A REVIEW ON ARTIFICIAL INTELLIGENCE IN CLASSIFICATION OF DISEASES

DR. M. YUVARAJU*	ASSISTANT PROFESSOR, DEPARTMENT OF EEE, ANNA UNIVERSITY REGIONAL CAMPUS, COIMBATORE, INDIA – 641046
V. NARENTHIRUVALAR	RESEARCH SCHOLAR, DEPARTMENT OF EEE, ANNA UNIVERSITY REGIONAL CAMPUS, COIMBATORE, INDIA – 641046
T. L. KAYATHRI	RESEARCH SCHOLAR, DEPARTMENT OF ECE, ANNA UNIVERSITY REGIONAL CAMPUS, COIMBATORE, INDIA – 641046

ABSTRACT:

Artificial intelligence can assist Medical field through a range of patient care and intelligent health systems. For the diagnosis of diseases, the development of new drugs, and the identification of patient vulnerabilities, artificial intelligence techniques ranging from machine learning to deep learning have become prevalent in healthcare. To precisely determine diseases using artificial intelligence algorithms, numerous medical data sources are required. As artificial intelligence (AI) technology progresses, it is currently being utilized to diagnose a wide range of medical conditions. This AI technology is powered by big data and has significant computation and learning power. This study examines the use of expert systems, neural networks, and deep learning in identifying diseases via AI technology. This article covers the comprehensive survey based on artificial intelligence techniques to diagnose numerous diseases such as Alzheimer, Parkinson, Heart Disease, Chronic Kidney disease, Chronic Lung disease, Eye disease, Covid-19 and so on.

KEYWORDS:

ARTIFICIAL INTELLIGENCE, DISEASE, ARTIFICIAL NEURAL NETWORK, DEEP LEARNING.

INTRODUCTION

Applications of artificial intelligence (AI) provide gains in terms of disease medical diagnosis. Medical specialists always come across fresh challenges with evolving responsibilities and frequent disruptions in the dynamic and changing healthcare system. Because of this variation, disease diagnosis frequently turns into a secondary concern for healthcare professionals.

The clinical assessment of medical data is another demanding cognitive job. Diagnostics is a highly complex process since the time that medical specialists have available to them is typically constrained, diseases might develop over time, and patient dynamics may alter. However, a thorough diagnostic approach is crucial for assuring prompt treatment and, as an outcome, achieving safe and efficient patient care. Since developing systems became more feasible, the value of AI as a component of the diagnostic process has been continually evolving. The enthusiasm and passion surrounding AI remains intact, and both researchers and practitioners are equally focused on this subject from many angles.

The term "artificial intelligence"(AI)has no standardized meaning, but it is generally understood to mean "the capacity of machine to perform cognitive functions that we associate with human minds, such as perceiving, reasoning, learning, interacting with the environment, problem-solving, decision making, and even demonstrating creativity. "AI, that encompasses a wide range of research fields like robotics and natural language processing, is typically associated with human-like behaviour. Machine learning is being utilized to create practical applications which are aimed at a single job, such as healthcare and disease diagnostics.

By constantly processing fresh and updated data, algorithms make predictions, continuously learn, and evolve over time. Algorithms gather information either through a variety of inputs and sources of knowledge or through years of experience. As a result, AI-enabled machines can process more knowledge than humans can, possibly outperforming humans for some medical activities. The use of AI to support medical professionals in the diagnosing process could be highly beneficial for the medical field and patients' overall health. Implementation of AI into the present technical infrastructure accelerates the detection of pertinent medical data from various sources that is suited to the patient's needs and the course of therapy. Simultaneously, when information from all relevant areas is taken into account, AI breaks down silo thinking, allowing knowledge to be shared across departmental boundaries. Furthermore, artificial intelligence delivers the same findings when using the same medical data and does not depend on situations, emotions, or time of day. It generates results based on a wider population rather than on subjective, personal experiences. Despite the promising potential of AI as a diagnostic tool, no full examination of techniques has been done to date, and there is still a lack of a complete conceptualization of the algorithms that have been used in the diagnosis of various diseases. The use of AI in healthcare, either broadly or in specific clinical domains, has been the subject of current investigations.

This article organizes our knowledge of AI algorithms that have been researched as elements of diagnostic tools for health care. When pondering unknown areas where the use of AI for healthcare services could be beneficial and further exploration may be required, researchers will find the overview of application domains useful.

Practitioners will be better able to comprehend how much AI improves the diagnosis process and how it benefits patients, medical professionals, and the whole treatment procedures. The usage of AI in diagnostics, including its current discussions, will be appreciated by society.

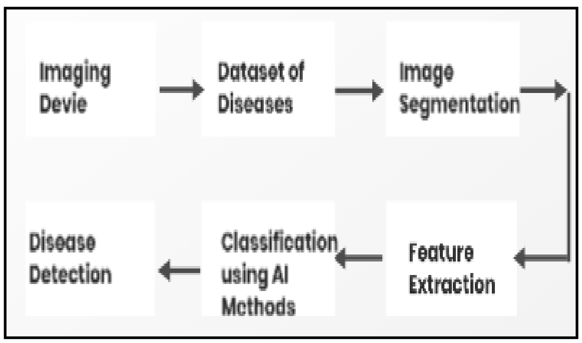

FIG. 1: BLOCK DIAGRAM OF AI IN HEALTHCARE

LITERATURE REVIEW

[1] Cardiac diseases are one of the primary causes of mortality globally, and heart disease can be reduced with early diagnosis. Aortic stenosis, mitral regurgitation, mitral stenosis, and prolapse of the mitral valve are the four main cardiac diseases that can be classified using AI methods. The heart sound (phonocardiogram) signal is captured via a specially built stethoscope, and it is processed before analysis. A low-cost single board processor has been blended with two deep learning-based neural networks, one-dimensional (1-D) convolutional neural network(CNN), and two-dimensional (2-D) convolutional neural network (CNN) models from the analysis of these signals to produce a standalone device. The suggested device contains an electronic stethoscope with a chest piece and a microphone, as well as a signal processor, a DSP processor, and a touch screen with a GUI interface. The GUI is divided down into four sections: report visualization, options, diagnostic procedure, and patient details.

The research will be capitalized after receiving the required approvals from the relevant authorities because the gadget shows possibility of enhancing the first screening process at Primary Health Care facilities.

[2] One of the most fatal neurological disorders impacting the senior population world-wide is Alzheimer's disease (AD). With the assistance of various methods, a group of Deep Learning (DL)models can learn remarkably complex patterns from MRI images to recognize AD. The DTE combines deep-learning with transfer-learning and ensemble-learning. The DTE's maximum classification accuracy for NC vs. AD and MCI vs. AD classification tasks for the massive ADNI baseline dataset was99.09% and 98.71%, respectively. The key outcomes from DTE-Wallowusto conclude that an ensemble of deep models that have been trained with random hyper-parameters results in better generalization than individual models.

[3] Alzheimer's disease is a degenerative condition that drags down the ageing process, leaving the brain ineffective of performing all of its routine tasks. By suggesting a binary version of the ABC method, the current study's primary goal was to classify brain volumetric data. The binary grey wolf algorithm scored best overall. For KNN, RF, and SVM, the values derived by the BABC were 0.64, 0.141, and 0.163, respectively. With the exception of BGWO, the other approaches are in competition, according to the convergence curves. In addition to these areas, the globus pallidus, which is in charge of unintentional muscular shaking, demands attention and stands out from previous studies.

[4] Eye disorders have been a serious problem around the world, especially in developing nations where resources for technology and funding are scarce.

The accuracy rate came out at 99.89%. The suggested classifier functions well according to numerical measures such as accuracy, recall, specificity, precision, and F1 score with values near to 1. ROC curves also support this. Convolutional Neural Networks are instruments for categorization and can aid ophthalmology science, in particular in relation to the prevalent issue of Glaucoma and Diabetic Retinopathy. The proposal presents almost perfect numerical metrics.

[5] The model outperforms traditional data classification techniques by offering much greater predictive abilities. The incidence of chronic kidney disease (CKD) is increasing quickly around the world. In order to diagnose CKD early and avoid the disease developing to a severe state, an approach using seven deep learning algorithms has been proposed in this work. The study used a scientific data-processing approach to find the missing values in the CKD dataset, that it explains as its enhancement to the body of knowledge. When comparing to other models, ANN, MLP, and Simple RNN performed best, accurately forecasting the disease 97% of the time.

[6] The most common cause of death worldwide is cardiovascular disease (heart disease), and early disease detection in particular can help save lives. Using a dataset of ECG images of cardiac patients, the proposed new light weight CNN architecture has improved the correctness rate of cardiovascular disease categorization to 98.23% compared with the current state-of-the-art methods. It can

also be run on a single CPU, overcoming the computational power limitation. Although having the smallest extracted feature size of any suggested CNN model, Table X demonstrates that it outperformed all others in terms of performance.

This proves that the key properties of the ECG images collection are what our suggested model is designed to learn. However, if optimization methods are employed to choose the values of its hyper-parameters, the proposed model could yield better outcomes.

[7] The Discrete Wavelet Transform (DWT) technique has been utilized to decompose the filtered signal into its frequency bands in order to extract features of EEG signals, where Alzheimer's disease is the most common neurological brain state that can be diagnosed using a variety of clinical methods. This work focused on the creation of an EEG signal analysis-based Alzheimer's disease diagnosis system. These studies compare multiple approaches and suggest the optimum combination approach for diagnosing Alzheimer's illnesses. Five categorization problems involving these groups have been researched: Control vs. mild AD group, Control vs. moderate AD group, mild vs. moderate AD group, Control vs. mild and moderate AD group, and Control vs. mild AD vs. moderate AD group. In the fifth problem, the suggested system used DWT C LBP C (QDA or ELM) combinations to achieve a mean classification accuracy reach of 98.1% and an AUROCC reach of 99.3%.

[8] Heart disease is one of the most complex diseases, and it affects an enormous percentage of individuals globally. The technique being proposed can also be swiftly put into use in the medical field to identify cardiac disease. A dataset on Cleveland heart disease is used to test the technology. Performance evaluation measures are also employed to evaluate the effectiveness of the identification system. When compared to MRMR FS algorithms and other classifiers, the processing times of the Logistic

Regression with Relief, LASSO, FCMIM, and LLBFS FS algorithms are the fastest. Our study's use of feature selection algorithms to choose the best features that improve classification accuracy and minimize the diagnosis system's processing time is a further unique aspect.

[9] The evaluation of falls in the elderly and specific diseases, such as Parkinson's disease, has made gait analysis incorporating kinetic data, such as pressure distribution underneath the foot, atopic of study. Tests cannot accurately identify diseases that impact the central nervous system. In this letter, we outline a detection algorithm that may classify people as having Parkinson's disease or being normal depending on how much load they carry while walking. The overall classification accuracy was95% under the linear discriminant analysis, and it is predicted that the quadratic one will be even more accurate. The radius of curvature is seen to be smaller in Parkinson patients than in healthy people. In future research, it would be helpful to distinguish between Parkinson's patients and healthy people from a geometric point of view.

[10] Parkinson's disease (PD) is a neurological disorder that mainly affects the patient's motor system and is irreversible. To bring an end to this degenerative process from beginning, early diagnosis and PD regression are essential. To deal with this issue, an efficient iterative optimization approach is put forth. Our method can identify a significant number of disease-related biomarkers, which is useful for PD-monitoring, by building the united embedding and sparse regression framework. In the meanwhile, we restrict the similarity matrix among subjects and use the p norm to execute sparse adaptive control to reveal the multi-modal data structure's fundamental information.

[11] In this study, the hyper parameters of the prediction model were optimized by using the most leading-edge hyper parameter standardization framework(OPTUNA). Coronary heart disease (CHD) is a serious condition that cannot be fully cured. The relevance of this work lies in the measurement of all predicted values utilizing the HY_ Opt GBM algorithm when using data from the Framingham Heart Institute's CHD study. Following the studies, the metrics for accuracy, F-core, AUROC, AUPRC, and MCC performed best when the parameters alpha and gamma were set to Noneand1, accordingly.

[12] One of the most serious medical conditions for which a correct diagnosis must be made as soon as possible. The use of machine-learning in medical care has improved. Seven classifier techniques, comprising artificial neural networks, C5.0, logistic-regression, chi-square automatic interaction sensors, linear support vector machines with penalties L1and L2, and random trees, have been used in this study. From the findings, it can be observed that the synthetic minority over-sampling strategy with full features uses LSVM with penalty L2 and achieves the highest accuracy of 98.86%. Both with and without SMOTE, LASSO regression's chosen features were effectively classified by all classifier methods. According to the findings, SMOTE is the best strategy for balancing a dataset.

[13] In the healthcare industry, where enormous amounts of data are generated, artificial intelligence (AI) has shown to be a priceless tool. In the last few years, specifically, we have seen an enormous rise of research using AI approaches in COPD research. However, the vast generation of large and complicated data in COPD necessitates a wider adoption of AI and more sophisticated methodologies.

Modern medical devices (spirometers, oscillometers, ventilation devices, sensors, wearables, etc.) and genomic information, which is becoming more widely available, compose a multiplex of data that begs for advanced AI algorithms in addition to the imaging modalities which frequently accompany COPD patients. In order to do this, the primary challenge is to integrate rich datasets with meticulous annotations inorder to create effective algorithms with the ability to generalize. These parameters must be met in order to create reliable models that will aid in providing COPD patients with better care.

[14] The most prominent neurodegenerative sickness globally is Alzheimer's disease. New techniques are required to offer an original perspective on the illness and its diagnosis, despite the fact that its basic mechanisms are starting to be identified. There are many automatic diagnostic technologies available, and the use of image biomarkers is crucial in contemporary medical practice. We now have new technologies that can automatically extract features from images without making assumptions about the underlying process thanks to the deep learning revolution. The deep convolutional auto- encoder (CAE) architecture that we introduced in this research is an instrument that can automatically non-linearly decompose a very sizable dataset (more than 2000 pictures). The data-driven features acquired using this technique have been strongly correlated (more than 0.63) with multiple clinical and neuro-psychological factors, including age and protein deposits. With an accuracy rate of roughly 84%, it has also been helpful in the differential diagnosis of Alzheimer's disease. The CAE system can therefore be used to help with the diagnosis of dementia and to shed fresh perspectives on the connections between structural damage and cognitive function as shown by these neuropsychological tests, opening the door to new collections of imaging biomarkers that are helpful in medical practice.

[15] The World Health Organization (WHO) announced the infectious diseaseCOVID-19 to be a pandemic in at the start of March 2020. In particular, the use of artificial intelligence tools to improve the early diagnosis, identification, and monitoring of COVID-19 infections from various data sources has showed significant promise. Second, deep learning techniques were looked into, which resulted in the suggestion of an ANN architecture created especially for this task. Third, various feature selection strategies have been investigated in order to decrease the dimensionality of the benchmark under consideration and enable the establishment of more effective prediction models. A thorough examination from several angles could help with this. Recently, high-dimensional environments have seen the investigation of ensemble selection approaches with favourable results.

RESULTS AND DISCUSSION

TABLE: IDENTIFICATION OF VARIOUS DISEASE WITH THE HELP OF AI TECHNIQUES

Author &Year	Methodology	Limitations	Remarks
Francisco J. Martinez Murcia (Jan 2020)	Alzheimer's disease classification, Deep-learning, Convolutional auto-encoder, Manifold learning, Data-fusion.	The most prevalent neuro degenerative disease in the world is Alzheimer's disease. New techniques are required to offer a fresh viewpoint on the illness and its diagnosis, despite the fact that its basic mechanisms are starting to be recognized.	A new understanding of the relationships between structural damage and cognitive capacity, as determined by the neuro psychological tests, can be gained by using the proposed CAE system to help with dementia diagnosis. This will open the door for the development to new imaging bio-markers that will be helpful in clinical practice.
Jian Ping Li (June 2020)	Heart disease classification, Features selection, Disease diagnosis, Intelligent system, Medical data-analytics.	In addition, irrelevant features slow down the diagnosis system's performance and increase computation times. As a result, the study's use of feature selection algorithms to choose the right features to boost the accuracy of classification as well as speed up the diagnosing system's processing is another novel aspect.	The proposed method (FCMIM-SVM) performance in term of accuracy compared with existing methods in the literature for heart disease diagnosis. The proposed method achieved accuracy of 92.37% as compared to the previous method.

Rami Alkhatib (June 2020)	Linear and quadratic discriminant analysis, Load distribution, Unbalanced gait, Vertical ground reaction forces (VGRFs).	A more featured result will be obtained in case of non-linear decision boundary. The overall classification is beyond 95%. This method of analysis forms a good approach before handling directly the signals. The results obtained are better and easily achieved rather than using cutting-edge algorithms like BFT, BPANN, *k*-NN, SVM with Ln kernel, SVM with Poly kernel, and SVM with Rbf kernel that yield a classification rate of 66.43, 89.97, 87.00, 88.47, 86.80, and 87.53%, respectively.	Another classifier is used to organize the remaining balanced gaits, which contain both normal and PD individuals, using a correlation as a straight forward feature. Under the linear discriminant analysis, overall classification accuracy was found to be 95%; the quadratic one is anticipated to improve upon this. The radius of curvature is seen to be smaller in Parkinson patients than in healthy people. In a future study, it would be helpful to distinguish between Parkinson's patients and healthy people From geometric point of view.
Pankaj Chittora (Feb 2021)	Artificial Neural Network, Filter Method, Wrapper Method.	Logistic and KNN weren't used in SMOTE since they failed to deliver the desired results. According to the findings, SMOTE is the best strategy for balancing a dataset. It should be noted that the LASSO regression model functioned better with SMOTE than it did without SMOTE when particular features were included.	For every classifier, the results were computed based on full features, selected features by CFS, selected features by Wrapper, selected features by LASSO regression, SMOTE with selected features by LASSO, SMOTE with full features. It was noted that LSVM achieved the maximum accuracy of 98.86% in SMOTE with full features.
Konstantinos P.Exarchos (May 2021)	Artificial intelligence, Machine-learning, Data mining, Chronic obstructive pulmonary disease, Chronic bronchitis, Emphysema	The primary difficulty is combining rich information with meticulous annotation in order to create efficient algorithms. With the capacity for generalization.	After being widely embraced in other areas of healthcare, AI is quickly encroaching on the field of respiratory research. A multiplex of data, including genomic information that is becoming accessible and the imaging modalities that frequently accompany COPD patients, requires the use of advanced AI algorithms.
Omar Bernabé (July 2021)	Artificial intelligence, Convolutional neural-networks, Machine-learning, Supervised-learning.	Eye illnesses have been a major issue everywhere, but notably in developing nations where resources for technology and funding are scarce. It is clear that each plan categorizes the same illness.	This proposal's contributions included enhancing the image by adding an additional channel to the RGB matrix, two illnesses' classifications, and a high rate of model correctness. The two most important eye illnesses are also categorized in this work.
Shamima Akter (Nov 2021)	Artificial neural-network, Chronic kidney disease, Classification, Deep- learning.	The results could be unreliable because of the tiny dataset. Finding a dataset with more attributes and higher instances is challenging. It is even more challenging to Collect data Dynamically from the IoMT platform.	This study evaluated the performance of seven DL algorithms for CKD prediction. When compared to other models, ANN, MLP, and Simple RNN Performed best, Accurately predicting the disease 97% of the time.

M. Tanveer (April 2022)	Deep-learning, Transfer learning, Ensemble learning, Alzheimer's disease.	The requirement of manually created features, which may result in sub-par performance, is a disadvantage of traditional machine-learning techniques.	Compared to a single deep model, an ensemble of deep models trained using random hyper-Paramet ers exhibits higher generalization. This is because each model in the ensemble finds a unique local optimum in the non-convex loss surface. Cross-validation can help to avoid models with poor local optima.
Mümine Kaya Keleş (August 2022)	Alzheimer's disease, Artificial bee-colony, Data mining, Feature selection, Machine-learning, Magnetic resonance imaging, Swarm intelligence.	The small sample size was this study's major drawback. Despite the relatively small sample size, this study provides insightful information about how AD is determined.	The primary objective of this work was to categorize brain volumetric data using a binary version of the ABC method. This study's second objective was to look into potential AD-related brain areas.
Khalil Alsharabi (August 2022)	Artificial neural-network, Discrete wavelet transform, Electroencephalogram, Extreme machine- learning, K-nearest neighbour, Linear discrimination analysis, Logarithmic band-power, Naïve Bayes, Quadratic discriminant analysis, Random forests, Support vector machines.	No study has decomposed the EEG signals using a suitable mix of techniques, Identify the features, then categorize them to create the ideal clinical diagnosis method for Alzheimer's disease.	The EEG datasets that were recorded for this study were band-pass filtered. The DWT method has then been researched to decompose the DWT technique has been paired with a filtered signal to its frequency ranges and a number of signal features in order to enhance the performance of the diagnosis. The classification of EEG features to the irrespective classes has then been examined using nine machine-learning algorithms.
Zhongwei Huang (August 2022)	Classification, Clinical score prediction, Embedding learning, Longitudinal multi-modal data, Sparse regression	In the data pre-processing, MRI images are registered to a standard template for tissue segmentation, which may remove	For the integrated classification and Clinical score prediction of Parkinson's disease (PD), we offer a unique Adaptive unsupervised feature selection Strategy through embedding -learning employing longitudinal multi-modal data. It is demonstrated that the suggested method Out performs other cutting-edge techniques.
		Some pathological changes of PD. We can use deep-learning techniques to segment neuro-imaging data to eliminate this effect.	
Andrea Loddo (Nov 2022)	Artificial intelligence, Machine learning, Deep learning, Feature selection.	Although many diagnostic jobs have seen impressive performance from artificial intelligence techniques, it is crucial to remember that medical applications call for a higher standard of accountability and transparency than other applications.	In order to detect COVID-19 from blood test data, this proposed work aimed to contribute to the domains of machine learning and deep-learning.

Rakesh Chandra Joshi (Dec 2022)	AI Cardio-care, Deep Neural-Networks, 1D CNN, 2D CNN, Phono-cardiogram	Diagnostic techniques based on clinical criteria and IoT-based systems with various body sensors are not practical for screening on a one-to-one basis in actual circumstances.	The suggested technique has also enhanced recognition robustness, especially in noisy environments, with signal augmentation methods to handle various real-world conditions. The proposed CNN design reduces computational complexity while optimizing the multi-disease classification problem to do real-time operations.
Huazhong Yang (March 2023)	Hyper-Parameter optimization, Light gbm, Loss Function, Machine-Learning, Optuna.	By constructing prediction models over multiple experiments, more precise results can be obtained. Future studies will also incorporate the technique suggested in this study. It will be required to modify the default values given in this work in order to achieve a successful outcome as the number of trials and datasets grows. As an alternative to utilize a single model to predict CHD, one may think about integrating various models to create a prediction model.	The random forest classifier generated accuracy, sensitivity, and specificity values of 0.78, 0.75, and 0.80, respectively. The proposed method's supremacy in predicting CHD in comparison to other methods was shown by pre-processing the data set using the synthetic minority oversampling technique (SMOTE), optimizing the algorithm's hyper -parameters, and improving its loss-function.
Mohammed B. Abu baker (April 2023)	Cardiovascular, Deep-learning, Electrocardiogram (ECG) images, Feature extraction, Machine learning, Transfer learning.	Due to the higher quantity of the retrieved features, Squeeze Net-based methods' training and testing periods were longer.	With the suggested CNN model, professionals in the medical area can detect heart problems from ECG images without having to use the manual procedure, Which produces unreliable and time-consuming findings.

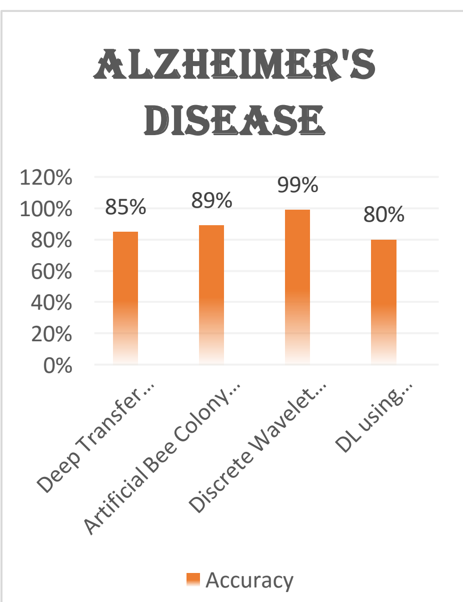

FIG.2: ALZHEIMER'S DISEASE ACCURACY COMPARISON

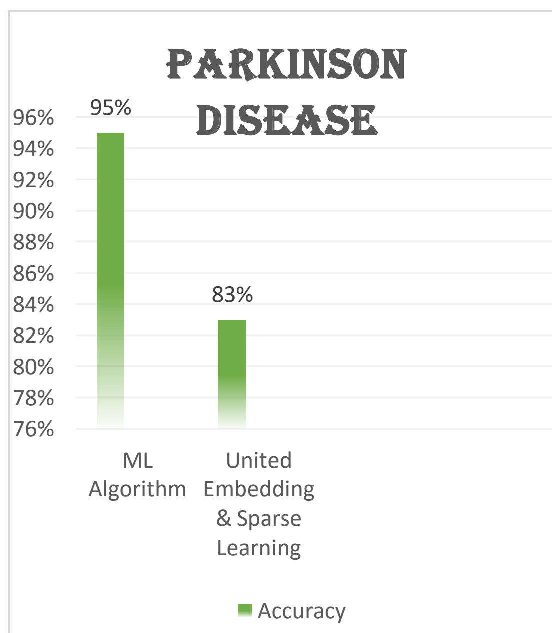

FIG.3: PARKINSON DISEASE ACCURACY COMPARISON

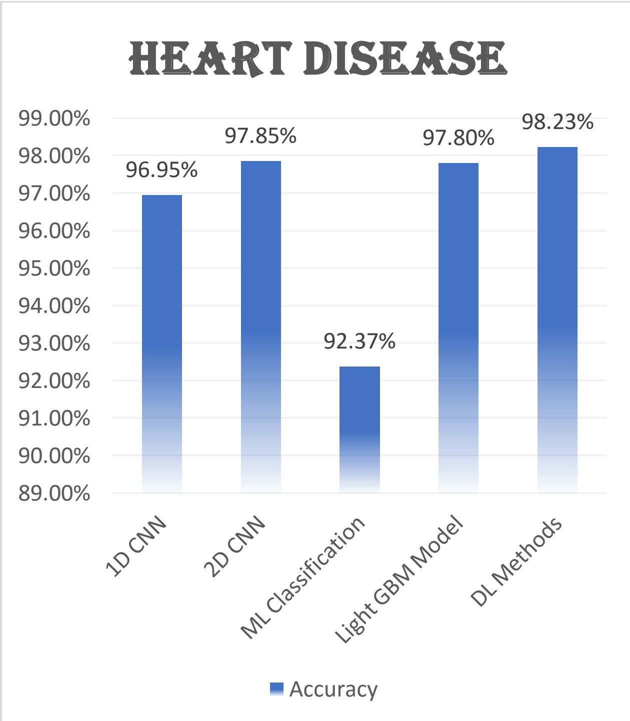

FIG. 4: HEART DISEASE ACCURACY COMPARISON

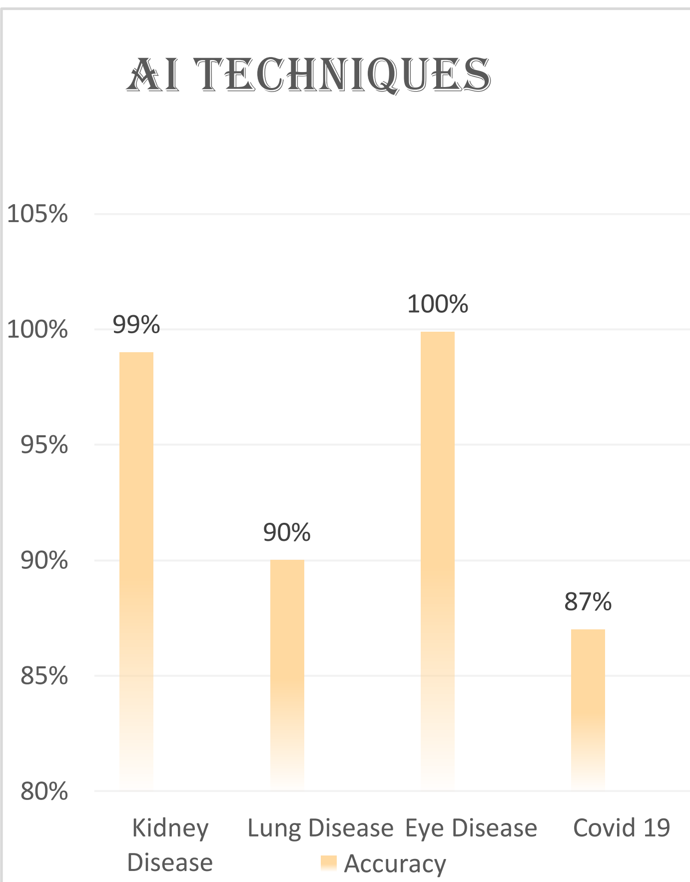

FIG.5: OTHER DISEASE ACCURACY COMPARISON

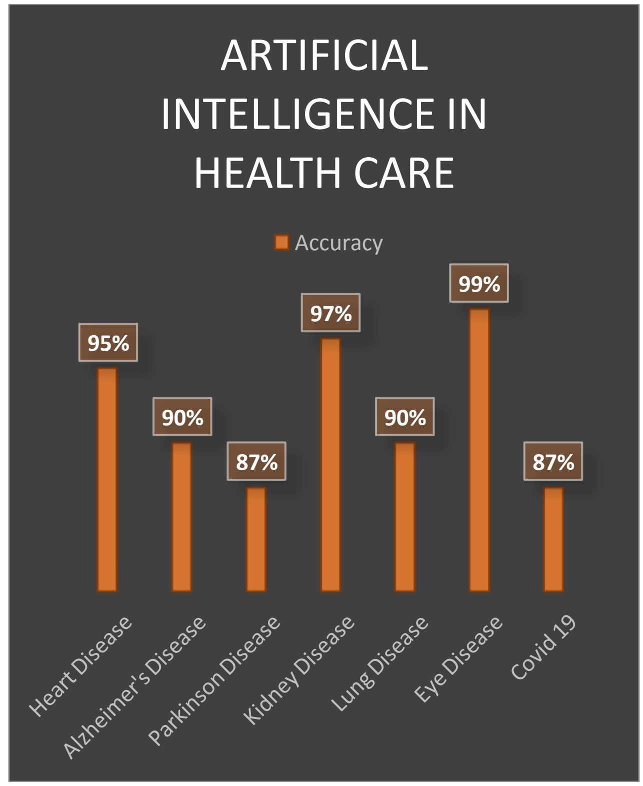

FIG. 6: OVERALL ACCURACY COMPARISON

CONCLUSION

In this article, the use of AI in diagnostics is shown through recent academic studies. Thus, we aim to direct researchers' endeavours to promote upcoming research in the area of AI as part of medical diagnostics. There are about 15 research papers taken for the study and analysis of the methods used with their accuracy. All the parameters mentioned above have been tabulated and plotted via graphs for a clean understanding of readers. For the future application of AI for disease diagnosis, it is also helpful to illustrate the intensity of studies, highly linked areas, and an overview of untapped research. Practitioners are aware of how much AI enhances the diagnosis process and how it benefits the entire healthcare system on a practical level.

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