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# Alzheimer's Disease Prediction Using Machine Learning Technique

**Sethu M[1], Vivekanadan S J[2], Reni Hena Helan R[3], Abirami G[4], Arun Karthik Raja M[5], Ashwanth Raj R[6], Kaushik S G[7]**

Assistant Professor, Department of Computer Science and Engineering[1,2,3,4]

Student, Department of Computer Science and Engineering[5,6,7]

Dhanalakshmi College of Engineering, Chennai, Tamil Nadu, India

**Abstract:** *Alzheimer's disease is a progressive neurologic disorder that causes the brain to shrink (atrophy) and brain cells to die. Alzheimer's disease is the most common cause of dementia — a continuous decline in thinking, behavioral and social skills that affects a person's ability to function independently The early signs of the disease include forgetting recent events or conversations. As the disease progresses, a person with Alzheimer's disease will develop severe memory impairment and lose the ability to carry out everyday tasks In that way MRI (magnetic resonance imaging) has become a useful medical diagnostic tool for the diagnosis of brain & other medical images. In this project, we are presenting a neural network method implemented for Alzheimer's detection via CNN Lenet5.*

**Keywords:** Alzheimer's disease

## I. INTRODUCTION

The brain is considered one of the most crucial organs in our body. All the activities and responses that allow us to think and believe are controlled and facilitated by the brain. It also empowers our sentiments and recollections. Alzheimer's disease is brain dysfunction which is unrepairable and progressive in nature. Someone in the world is diagnosed with Alzheimer's disease every four seconds. It enhances at a languid pace and tears down the memory cells, thereby destroying an individual's thinking ability. It's a degenerative nerve disorder that leads to loss of function or even death of neurons. The average life expectancy after an Alzheimer's diagnosis is only about four to eight years. On an average, 1 out of 10 people over the age of 65 is affected by this condition, but sometimes it can strike at a younger age and has been diagnosed in several people in their 20s. This disease is the primary cause of dementia in older people. Dementia causes a decline in cognitive skills that are used to perform daily activities, 60-80% of dementia cases are Alzheimer's.

One of the most common and preliminary disease detection tests, along with psychological examinations, is the brain MRI scanning and analysis. The medical professionals examine the MRI scans and assess possible factors that have the potentialtoreveal the presence of Alzheimer's disease, such as, brain matterdegeneration, tumor, etc. Although manual examinations of MRI data prove to be effective in detecting the presence of Alzheimer's disease, this process tends to reduce the efficiency of expeditious arrival of conclusions. This paper proposes an automatic detection of Alzheimer's disease.

## II. LITERATURE REVIEW

**1. Detection of Alzheimer's Disease with Shape Analysis of MRI Images Author: Hiroki Fuse; Kota Oishi; NorihideMaikusa; Tadanori Fukami; Japanese Alzheimer's Disease Neuroimaging Initiative,2018 Joint 10th International Conference on Soft Computing and Intelligent Systems (SCIS) and 19th International Symposium on Advanced Intelligent Systems (ISIS)**

In the current study, we tested the effectiveness of a method using brain shape information for classification of healthy subjects and Alzheimer's disease patients. A P-type Fourier descriptor was used as shape information, and the lateral ventricle excluding the septum lucidum was analyzed. Using a combination of several descriptors as features, we performed classification using a support vector machine. The results revealed classification accuracy of 87.5%, which was superior to the accuracy achieved using volume ratio to intracranial volume (81.5%), which is widely used for conventional evaluation of morphological changes. The current findings suggest that shape information may be more useful in diagnosis, compared with conventional volume ratio.

**2. Alzheimer disease detection and tracking of Alzheimer patient, Author: Priyanka Thakre; V.R.Pawar,2016 International Conference on Inventive Computation Technologies (ICICT)**

Alzheimer disease is one of the forms of dementia. AD is tremendously increasing disease in the world. There are so many biomarkers detect the Alzheimer disease. From that Electroencephalograph signal is give correct result and performance. In Alzheimer disease, death of brain cells are occurs so there is many causes happened such as memory loss, poor in calculation and recent event happened etc. Early detection of Alzheimer disease is very useful for him and his family. Early detection of Alzheimer patients is very useful for him and his family. In detection, firstly EEG database is filter then noise and artifacts is removed from EEG database using independent component analysis. By wavelet transform four features are extracted and classification is done by support vector machine. In monitoring system, Alzheimer patient is track by using GPS and GSM. With the help of this monitoring system Alzheimer patient is travel anywhere without caregiver.

**3. Moving from detection to pre-detection of Alzheimer's Disease from MRI data A. N. N. P Gunawardena; R. N Rajapakse; N. D Kodikara; I. U. K. Mudalige, 2016 Sixteenth International Conference on Advances in ICT for Emerging Regions (ICTer)**

Alzheimer's Disease (AD) is the most common form of dementia, affecting approximately 10% of individuals under 65 years of age, with the prevalence doubling every 5 years up to age 80, above which the prevalence exceeds 40%. Currently diagnosis of AD is largely based on the examination of clinical history and tests such as MMSE (Mini-mental state examination) and PAL (Paired Associates Learning). However, many present studies have highlighted the inaccuracies and limitations of such tests. Thus, medical officers are now moving to the more accurate neuroimaging data (Magnetic Resonance Imaging- MRI) based diagnosis for these types of diseases where brain atrophy transpires. However, it is a considerable challenge to analyses large numbers of images manually to get the most accurate diagnosis at present.

**4.Alzheimer's Disease and Dementia Detection from 3D Brain MRI Data Using Deep Convolutional Neural Networks H. M. Tarek Ullah; Zishan Ahmed Onik; Riashat Islam; Dip Nandi, 2018 3rd International Conference for Convergence in Technology (I2CT)**

As reported by the Alzheimer's Association, there are more than 5 million Americans living with Alzheimer's today, with an anticipated 16 million by 2050. The neurodegenerative disease is currently the 6th leading source of death in the US. In 2017 this disease would cost the nation $1.1 trillion. 1 in 3 seniors die in Alzheimer's disease or another dementia. It kills more than breast cancer and prostate cancer combined. As of these papers writing, detecting Alzheimer's is a difficult and time-consuming task, but requires brain imaging report and human expertise. Needless to say, this conventional approach to detect Alzheimer's is costly and often error prone. In this paper an alternative approach has been discussed, that is fast, costs less and more reliable. Deep Learning represents the true bleeding edge of Machine Intelligence. Convolutional Neural Networks are biologically inspired Multilayer perceptron especially capable of image processing. In this paper we present a state-of-the-art Deep Convolutional Neural Network to detect Alzheimer's Disease and Dementia from 3D MRI image.

**5. Early Prediction Of Alzheimer's Disease Dementia Based On Baseline Hippocampal MRI and 1-Year Follow-Up Cognitive Measures Using Deep Recurrent Neural Networks, Autho; Hongming Li; Yong Fan, 2019 IEEE 16th International Symposium on Biomedical Imaging (ISBI 2019)**

Multi-modal biological, imaging, and neuropsychological markers have demonstrated promising performance for distinguishing Alzheimer's disease (AD) patients from cognitively normal elders. However, it remains difficult to early predict when and which mild cognitive impairment (MCI) individuals will convert to AD dementia. Informed by pattern classification studies which have demonstrated that pattern classifiers built on longitudinal data could achieve better classification performance than those built on cross-sectional data, we develop a deep learning model based on recurrent neural networks (RNNs) to learn informative representation and temporal dynamics of longitudinal cognitive measures of individual subjects and combine them with baseline hippocampal MRI for building a prognostic model of AD dementia progression. Experimental results on a large cohort of MCI subjects have demonstrated that the deep learning model could learn informative measures from longitudinal data for characterizing the progression of MCI subjects to AD dementia, and the prognostic model could early predict AD progression with high accuracy.

**6. Longitudinal Prediction Modelling of Alzheimer Disease using Recurrent Neural Networks, Author:SolaleTabarestani; MaryamossadatAghili; Mehdi Shojaie; Christian Freytes; Mercedes Cabrerizo; Armando Barreto; Naphtali Rishe , 2019 IEEE EMBS International Conference on Biomedical & Health Informatics (BHI)**

This paper proposes an implementation of Recurrent Neural Networks (RNNs) for (a) predicting future Mini-Mental State Examination (MMSE) scores in a longitudinal study and (b) deploying a multiclass multimodal neuroimaging classification process that involves three different known stages of Alzheimer's progression, cognitively normal (CN), Mild Cognitive Impairment (MCI) and Alzheimer's Disease (AD). This multimodal data is fed into two well-studied variations of the RNNs; Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU). The accuracy, F-score, sensitivity, and specificity of the models are reported for the classification task as well as the root mean square error (RMSE) and correlation coefficient for the regression task. The results demonstrate the superiority of the proposed model over state-of-the-art classification and regression techniques of Support Vector Machine (SVM), Support Vector Regression (SVR) and Ridge Regression.

**7. A Deep Decomposition of MRI to Explore Neurodegeneration in Alzheimer's Disease, Author:F. J. Martínez-Murcia; J. M. Górriz; J. Ramírez; D. Castillo-Barnes; F. Segovia; D. Salas-González; A. Ortiz, 2018 IEEE Nuclear Science Symposium and Medical Imaging Conference Proceedings (NSS/MIC)**

Deep learning has revolutionized data analysis and particularly medical imaging, providing unprecedented insight to non-linear features. Image decomposition techniques such as Principal Component Analysis have been used for a long time, evolving towards complex non-linear decomposition algorithms. Convolutional networks, and particularly convolutional autoen-coders are known for providing high-level abstract features that describe the internal distribution of data in high-dimensional manifolds. In this work, we aim at gaining a deeper understanding the progression of the disease by predicting neuro logical test outcomes based solely on MRI data. In order to do so, we perform a self-supervised decomposition of the MRI data using a deep convolutional autoencoder. The distribution of features in the z-layer is then used within a neural network-based regression, in order to test whether these imaging-derived biomarkers are related to several neuropsychological tests. The prediction of neuropsychological test outcomes achieved R 2 rates up to more than 0.3, with correlations higher than 0.5 in the case of variables heavily linked to neurodegeneration and cognitive state such as the MMSE or the ADAS11 scores.

**8. Correlation-Aware Sparse and Low-Rank Constrained Multi-Task Learning for Longitudinal Analysis of Alzheimer's Disease, Author:Pengbo Jiang; Xuetong Wang; Qiongling Li; LeimingJin; Shuyu Li, IEEE Journal of Biomedical and Health Informatics ( Volume: 23, Issue: 4, July 2019)**

Alzheimer's disease (AD), as a severe neurodegenerative disease, is now attracting more and more researchers' attention in the healthcare. With the development of magnetic resonance imaging (MRI), the neuroimaging-based longitudinal analysis is gradually becoming an important research direction to understand and trace the process of the AD. In addition, regression analysis has been commonly adopted in the AD pattern analysis and progression prediction. However, most existing methods assume that all input features are equally related to the output variables, which ignore the difference in terms of the correlation. In this paper, we proposed a novel multi-task learning formulation, which considers a correlation-aware sparse and low-rank constrained regularization, for accurately predicting the cognitive scores of the patients at different time points and identifying the most predictive biomarkers. In addition, an efficient iterative algorithm is developed to optimize the proposed non-smooth convex objective formulation. We also have performed experiments using data from the AD neuroimaging initiative dataset to evaluate the proposed optimization formulation. Especially, we will predict cognitive scores of multiple time points through the baseline MRI features. The results not only indicate the rationality and correctness of the proposed method for predicting disease progression but also identify some stable and important MRI features that are consistent with the previous research.

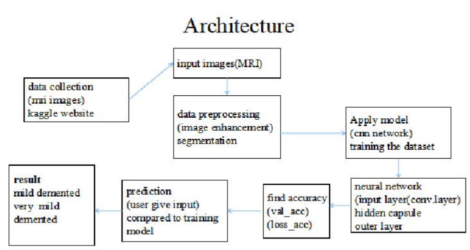
**9. Profile-Specific Regression Model for Progression Prediction of Alzheimer's Disease Using Longitudinal Data, Author: SolaleTabaristan; MaryamossadatAghili; Mehdi Shojaie; Christian Freytes; Malek Adjouadi,2018 17th IEEE International Conference on Machine Learning and Applications (ICMLA)**

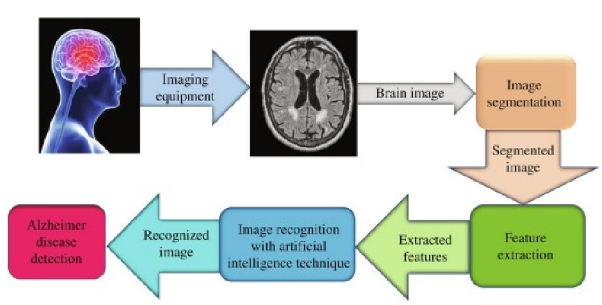
Studies on progression and prediction of Alzheimer's disease (AD) at multiple time points are less prevalent than the standard cross-sectional studies, which have been around for over two decades. The reason is that longitudinal datasets have not been readily available until recently, therefore predictive analysis of AD is relatively new to the scene. Even though some new lines of research have started to focus on regression modelling of the patient's pattern change in the future, they neglect the fact that the progression curves for different initial profiles at the baseline are fundamentally different from each other. These trends can hardly be modelled using a general regressor no matter how complex and nonlinear the model is. Therefore, encoding the disease progression for patients with different disease severity using separate regressors may achieve results that are more reliable. Following this assertion, we propose a model that in its first step classifies the subjects in the baseline data into four groups of Early Mild Cognitive Impairment (EMCI), Late Mild Cognitive Impairment (LMCI), and Cognitively Normal Controls (NC). In the second stage, we trained profile specific regressors to estimate Mini-Mental State Examination (MMSE) scores in multiple future time-points up to 36 months ahead of time. To validate our model, we perform a set of experiments on ADNI baseline MRI, FDG-PET, and cerebrospinal fluid (CSF) data from 1,458 subjects, among them 333 AD patients, 529 LMCI, 255 EMCI, and 341 NC. Experimental results demonstrate the effectiveness of the proposed method in terms of Root Mean Square Error (RMSE) exhibiting an average of 1.12 decrease in the MMSE questionnaire scale range of [0 30] over comparable RMSE scores obtained with state-of-the-art regression kernels.

## III. SYSTEM ARCHITECTURE

Design is a multi-step that focuses on data structures software architecture, procedural details, procedure etc… and interface among modules. The design procedure also decodes the requirements into presentation of software that can be accessed for excellence before coding begins. Computer software design change continuously as novel methods; improved analysis and border understanding evolved. Software proposal is at relatively primary stage in its revolution.

Therefore, software design methodology lacks the depth, flexibility and quantitative nature that are usually associated with more conventional engineering disciplines. However, methods for software designs do exit, criteria for design qualities are existing and design notation can be applied.



## IV. SYSTEM IMPLEMENTATION

### Collection of Data set

The collection of data used in this system includes rainfall data from many regions within India. It includes rainfall data from 1901 to 2015. Along with that, average rainfall and rainfall between the transition of two months have been included. The dataset contains a total of 4000 rows. The dataset was obtained from the Kaggle website, which is a data collection and publishing website. It includes attributes such as subdivision, Year, Months etc.

### Pre-processing

Data Arrangement: The material we've chosen is unlikely to be in a format that allows you to interact with it. The details could be in a social database, but we needed it in a simple text or a restricted record configuration. So, it is formatted in a data framework or material document. Import dataset and libraries: The formatted data is imported into a CSV file So that Jupiter notebook can read the file and continue the process. All-important libraries required like NumPy, pandas, matplotlib, seaborn are imported for reading, visualization, and manipulating the data.

Removing null values: Sometimes, the information of data may miss. In that case, we can perform two methods in removing the null values either deleting the row which contains the null value or calculating the mean value of the particular column or a row and replaces the missing value with the mean value. Therefore, it gives better results than the previous method. Splitting the data: Choose the independent variables or feature columns of the database, represent them as x, and define the target or dependent variable rain tomorrow as y. The database is separated into two separate sets - train data and test data using function train_test_split (). Typically, the dataset is divided into 7:3 or 8:2 ratios. That means we can use 70-80% of the data for training the algorithm while leaving out the remaining 20-30% for test data. The splitting of data depends on the form and size of the dataset.

### Model Creation

The predicting the air quality problem, decision tree algorithm prediction model is effective because of the following reasons: It provides better results in classification problem. It is strong in pre-processing outliers, irrelevant variables, and a mix of continuous, categorical and discrete variables. It produces out of bag estimate error which has proven to be unbiased in many tests and it is relatively easy to tune with.

### Model Prediction

Machine learning needs data gathering have lot of past data. Data gathering have sufficient historical data and raw data. Before data pre-processing, raw data can't be used directly. It's used to pre-process then, what kind of algorithm with model. Training and testing this model working and predicting correctly with minimum errors. Tuned model involved by tuned time to time with improving the accuracy.

## V. ALGORTIHM USED

### Objective

Segmentation of brain image is imperative in surgical planning and treatment planning in the field of medicine. In this work we have proposed a neural network approach to detect Alzheimer's disease using via convolutional neural network which comes under machine learning algorithm to attain high accuracy**.**

### Convolutional Neural Network

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

There are three types of layers that make up the CNN which are the convolutional layers, pooling layers, and fully-connected (FC) layers. When these layers are stacked, a CNN architecture will be formed. In addition to these three layers, there are two more important parameters which are the dropout layer and the activation function which are defined below.

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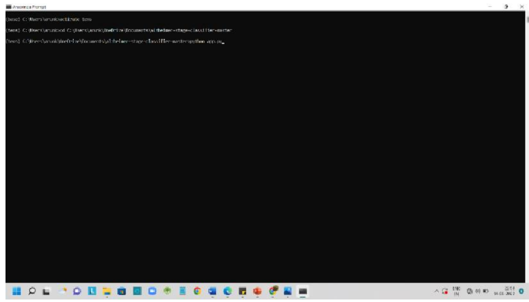
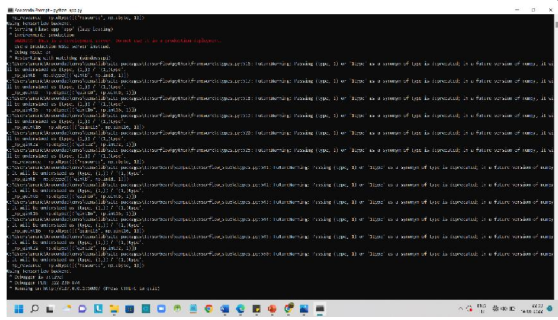
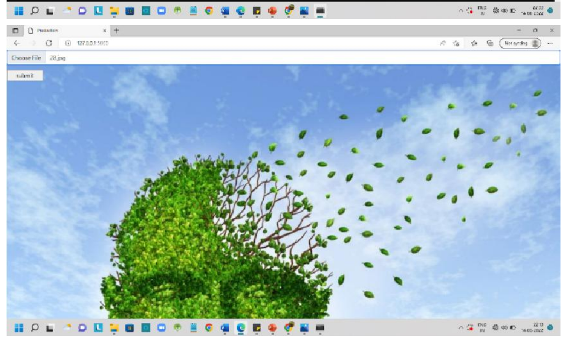
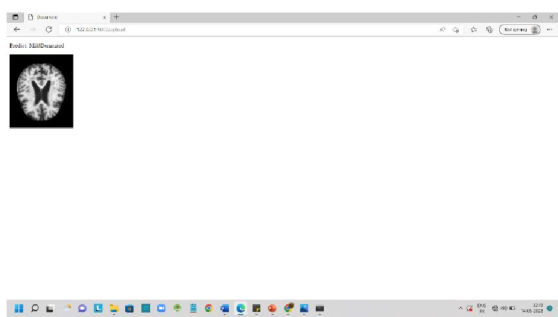
## VI. RESULTS



Accuracy depends on the size of the dataset. Here we have attained above 98% accuracy







## VII. CONCLUSION

This paper determines a prospective solution for detecting the disease at an early stage. The models used in this paper have successfully classified the images into the appropriate four classes and indeed provided us with promising results. The cnn model has shown decent accuracy in classification of images. The model has displayed certain promising graphs. It used a batch size of 64. The model has runed for 10 epochs. The model provided an accuracy of about 95% in the train data and about 80% in the test data. The proposed model can help doctors diagnose Alzheimer's Disease more effectively and can be modified

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