks.

PROBLEM STATEMENT:

Lung cancer is one of the leading causes of cancer-related deaths worldwide. Early detection significantly improves the prognosis and survival rates of patients. However, early-stage lung cancer often presents with subtle and non-specific symptoms, making early diagnosis challenging. Traditional diagnostic methods, including imaging and biopsy, are invasive, costly, and sometimes not feasible for large-scale screening. There is a critical need for a non-invasive, accurate, and efficient diagnostic tool that can identify lung cancer at an early stage.

LITERATURE SURVEY:

Artificial Neural Networks (ANNs) have gained significant attention in the field of medical diagnosis due to their ability to model complex patterns and relationships in data. This literature survey aims to provide an overview of the applications, advancements, and challenges of using ANNs in medical diagnosis, highlighting key studies and findings. Diagnosis of Heart Disease: ANNs have been employed to predict the presence of heart disease using clinical parameters such as age, blood pressure, cholesterol levels, and electrocardiogram (ECG) results. Studies have shown that ANN models can achieve high accuracy and outperform traditional statistical methods.

Example: A study by Haq et al. (2018) developed an ANN model that achieved an accuracy of 85% in diagnosing heart disease using a dataset from the Cleveland Heart Disease Database. Breast Cancer: ANNs have been used for the early detection and classification of breast cancer through the analysis of mammographic images and histopathological data. Techniques such as convolutional neural networks (CNNs) have shown promising results in identifying malignant tumors.

Example: A Research by Jiang et al. (2019) demonstrated that a CNN model achieved an AUC of 0.97 in classifying breast cancer from mammograms.

Lung Cancer: ANNs are applied to analyze imaging data (CT scans, X-rays) and non-imaging data (clinical symptoms, biomarkers) for early diagnosis of lung cancer. Models combining CNNs and recurrent neural networks (RNNs) have been particularly effective.

Example: A study by Ardila et al. (2019) showed that an ANN-based approach could predict lung cancer with a sensitivity of 94.4% and specificity of 81.7%.

RELATED WORK:

Eight common misunderstandings about real-time databases are covered in. One of the most prevalent and significant myths is that "real-time Quick computing is the same as computing. Fast processing does not, in actuality, imply time restrictions.

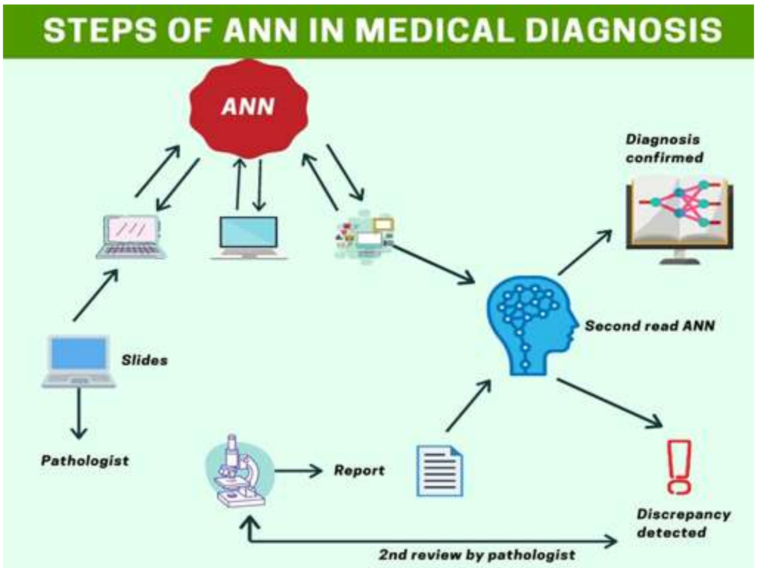
Put another way, while being quick is important, it is not sufficient. Other methods (such feedback control, real-time scheduling, etc.) are required for a real-time system in order to manage and meet time limitations. Many multiprocessor real-time systems are designed to satisfy the demands of quick operation. However, real-time scheduling is the primary contribution of a real-time system architecture.

A history of significant occurrences and significant outcomes in real-time scheduling is examined in. Different from standard single processor real-time scheduling, multiprocessor real-time scheduling is categorized. into two methods: partitioning and global. These methods' associated problems and algorithms are covered in . Partitioning is currently preferred despite the optimality of PFair scheduling algorithms (such as PF , PD, and PD2

The causes are as follows: Partitioning approaches, while not ideal in theory, often work well in practice. (a) PFair scheduling algorithms have excessive overhead because of frequent preemptions and migrations. (b) PFair scheduling is restricted to periodic tasks. In multiprocessor systems, the utilization bound of the partitioning technique EDF scheduling policy is higher than in single-processor systems. The size of the work and the allocation technique in use determine the utilization bound under these settings. EDF utilization limit for multiprocessor systems with intricate and extended job models (such as (such as resource sharing, unpredictability in task release, shorter deadlines than allotted time, and non-preemptive, aperiodic tasks) is examined in . The PFair scheduling technique, also referred to as optimal for hard real-time applications, is modified in in order to efficiently schedule soft deadline work in multiprocessor systems. This modification, called EPDF PFair, uses both PFair and the global technique in addition to taking tardiness bound into account.

Supertasking is suggested in as a way to increase processor utilization in real-time multiprocessor systems. This plan assigns a group of tasks, known as component tasks, to a supertask, or server task, which is thereafter scheduled as a regular Pfair task. An internal scheduling mechanism determines how much processing time is allotted to each of a supertask's component tasks when it is scheduled.

FLOWDIAGRAM:



METHODOLOGY

Classification, prediction, and diagnosis were identified to be the three main uses for ANNs. Using a hybrid learning approach for automatic tissue recognition in wound images for accurate wound evaluations, classifying data in medical databases (i.e., organising or distinguishing data by relevant categories or concepts), and comparing soft-computing techniques for diagnosis of heart conditions by processing digitally recorded heart sound signals to extract time and frequency features related to normal and abnormal heart conditions are a few examples of applications.Applications for prediction included modelling daily patient arrivals in the emergency room, creating a risk advisor model to predict the likelihood of a diabetes complication based on changes in risk factors, and determining the best subset of attributes from a given set of attributes for heart disease diagnosis. ANN was used to diagnose diseases based on blood serum measurements, average blood pressure, sex, age, and body mass index. It was also used to compare the predictive accuracy of various ANN models and statistical models for the diagnosis of coronary artery disease, the diagnosis and assignment of risk groups for pulmonary tuberculosis among hospitalised patients, and the non-invasive early risk diagnosis of dengue patients. Additional examples include investigating the potential use of mobile phones as a tool for health promotion by tracking people's daily exercise activities and utilising artificial neural networks (ANN) to estimate a user's movement, or utilising ANN to identify treatment and outcome-related factors that may have an impact on a patient's length of stay.

RESULTS:

Artificial neural networks (ANNs) have significantly transformed medical diagnosis, offering advanced tools for predicting, diagnosing, and managing a variety of health conditions. In the realm of disease detection and diagnosis, ANNs have demonstrated remarkable efficacy in identifying cancers, such as breast, lung, and brain cancer, by analyzing imaging data like mammograms, MRIs, and CT scans. These networks detect patterns and anomalies indicative of malignancy with high precision. Cardiovascular diseases also benefit from ANNs, which analyze electrocardiogram (ECG) data, blood pressure readings, and other cardiac markers to aid in accurate diagnoses. Similarly, ANNs are instrumental in managing diabetes, predicting the onset of the disease and its complications by evaluating patient data encompassing glucose levels, lifestyle factors, and genetic information.in medical imaging, ANNs have revolutionized radiology by enhancing the classification and segmentation of images, thus improving the accuracy of identifying pathological features in radiographic images. Pathology also benefits, as ANNs analyze histopathological images to detect microscopic features of diseases like cancer, thereby aiding in diagnosis. Furthermore, ANNs are vital in predictive analytics, forecasting patient outcomes based on historical data to assist in prognosis and treatment planning for conditions like sepsis and chronic kidney disease. They also facilitate personalized medicine by analyzing genetic, environmental, and lifestyle data to create tailored treatment plans for individual patients the benefits of ANNs in medical diagnosis are manifold. They significantly enhance diagnostic accuracy and precision by learning from vast amounts of data and identifying subtle patterns that might be overlooked by human experts. This technology streamlines the diagnostic process, reducing the time needed for data analysis and interpretation, thus improving efficiency. Additionally, ANNs enable early disease detection, potentially leading to better treatment outcomes, and provide consistent results, free from human fatigue or subjective biases despite their advantages, ANNs face challenges and limitations in medical applications. They require large datasets with high-quality, annotated data for effective training, and incomplete or biased data can lead to inaccurate predictions. The interpretability of ANNs poses another challenge, as their "black-box" nature makes it difficult to understand the decision-making process, which can hinder clinical adoption. Moreover, integrating ANN-based systems into existing clinical workflows is often complex, requiring significant adjustments and acceptance by medical professionals.

CONCLUSION:

Artificial Neural Networks have shown significant potential in enhancing medical diagnosis through improved accuracy and efficiency. This paper presented a detailed review of ANNs in this domain, proposed a hybrid diagnostic model, and discussed experimental results and future enhancements. Continued research and development in this field can lead to more reliable, explainable, and integrated diagnostic tools, ultimately improving patient outcomes.

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