

An Early Prediction and Detection of Alzheimer's Disease

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ABSTRACT

One of the main worries recently has been Alzheimer's illness. This illness affects over 45 million people worldwide. Alzheimer's is a degenerative brain illness that primarily affects older people and has an unknown cause and pathogenesis. Dementia, which gradually kills brain cells, is the primary cause of Alzheimer's disease. This illness caused people to lose their capacity for thought, reading, and many other things. By foreseeing the disease, a machine learning system can mitigate this issue. The major goal is to identify dementia in a variety of people. The findings and analysis from multiple machine learning models used to identify dementia are presented in this research. The system was created using the Open Access Series of Imaging Studies (OASIS) dataset. Despite being modest, the dataset is small. Several machine learning models have used and studied. Prediction techniques include support vector machines, logistic regression, decision trees, and random forests. The system has been used both with and without fine-tuning. When the results are compared, it is discovered that the support vector machine produces the best outcomes of all the models. Among many patients, it is the most accurate at spotting dementia. Among them, dementia. Even though there are many machine learning systems, their results are often inconsistent and wrong. They also struggle with concerns of overfitting and underfitting. So, using machine learning to assist medical technicians, we have developed a model that can detect Alzheimer's disease early. It will confirm and demonstrate whether or not someone has Alzheimer's disease.

Keyword - Alzheimer's Disease, Machine Learning, Support vector machine, Decision Tree, Logistic regression, and Random forest

1. INTRODUCTION

Nowadays, machine learning models are primarily employed in medical diagnostics. In order to identify Alzheimer's syndrome, this research examines several machine learning performances. Alzheimer's syndrome is an inherited, irreversible brain disorder that gradually impairs cognitive function, memory, and reasoning abilities. In Alzheimer's disease, a significant fraction of neurons stop functioning and lose their synaptic connections. People in their 30s to mid-60s are rarely diagnosed with Alzheimer's disease. Alzheimer's disease symptoms might include changes in sleep patterns, depression, anxiety, trouble with fundamental tasks like reading or writing, as well as aggressive actions and poor decision-making. It gradually impairs thinking skills and causes memory loss. Dementia is the

main contributing factor to this illness. According to a survey, there are currently between 40 and 50 million dementia sufferers globally, and by the year 2050, that figure is expected to reach about 131.5 million.

Dementia is the breakdown of brain function, comprehension, recognising, reasoning, and behavioural skills to the point where a person experiences difficulties with day-to-day activities and behaviours. There are few dementia patients who are unable to manage their emotions, and personalities can alter. Dementia ranges in intensity, starting with the mildest stage. Older adults are primarily affected. Other than treatment, there is no cure. By foreseeing the disease, a machine learning system can mitigate this issue. The study of computer programmes that use algorithms and statistical models to learn through inference and patterns without being explicitly programmed is known as machine learning (ML). Algorithms for machine learning naturally get better with use. It identifies methods, develops models, and employs the process it has learned to produce the desired result.

In order to automatically determine the output, it finds techniques, trains models, and applies the learnt strategy. Systems that use machine learning can also change with the environment. A machine learning system that has been trained to recognise particular kinds of patterns using a machine learning algorithm is called a model. In other words, it analyses the data and unearths any hidden structures inside a dataset. The formula that uses the input and output functions and applies it to fresh data to anticipate the response is determined by the feature extraction and the known responses of a dataset.

2. RELATED WORKS

Dementia is the failure of brain function, understanding, recognizing, thinking, and behavioral skills to such a level that an individual faces problems in everyday life and behaviors [1]. Few people with Dementia are unable to deal with their emotions, and their personalities can be changed [2]. From the mildest stage, Dementia varies in severity [30]. It mainly affects older people. No cure is available other than treatment [3].

There is little data available on Alzheimer's patients in Bangladesh. According to the WHO data published in 2017, Alzheimer's or Dementia deaths in Bangladesh reached 9,917 or 1.26% of the total deaths, which was the last data found in this aspect that ranks Bangladesh number 152 globally [3]. In Bangladesh, the awareness about Alzheimer's is now in the primary stage. Therefore, impacted patients and families are regularly experiencing various issues [4]. The fund for researching Alzheimer's is limited. A lower-middle-income country like Bangladesh is not yet prepared for the management of Alzheimer's [34]. Besides that, almost one-fifth of the Bangladeshi adult population is overweight, according to a global study [35], which is the leading risk factor for Alzheimer's. Therefore, there are more chances of occurrences of Alzheimer's [36]. To give a treatment for this disease, physicians tend to test individuals for Alzheimer's disease by obtaining a medical and family history and psychiatric history from the point of view of specialists such as neurologists, neuropsychologists, geriatricians, and geriatric psychiatrists [37].

Studies show that the situation may improve if people can detect Alzheimer's disease early by taking therapy at the initial stage [38]. For this, they have to predict the progress of the disease accurately from mild condition to Dementia. Machine learning technology can help to predict accurately early Alzheimer's disease. There are many machine learning systems, but they give inconsistent and inaccurate predictions. They also have overfitting and underfitting issues. Therefore, a model has been developed by us which can indicate Alzheimer's disease early, using machine learning to support medical technicians. It will verify and show if anyone has Alzheimer's disease or not.

3. PROPOSED SYSTEM

While logistic regression can only be used with linear problems, SVM can be applied to nonlinear ones. SVM performs outliers more effectively because it calculates the greatest margin. Compared to logistic regression, decision trees are more adept at handling collinearity. Decision trees perform better than logistic regression for categorical data. A random forest is a collection of randomly produced decision trees, where the predicted result is determined by the forest's majority vote. Random forest outperforms decision trees in terms of accuracy and

reliability. While decision trees use hyperrectangles in the input space to solve the problem, SVM uses kernel approaches to address nonlinear problems. SVM outperforms random forest in classification problems.

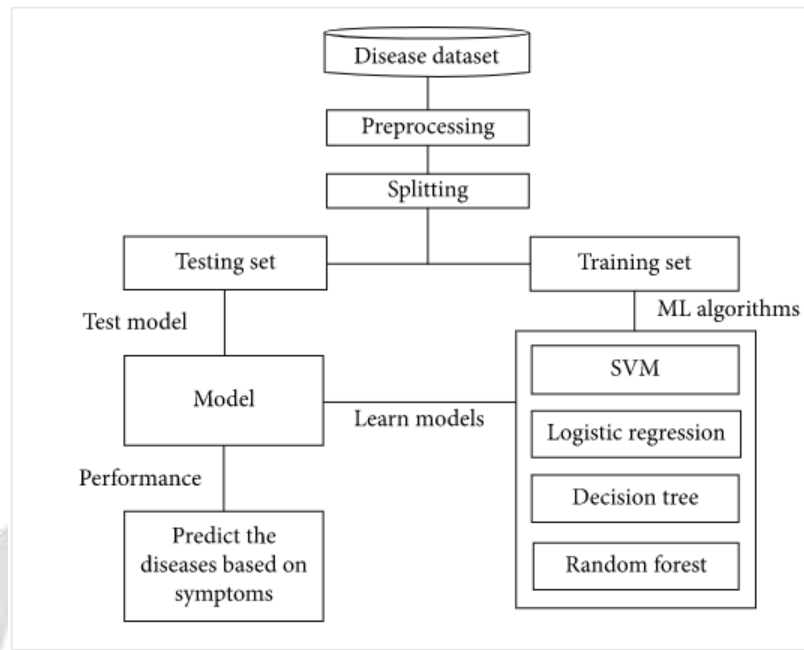


Fig 1 Block diagram of machine learning

3.1 DATASET

The OASIS dataset has been used in the system, which contains all the attributes and values. First, the dataset has been analyzed by us for any categorical values, and there are several categorical values present in the dataset. Among them, gender and group attribute columns are converted into numeric values 0 and 1. The correlation between attributes has been checked by us using the “correlation matrix” function based on group attributes and plotted to understand them better. Gender, SES, and ASF showed a closer correlation with the group attribute. Next, the features have been assigned to make the prediction, and the target value has been set so that the model can predict. Then, the dataset was split for training-validation and testing. Random sampling has been used for the split, but this creates an imbalance between training and testing split. So, stratified sampling has been applied with a training-validation size of 80% and a testing size of 20%.

Table 1. Detail of dataset attributes.

Number	Attribute name	Attribute description
1	Subject ID ^a	Patient's identification number
2	MRI ^b ID	Patient's imaging identification number
3	Group	Demented, nondemented, or converted
4	Visit	Number of visits of each patient
5	MR ^c Delay	Magnetic resonance delay is the delay time given b
6	M/F ^d	Patient's gender
7	Hand	Right-handed or left-handed
8	Age	Patient's age at the scanning
9	EDUC ^e	Educational level of the patient
10	SES ^f	Socioeconomic status of the patient
11	MMSE ^g	Mini-Mental State Examination score
12	CDR ^h	Clinical Dementia Rate score
13	eTIV ⁱ	estimated total intracranial volume result
14	nWBV ^j	normalized whole brain volume result
15	ASF ^k	Atlas Scaling Factor

Fig -2Dataset Used

4. CONCLUSIONS

The application of machine learning models in medical diagnosis is now pervasive. In order to identify Alzheimer's syndrome, this research examines several machine learning performances. Alzheimer's syndrome is an inherited, irreversible brain disorder that gradually impairs cognitive function, memory, and reasoning. In Alzheimer's disease, a significant fraction of neurons stop functioning and lose their synaptic connections. People in their 30s to mid-60s rarely develop Alzheimer's disease. Alzheimer's disease symptoms might include changes in sleep patterns, depression, anxiety, difficulty with fundamental tasks like reading or writing, as well as aggressive behavior and poor decision-making. Machine learning algorithms are very better than other wearable systems because they have less expense and time consuming than others.

5. REFERENCES

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