A review of various algorithms applied on the Alzheimer's disease prediction

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Abstract

Alzheimer's is a type of brain disease that affects the brain. These types of diseases are more common in elderly people nowadays. People with this disease have reduced memory and very weak memory. Also, their brain is not functioning properly. Due to this their daily practice is gradually starting to deteriorate. Alzheimer's is a type of dementia that cannot be completely cured. In this paper various prediction techniques for this disease using graph neural networks denoted as GNN and Support Vector Machine (SVM) are reviewed.

Key words: Alzheimer, dementia, Disease prediction, Graph Neural Network, Support Vector Machine..

INTRODUCTION

Alzheimer's is a disorder of the nervous system that weakens the brain. Due to this, the memory power of the affected persons is reduced and they are not able to remember anything. The disease is most common in old age. Individuals with this disease have great difficulty in identifying objects and faces.

Most often, people over the age of eighty-five suffer from Alzheimer's disease. Alzheimer's disease can also be caused by a head injury. Furthermore, Alzheimer's disease causes sleep disorders. The disease is also genetic. Inability to keep track of time and loss of items due to forgetfulness bad guesses, inability to complete daily tasks on time, difficulty in speaking are some of the symptoms.

The moderate symptoms are as follows.. The first one is uncontrolled anger for no reason. The second one is difficulty identifying friends and family members. Similarly, there will be difficulty in reading and writing and inability to learn any new tasks.

Sometimes there will be behavioral changes such as crying, anxiety, wandering, restlessness. Some severe symptoms are Weight loss, Seizures, skin infections, difficulty swallowing, and finally difficulty in passing urine.

There is no cure for Alzheimer's disease. However, doctors prescribe some medication so that the affected person can get some relief. There is no cure for Alzheimer's disease. Therefore, to control this disease one must first control its risk factors, which are Diabetics, high blood pressure, and high fat.

Normally a graph has two elements like vertices and edges denoted as V for vertices and as E for edges. This notation is normally denoted as a graph in computer science.G=(V,E) and these are directed graphs when they are directed to some directions and undirected graphs when they are not denoted any directions. Similarly, they are termed as a weighted and unweighted graphs when they hold numbers as weight like a kilometer or any notations.

Whereas in Graph Neural network, the network process directly operates on the graph structure. By using this graph neural network, we can do the classification process. Here, every node is labeled so that we can predict the label of the node without knowing the basic element.

Graphs are practically available around us as real-world objects. For example, social media is also a graph with users and clients as nodes. These social media and users are connected with each other as a graph naturally. Many researchers have concentrated on this and developed the neural network which was developed to work on the data available on the graph for many years (Scarselli *et al.* 2009). Nowadays this

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work concentrates on web mediafake news promotion detection (Monti *et al*. 2019), medical fields like antibacterial detection (Stokes *et al*. 2020), controlling the traffic (Zho *et al*. 2021) using prediction, and others.

Review of Algorithms in Alzheimer Disease Prediction

Various methods applied to predict the Alzheimer's disease are given below. Morshedul Bari Antor (2021) and his team applied various machine learning methods on the Alzheimer-affected patient dataset. The team used the dataset available on the Open Access Series of Imaging Studies (OASIS). The dataset available on this domain is very small but reliable to use for analysis. These use many machine learning methods and SVM Support Vector Machine is one among them. The flow chart of the SVM model is given in figure 1.

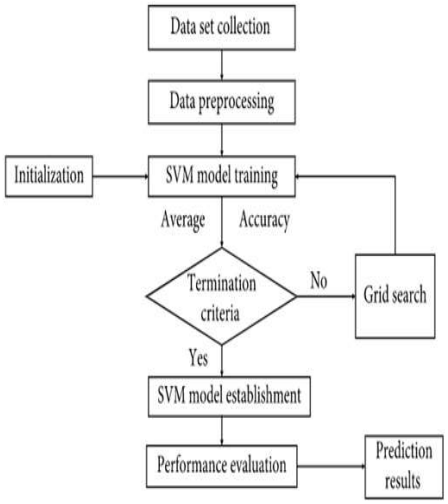

Fig. 1. Flow chart of SVM

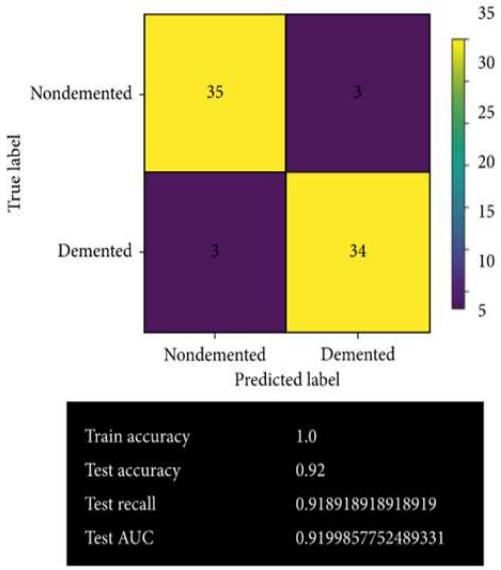

Fig. 2. SVM prediction Label

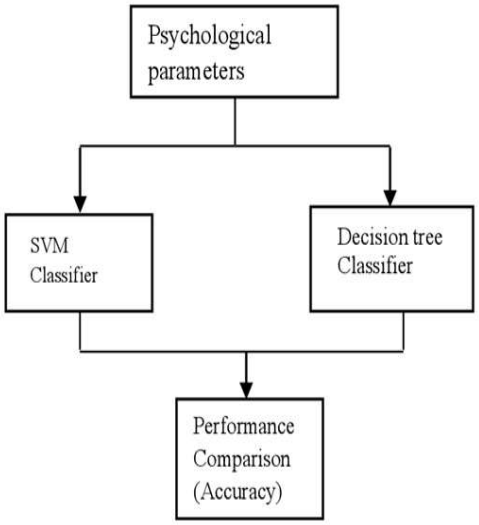

Fig. 3. Data flow diagram

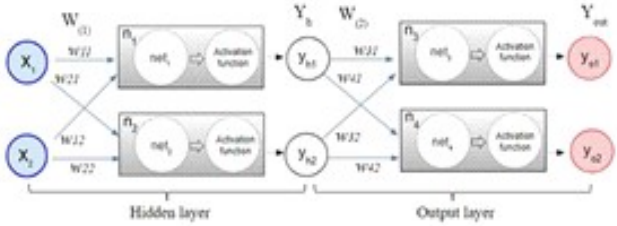

Fig. 4. The multilayer perception procedure.

Support Vector Model SVM performance a correct prediction of 56 as numbers without fine-tuning the dataset and 19 numbers as the wrong prediction with 85% training accuracy and 75% testing accuracy. Similarly, with fine-tuning, it gave 69 numbers of correct prediction and 6 numbers of the wrong prediction with 92% accuracy as shown in figure 2.

Neelaveni and Devasana (2020) used machine learning to predict early to avoid the seriousness of the diseases. For this, they used the parameter like the patient age, how many times the patient visited for counselling and the patient education level and many.

Figure 3 in the above flow was created by Neelaveni and Devasana (2020) team to predict the diseases in the early stages.

Suhaira *et al*. (2021) proposed a methodology to predict the disease with high accuracy. The methodology was a classifier algorithm. They use many classifier algorithms and compare them to increase the performance result. Their samples contained the age group above 60 to 96 as longitudinal samples around 150.

Jo *et al*. (2019) and his team proposed deep learning to show the best performance among traditional machine learning. They produce an automated classification of

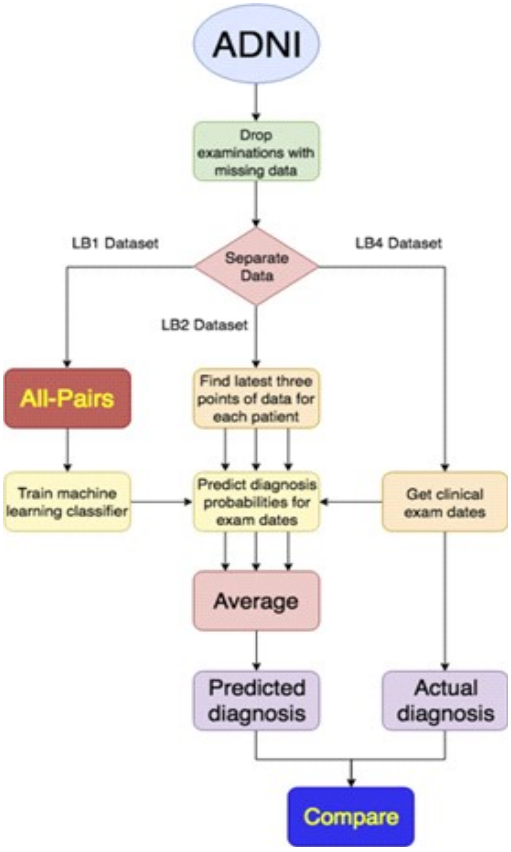

Fig.5. Flowchart showing methodology for training and evaluating machine learning models.

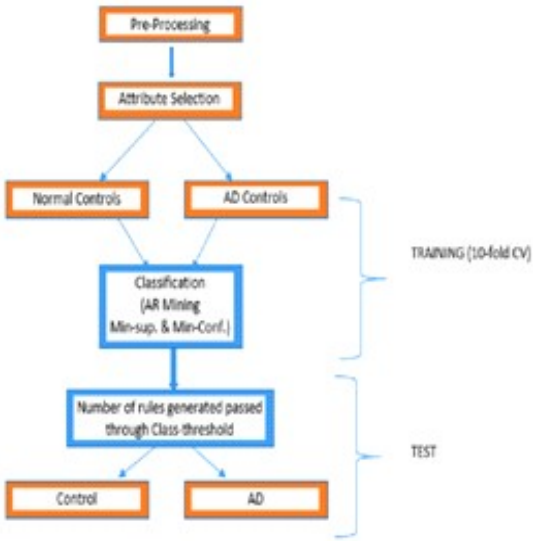

Fig. 6. A proposed model for early detection of Alzheimer's disease.

these diseases which gained the attention of every researcher toward these diseases. These methods are gained from the neuroimaging data while applying the deep learning methods.

Figure 4 shows the process of the neural network made by multilayer perceptron.

Albright Jack (2019) proposed some machine learning methodologies in the dataset. Figure 5 shows how the dataset is trained using machine learning. Machine learning is SVM support vector machine, regression algorithm, neural networks and many using the python language libraries like Scikit-learn and Keras.

Chaves et al. (2011) proposed characterizing the perfusion patterns on the images. So the images are used to produce pieces of knowledge by experts in the medical field. The dataset from ADNI was around 97, where 41 are labeled as healthy contents and the remaining 56 have come under patients affected by Alzheimer's disease. From this, they compared some algorithms like support vector machines with good accuracy of more than 90%.

Klöppel *et al,* (2008) proposed a method that detects Alzheimer's disease using the Magnetic resonance imaging MRI structural at the early stages of the disease. Here he used the techniques support vector machine on the MRI image to detect the reliable results. They collected the images as datasets from different centres and analysed them. The results show 97% best results by using the brain images as datasets. The dataset used is very small when compared with other works.

Khan and Usman (2015) proposed machine learning methods to detect the early stages of Alzheimer's disease as shown in figure 6.

Liu *et al*. (2012) proposed a classification method *viz*..ensemble sparse method on Alzheimer's disease. They struggled to detect with a good result due to the number of samples they got being very small and with a lot of noise. They used the support vector machine algorithm and decision tree algorithm for their work.

Zhang *et al*. (2011) proposed a method with more biomarkers rather than a single biomarker on the patient dataset. Here they took the biomarkers like PET (positron emission tomography), MRI, and CSF (Cerebrospinal fluid) scans of the Alzheimer's disease patient for their analyses.The result produced by the combination of CSF and PET was better when compared with the combination of MRI and PET when using classification.

Similarly, Westman *et al*. (2012) studied the MRI and CSF combination dataset with nearly 369 data of patients for their classification. Out of this 369, 96 are Alzheimer's disease affected and the remaining 273 are healthy people.

CONCLUSION

Even though the above discussed methodologies are producing some good results, methods to predict at early stages should be attempted.

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