An Early Prediction and Detection of Alzheimer's Disease: A Comparative study using Machine Learning Algorithms- Literature survey

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ABSTRACT

Alzheimer's disease has recently been a major concern. Over 45 million people worldwide are afflicted by this condition. Alzheimer's is a degenerative brain disease with an unknown cause and path physiology that primarily affects older adults. Alzheimer's disease is mostly brought on by dementia, which gradually destroys brain cells. People lost their ability to read, think, and do many other things as a result of this sickness. A machine learning system can solve this problem by anticipating the sickness. Finding dementia in a range of persons is the main objective. This study presents the results and analysis from various machine learning models used to detect dementia. The Open Access Series of Imaging Studies (OASIS) dataset was used to construct the system The da taset is small while being tiny. Many machine learning models have been used and investigated. Support vector machines, logistic regression, decision trees, and random forests are examples of prediction approaches. Both with and without fine-tuning, the system has been used. The support vector machine is shown to generate the best results of all the models when the results are compared. It is the most effective in identifying dementia among a large number of people. dementia is one of them. Although there are many machine learning systems, their conclusions are frequently erroneous and inconsistent. Additionally, they battle with worries about both overfitting and underfitting. Therefore, we have created a model that may identify Alzheimer's disease early using machine learning to aid medical technicians. If someone has Alzheimer's disease, it will prove it and confirm it.

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

1. INTRODUCTON

Nowadays, the main application of machine learning models is in diagnostics. This study looks at a number of machine learning performances to identify Alzheimer's syndrome. Alzheimer's syndrome is an inherited, irreversible

brain condition that progressively weakens logic, memory, and cognitive function. A sizeable portion of neurons in Alzheimer's disease stop working and lose their synaptic connections. Alzheimer's disease is infrequently detected in people between the ages of 30 and 60. Changes in sleep patterns, melancholy, anxiety, difficulties with basic skills like reading or writing, as well as aggressive behaviour and poor decision-making, are possible indicators of Alzheimer's disease. It gradually erodes mental capacity and results in memory loss. The primary cause of this condition is dementia. There are currently between 40 and 50 million people worldwide who have dementia, and by the year 2050, that number is projected to rise to almost 131.5 million, according to a poll.

When a person's brain function, comprehension, recognition, reasoning, and behavioural skills have been compromised to the point where they are unable to carry out routine tasks and behaviours, this condition is known as dementia. Patients with dementia rarely lose the ability to control their emotions, and personalities might change. Starting with the mildest stage, dementia ranges in intensity. The majority of affected persons are older. There is no known cure other than medication. A machine learning system can solve this problem by anticipating the sickness.. Machine learning is the study of computer programmes that learn through inference and patterns without being explicitly programmed by using statistical models and algorithms (ML). Machine learning algorithms improve over time naturally. To achieve the intended outcome, it selects strategies, creates models, and applies the procedure it has learned.

It develops techniques, trains models, and employs the learned approach to automatically identify the output. Machine learning-based systems can also adapt to their surroundings. A model is a machine learning systemthat has been taught to recognise specific patterns using a machine learning algorithm. In other words, it examines the data and reveals any structures that may be concealed inside a dataset. The feature extraction and the known responses of a dataset determine the formula that applies the input and output functions to new data to predict the response.

2. LITERATURE REVIEW

This section of the paper discusses about the studies related to Alzheimer’s disease using different assistive technologies.

Kanno, K. M. states in the paper about the augmented reality in [1] as, Alzheimer's disease (AD) has gained increasing attention from the medical community. It is the most typical cause of dementia in older persons, according to studies. Additionally, a sizable portion of patients and their caregivers continue to suffer significant difficulties in receiving care and carrying out daily duties. Recurrent symptoms include forgetfulness and spatial awareness. However, smartphones have spread into more aspects of their daily lives. In order to assist those who have been diagnosed with early-stage Alzheimer's disease in recognising items and people, this study proposes a mobile application. Additionally, it can track a person with AD's location because they regularly get confused and disoriented. The programme described here provides an accessible user interface based on Augmented Reality technology that employs spoken commands for several functions, including people recognition from photographs, time reminders for taking medications, and identification of which medications to take. Additionally, studies demonstrated a promising voice recognition interface and the viability of identifying people using the caregiver's mobile app.

This study's objective was to present an overview of hospital care strategies for dementia patients. We have out a systematic review that took interventional study designs into account. Along with five computerised databases, a hand search, and citation tracking, we ran our searches. We utilised the AMSTAR, ROBANS, and Cochrane Collaboration tools to evaluate bias risk. We described the results in narrative form. Twenty research' conclusions revealed a wide range of interventions and results. We divided the interventions into eight different types of interventions. The most widely reported form of intervention, educational programmes, increased staff outcomes. The utilisation of specially trained nurses, family-/person-centered care initiatives, and delirium treatment programmes were successful in improving several patient-related outcomes. To say whether measures are successful in enhancing dementia care in acute hospitals, however, requires more research than is available at this time. Future studies should concentrate on pertinent patient and caregiver outcomes and must take the complexity of the therapies into account when assessing them. A main kind of dementia that has recently received significant interest in neuroimaging approaches is Alzheimer's disease (AD). The signs appear gradually and interfere with a person's regular activities. AD doesn't just afflict the elderly; it can strike anyone at any age. In the early stages of the illness, patients experience modest memory loss, which is followed by a decline in their ability to talk and communicate.

Although there is currently no cure for the condition, early detection will lessen the disease's severity and enable sufferers to lead decent lives. According to research, the number of AD patients will double over the next 20 years. This research uses a variety of methods for AD diagnosis to undertake a systematic review on dementia that progresses to Alzheimer's disease. On recent work for the early diagnosis of AD utilising various methodologies of machine learning, IOT, Artificial Intelligence, etc., various analysis and assessment strategies are also examined. This essay also covers the difficulties in processing data on Alzheimer's and potential routes for future research. Although the approach analysis yields a positive prognosis, just a few pathologically untested data sets are used for the evaluations. Additionally, several imaging modalities are used, which cannot be assessed to establish a fair comparison.

The researchers Marcello Iencaa et al. discovered intelligent assistive technologies (IATs) that deal with the numerous challenges related to dementia and offer a variety of new solutions to protect dementia sufferers. Despite the fact that technical advancements are increasing annually, there are very few therapeutic applications created for dementia sufferers. In order to better care for people, it is necessary to develop new intelligent assistive technologies (IATs), not only for dementia patients but also for caregivers and clinicians. In order to highlight the benefits and drawbacks of the applications that are available for dementia sufferers, Kanwal Yousaf focuses primarily on identifying the existing healthcare apps for Android and iOS. They take into account the following factors, including assistance for caregivers, monitoring, dementia screening, socialisation, tracking, and reminiscence. With the assistance of the caregivers, they conducted a comparative research. To test the software that makes the design process so efficient, they are given wearable devices. As opposed to the authors Kalyani et al., who highlight the research directions, concentrate on numerous novel concepts that can be implemented in the field and offer a variety of assistive technologies. The challenges they face are also covered in this essay. Brain waves are studied using augmented reality concepts by E. Mat Nasir et al. By obtaining the image from the camera, this is accomplished. After processing, the 3D GUI is saved in the Open CV along with the acquired image. Computer monitoring and analysis based on the 3D model and image-based detail detection are required for this system.

People now have access to affordable, effective healthcare thanks to the use of assistive technology (AT) in therapeutic treatments. Mobile health (mHealth) has significantly expanded in recent years to help patients with chronic illnesses. This research paper summarises data supporting the use of mHealth dementia applications in helping those with dementia, particularly those with Alzheimer's disease (AD), and their carers. It includes a thorough analysis to identify and review existing mHealth dementia applications (apps). To locate evidence from the literature, six internet databases were explored. 29 of the 2818 research articles that were found after the search met quantified inclusion and exclusion criteria. The literature revealed six groupings together with the related sub-groups. ADL-based cognitive training, monitoring, dementia screening, reminiscence and socialising, tracking, and caregiver assistance are the primary categories. In order to determine the benefits and drawbacks of currently available, for-profit dementia and AD healthcare apps, two commercial mobile application stores, the Apple App Store (iOS) and Google Play Store (Android), were also investigated. 38 mobile apps out of 678 qualified according to the exclusion and inclusion criteria. The shortlisted commercial apps tended to focus on various dementia-related issues that were noted in research studies. Despite the limited amount of research that is currently available, this extensive study determined the viability of using mobile health-based applications for dementia, including AD patients and their caregivers. These apps have the ability to incorporate a variety of strategies and resources to dementia community care.

The fundamental criteria for Chronic Obstructive Pulmonary Disease (COPD) and Alzheimer's illness in the existing medical databases are feature extraction and disease prediction. The majority of medical databases have diverse properties with varying patterns of severity at different levels. Making decisions could benefit from the feature extraction and classification of high risk patterns. Data categorization algorithms are used in medical applications to determine the severity of an illness, which aids in the early identification of new disease patterns.Additionally, machine learning techniques are more dependable for heterogeneous features, have a higher true positive rate, and are more accurate. The homogeneous illness datasets with restricted feature space are classified using conventional classification models like Naive Bayes, SVM, Feed forward neural networks, Regression models, etc. Traditional data classification algorithms are unable to process the illness patterns due to inconsistent, class imbalance, and sparsity difficulties, which may affect the disease prediction rate and error rate. This is because the size of the Alzheimer's disease patterns and its categories is growing. As a result, a classification model with high true positivity and low error rate is crucial for predicting the severity level of diverse feature types.

In order to increase the disease classification rate and test new types of disease patterns for in-the-moment patient disease prediction, a novel feature selection based classification model is proposed in this study. For real-time patient disease prediction utilising the training datasets, a novel probabilistic based feature selection measure for classification method is created and applied in the proposed model. In terms of true positive rate, error rate, and F-measure, experimental results demonstrate that the suggested feature selection based classification method is superior to the conventional techniques.

A long-term neurological condition, Alzheimer's disease (AD). The likelihood of additional worsening will be significantly reduced by early diagnosis. Unfortunately, rather than anticipating how a disease might progress, present research mostly focuses on categorising disease states in their current stage. A particular type of recurrent neural network called long short-term memory (LSTM) may be able to link prior knowledge to the current task. We suggest a forecasting model based on LSTM after realising that a patient's temporal data may be useful for predicting how the disease would progress. In order to represent the temporal relationship between characteristics and the subsequent stage of Alzheimer's disease, an LSTM network with fully connected layer and activation layers is constructed. Our model outperforms the majority of the current models, according to the experiments.

The most prevalent type of dementia, Alzheimer's disease (AD), affects 44 million individuals globally. Numerous environmental and genetic risk factors have been connected to AD. Amyloid precursor protein, presenilin1 and presenilin2 mutations are among the most prevalent genetic causes. Similar to most diseases, early AD diagnosis is crucial for both the implementation of the best treatments and the course of the disease. The most prevalent applications of biomarkers are in the diagnosis and prognosis of disease. There are many different biomarkers, which can be classified as biological, computational, or digital and can be produced from a variety of sources. Genetic biomarkers for AD (APP, APOE e4, PSEN1 and PSEN2), plasma and cerebrospinal fluid (CSF) tau and A, as well as neuroimaging biomarkers, are all examples of AD biomarkers. The primary genetic and environmental causes of AD are outlined, along with the methods used to identify them and any potential novel biomarkers that merit further investigation.

It might be argued that the bulk of algorithms for analysing brain imaging heavily depend on unsupervised learning. Deep InfoMax (DIM), a recently developed unsupervised method, is a potential tool for flexible non-linearly examining brain structure. In this study, we compare supervised convolutional neural networks inspired by AlexNet and ResNet to the use of DIM variations in a setting of Alzheimer's disease progression. We employ a classification task between four groups as a benchmark: patients with mild cognitive impairment (MCI) that is stable or progressing, those who have Alzheimer's disease, and healthy controls. The Alzheimers Disease Neuroimaging Initiative (ADNI) database included 828 participants for our dataset. Our research provides reassuring proof of DIM's great potential value in upcoming neuroimaging studies.

Important research areas in the study of Alzheimer's disease include the prediction of participants' cognitive function from their magnetic resonance imaging (MRI) measurements and the discovery of pertinent imaging biomarkers. Traditionally, a linear regression problem is created to do this objective. A linear sparse regression model has recently been found to improve prediction accuracy. While neglecting valuable structure information in regression coefficients, the majority of current studies solely exploit the sparsity of regression coefficients. Furthermore, the correlations between cognitive function and MRI measurements may be more complex and even nonlinear in these linear sparse models. In this work, we construct a sparse multivariate regression model for this job and put forth an empirical sparse Bayesian learning algorithm, both of which are motivated by these observations. The suggested approach extends the predictor matrix with block structures, which distinguishes it from other sparse algorithms by modelling the response as a nonlinear function of the predictors. Additionally, it makes use of both the intra-block correlation inside each regression coefficient vector as well as the correlation between the vectors of the regression coefficients. Using the Alzheimer's Disease Neuroimaging Initiative database as a test subject, experiments revealed that the suggested algorithm not only outperformed state-of-the-art competing approaches in terms of prediction performance, but also successfully detected physiologically significant patterns.

3. CONCLUSIONS

Machine learning models are increasingly widely used in medical diagnostics. This study looks at a number of machine learning performances to identify Alzheimer's syndrome. Alzheimer's syndrome is an inherited, irreversible brain condition that progressively weakens logic, memory, and cognitive function. A sizeable portion of neurons in Alzheimer's disease stop working and lose their synaptic connections. Alzheimer's disease rarely strikes people between the ages of 30 and 60. Changes in sleep patterns, melancholy, anxiety, difficulties with basic skills like

reading or writing, aggressive conduct, and poor decision-making are just a few of the signs of Alzheimer's disease. Because they are less expensive and time-consuming than other wearable devices, machine learning algorithms are far superior to them.

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