Alzheimer's Disease Detection using Machine Learning

[1]Dr. Gayatri Patil , [2]Mr. Dhananjay Kingre ,[3] Ms. Sanskruti Kamashetti, [4]Ms. Nikita Phad ,

[5]Ms. Samrudhhi Bansod

1 Guide, Information Technology Dept, Genba Sopanrao Moze College of Engineering,Balewadi,

Pune,India

2, 3,4,5 Students, Information Technology Dept, Genba Sopanrao Moze College of Engineering,

Balewadi Pune, India

ABSTRACT

Alzheimer disease is one of the most common and fastest growing neurodegenerative diseases in the western countries. Development of different biomarkers tools are key issues for diagnosis of Alzheimer disease and its progression. Prediction of cognitive performance of subjects from EEG and identification of relevant biomarkers are some of the research problems. EEG signal analysis can be well suited for automated diagnosis of Alzheimer's disease. Although, EEG based techniques are helpful in screening of Alzheimer and dementia; still there is a scope of improvement in terms of diagnostic accuracy, sensitivity, and specificity. Thus, many issues are still left out in field of Alzheimer diagnosis using EEG signals related to the choice of features which can help in distinguishing the two or more subjects. This paper focuses on new features for diagnosis of Alzheimer's disease using EEG signals with effective increase in diagnostic accuracy. The use of new complexity-based features is proposed in this paper which increases the diagnostic accuracy and helps in early Alzheimer's diagnosis. College Short Form Name, Department of Computer Engineering 20

1.INTRODUCTION

Alzheimer's Disease (AD) is a neuro degenerative affects primarily the elderly population. It is a progressive disease and the fact that there is no treatment to stop or reverse the progression of the disease.

According to the reports from 2005 through 2030, there is a steady growth in the percentage estimate of the number of people affected by AD. Presently 40 million people suffer from AD worldwide. It is distinctly possible to reach 135 million by 2050.

However, an interesting feature of AD is, though incurable, early detection and appropriate treatment of the disease can control the degeneration of neurons. In the current context, Computer-Aided Diagnostics uses advanced computer algorithms in the field of image processing and pattern recognition for identification of Features of Interest or Region of Interest in the MR image under observation.

The developed programs are expected to highlight the necessary features while keeping a control on the false negative rate systems when carefully developed are much better inaccuracies and can greatly assist the neurologist to understand the physiological changes in the brain.

2. LITERATURE SURVEY

- [1] Use of Non-linear and Complexity features for EEG Based Dementia Alzheimer disease Diagnosis, Author: Nilesh. N. Kulkarni1, Saurabh. V. Parhad2, Yasmin. P. Shaikh3. Alzheimer disease is one of the most common and fastest growing neurodegenerative diseases in the western countries. Development of different biomarkers tools are key issues for diagnosis of Alzheimer disease and its progression. Prediction of cognitive performance of subjects from EEG and identification of relevant biomarkers are some of the research problems. EEG signal analysis can be well suited for automated diagnosis of Alzheimer's disease. Although, EEG based techniques are helpful in screening of Alzheimer and dementia; still there is a scope of improvement in terms of diagnostic accuracy,

sensitivity and specificity. Thus, many issues are still left out in field of Alzheimer diagnosis using EEG signals related to the choice of features which can help in distinguishing the two or more subjects. This paper focuses on new features for diagnosis of Alzheimer's disease using EEG signals with effective increase in diagnostic accuracy. The use of new complexity-based features is proposed in this paper which increases the diagnostic accuracy and helps in early Alzheimer's diagnosis.

- [2]Multivariate Analysis of Structural MRI and PET (FDG and 18FAV-45) for Alzheimer's Disease and Its Prodromal Stages Author: Qi Zhou, Mohammed Gujranwala , Mercedes Carburize ,Warren Barker, David Loewenstein, Ranjan Daura and Malek Adjouadi A multivariate analysis method, orthogonal partial least squares to latent structures (OPLS), was used to discriminate Alzheimer's disease (AD), early and late mild cognitive impairment (EMCI and LMCI) from cognitively normal control (CN) using MRI and PET measures. Free Surfer 5.1 generated 271 MRI features including 49 subcortical volumes, 68 cortical volumes, 68 cortical thicknesses, 70 surface areas and 16 hippocampus subfields. Subjects with all aforementioned MRI measures passing quality control and valid Fludoxy glucose (18F) (FDG) and Florbetapir (18F) PET scans were selected from ADNI database, resulting in a total of 524 participants (137 CN, 214 EMCI, 103 LMCI and 70 AD) for the study. All together 286 features including 15 significant PET uptake features (7 for FDG and 8 for AV-45) were utilized for OPLS analysis. Predictive power was evaluated by (), a quantifier of the statistical significance for class separation. The results show that MRI features (()=0.645), and PET features (( ) = 0.636) has comparable predictive power in separating AD from CN, and MRI features are better predictor of LMCI (( ) = 0.282) than PET (( ) = 0.294). Combination of PET and MRI has the most predictive power for LMCI and AD with () of 0.294 and 0.721, respectively. While for EMCI, cortical thickness was found to be the best predictor with a () of 0.108, suggesting cortical thickness may be the first structural change ahead of others and should be prioritized in prediction of very mild cognitive impairment.

- [3]A novel gene selection method using GA/SVM and Fisher criteria in Alzheimer's disease. Sayeed Zahra Paylakhi1, Sajjad Ozgoli1, Sayeed Hassan Paylakhi2 Identification of those genes which cause diseases can develop the process of diagnosis and the treatment of diseases. In this paper, a gene selection method based on genetic algorithm (GA) and support vector machines (SVM) is presented. At first, Fisher criteria is utilized in order to do filtration for those genes which are noisy and redundant in high dimensional microarray data. Then, GA/SVM model is used for selection of various subsets of maximally informative genes with the use of different training sets. The frequency of appearance of each gene in various subsets of genes is analyzed. Therefore, the last subset contains those genes which are highly informative. In fact, Fisher and GA/SVM methods have been merged in order to take benefit from a filtering method as well as an embedded method. The proposed method is tested on DNA microarray gene expression data of Alzheimer's disease. The results show that the proposed method has a good selection and classification performance, which can yield 100biological point of view, at least 8 (53Alzheimer associated genes. Thus, these genes not only can serve as predictors of the disease, but also can use as a means to find new candidate genes

- [4] A Novel Gaussian Discriminant Analysis-based Computer Aided Diagnosis System for Screening Different Stages of Alzheimer's Disease Author-Chen Fang1 , Chun Fei Li1 , Mercedes Cabrerizo1 , Armando Barreto1 , Jean Andrian1 , David Loewenstein2,3, Ranjan . This study introduces a novel Gaussian discriminant analysis (GDA)- based computer aided diagnosis (CAD) system using structural magnetic resonance imaging (MRI) data uniquely as input for screening different stages of Alzheimer's disease (AD) involving its prodromal stage of mild cognitive impairment (MCI) in relation to the cognitive normal control group (CN). Taking advantage of multiple modalities of biomarkers, over the past few years, several machine learning-based CAD approaches have been proposed to address this high-dimensional classification problem. This study presents a novel GDA-based CAD system based on a tenfold cross validation and a held-out test data set. Subjects considered in this study included 187 CN, 301 MCI, and 131 AD subjects from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. In the tenfold cross validation, the proposed system achieved an average F1 score of 97.20sensitivity of 99.14discriminating together the MCI and AD groups from the CN group; and an average F1 score of 79.8287.43discriminating AD from MCI. By testing on the held-out test data, for discriminating MCI and AD from CN, an accuracy of 93.28were obtained. These results also show that by separating left and right hemispheres of the brain into two decisional spaces, and then combining their outputs, the GDA-based CAD system demonstrates a high potential for clinical application

- [5] Comparison Analysis of Machine Learning Algorithms to Rank Alzheimer's Disease Risk Factors by Importance Author Mohamed Mahboub, Dr Martin Randle's , Dr Thar .People have always feared aging, and the increasing rate of dementia disease caused this fear to twofold. Dementia is irreversible, unstoppable and has no known cure. According to Alzheimer's Disease International 2015 and World Alzheimer Report 2015, the estimated financial cost for healthcare services of Alzheimer's Disease is Trillion in 2018. This paper discusses the importance of investigating Alzheimer's Disease using machine learning, the need to use both behavioral and biological markers data, and a computational method to rank Alzheimer's Disease risk factors by importance using different machine learning models on Alzheimer's Disease clinical assessment data from ADNI. The dataset contains Alzheimer's Disease risk factors data related to medical history, family dementia history, demographical, and some lifestyle data for 1635 subjects. There are 387 normal control, 87 significant memory concerns, 289 early mild cognitive impairment, 539 late mild cognitive impairment and 333 Alzheimer's Disease subjects. We deployed different machine learning models on the dataset to rank the importance of the variables (risk factors). The results show that some risk factors in subjects genetically, demography and lifestyle are more important than some medical history risk factors. Having APOE4, education level, age, weight, family dementia history, and type of work rank as more influential among Alzheimer's Disease subjects.

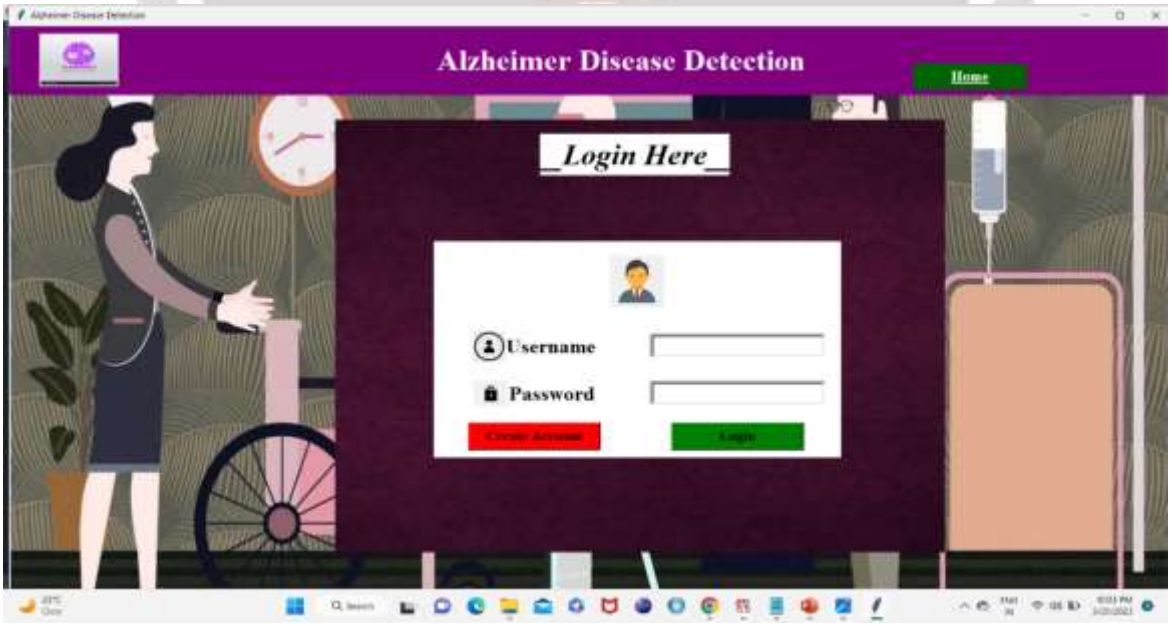
3.PROPOSED METHODOLOGIES

3.1 OBJECTIVES

In Alzheimer's Disease Detection Project is to make the diagnosis of the disease easier, to detect the disease in its early stages and use the machine algorithm efficiently. And we must use CNN algorithm for more accuracy of result.

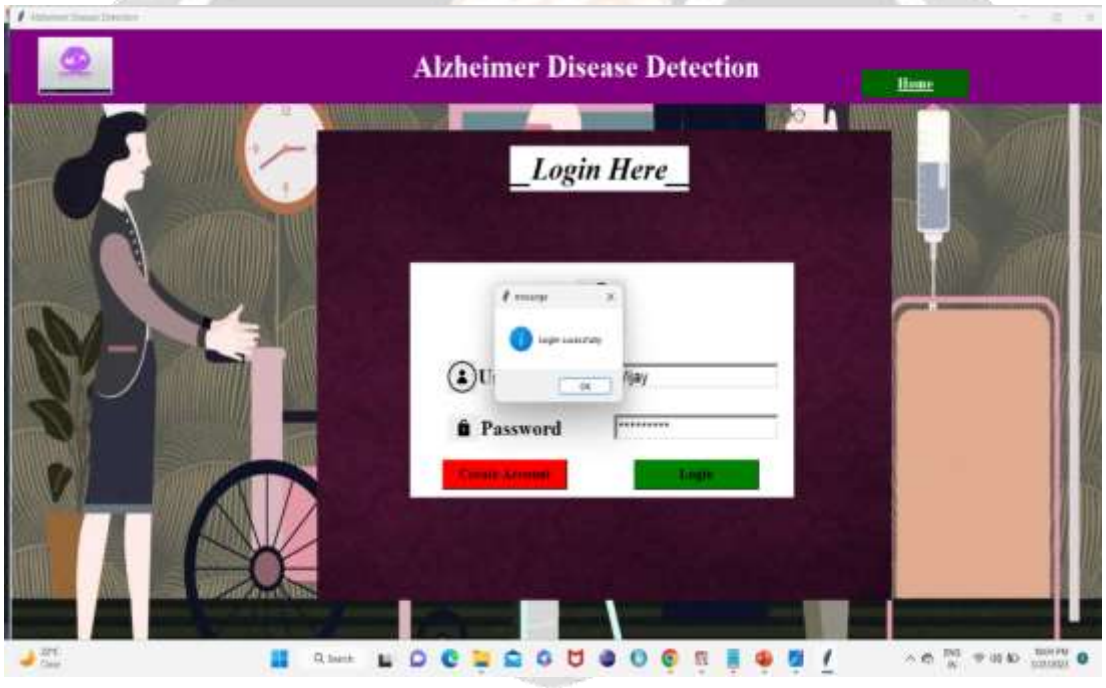
3.2 IMPLEMENTATION

- In Alzheimer's Disease Detection the front page has two option first is create account and second is login.



- If you have to create new account then click on create account button. Then account is created successfully.

- After feel all information regarding to the new registration your account created successfully and then enter username and password to login your account .
- After entering correct username and password your login successfully.

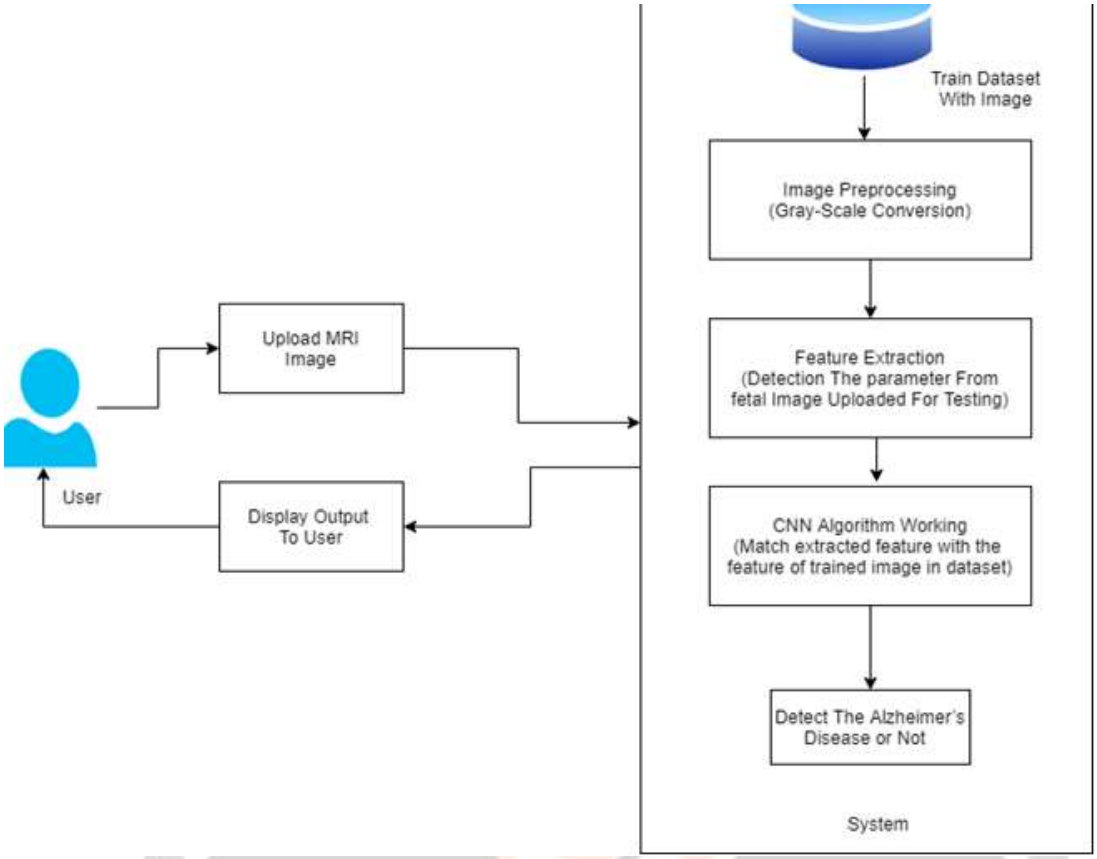


- Once user registers, their details will be stored to the database. Once Login is successful user will do some operations like select image, image process ,CNN prediction.

3.3 ALGORITHM USED

- Convolutional neural network (CNN) is used.
- Convolutional neural network is a specific kind of neural network with multiple layers. CNN process data that has a grid-like arrangement then extracts features.
- One of the most important advantage of using CNN is that you don't need to do lot of pre-processing on images.
- CNN works on your input data and apply filters on that input. CNN is very special that are able to tune the filters as training happens.
- In CNN each node in a layer is defined by its weight values. When you give some data , like an image, it takes the pixel values and picks out some of the visual features.

3.4 ROPOSED WORKFLOW



4. Future scope

It can be into a proper user interface application so that it is easily accessible to everyone.

It can be transferred as a tool in hospitals so that it helps the patients with Alzheimer's disease.

5.CONCLUSION

In this work, an effort has been made to study the 3D brain MR image slices for AD diagnosis. All the three different views of slices (Axial, Sagittal, and Coronal) of gray matter and the white matter has been used for this study.

Based on several observations slice number 51 has been chosen and used for further analysis. The first-order statistical feature has been extracted from each slice**.**

6.REFERENCES

- A. Association et al., "2017 Alzheimer's disease facts and figures," Alzheimer's Dementia, vol. 13, no. 4, pp. 325–373, 2017.
- S. Li, O. Okonkwo, M. Albert, and M.-C. Wang, "Variation in variables that predict progression from MCI to AD dementia over duration of follow-up," American Journal of Alzheimer's Disease (Columbia, Mo.), vol. 2, no. 1, pp. 12–28, 2013.
- R. Roberts and D. S. Knop man , "Classification and epidemiology of MCI," Clinics in Geriatric Medicine, vol. 29, no. 4, pp. 753–772, 2013.
- N. Fox, R. Black, S. Gilman, M. Rosser, S. Griffith, L. Jenkins, M. Koller et al., "Effects of A immunization (AN1792) on MRI measures of cerebral volume in Alzheimer disease," Neurology, vol. 64, no. 9, pp. 1563– 1572, 2005.

- G. B. Frisoni , N. C. Fox, C. R. Jack Jr, P. Scholten's , and P. M. Thompson, "The clinical use of structural MRI in alzheimer disease," Nature Reviews Neurology, vol. 6, no. 2, pp. 67–77, 2010.
- C. R. Jack, R. C. Petersen, Y. C. Xu, P. C. OBrien, G. E. Smith, R. J. Ivnik, B. F. Boeve, S. C. Waring, E. G. Tangelos, and E. Kokmen, "Prediction of AD with MRI-based hippocampal volume in mild cognitive impairment," Neurology, vol. 52, no. 7, pp. 1397–1397, 1999.
- R. Cuing net, E. Girardin, J. Tessiers, G. Auzias, S. Lehericy, M.-O. Habert, M. Chupin, H. Benali, O. Col- ´ liot, A. D. N. Initiative et al., "Automatic classification of patients with alzheimer's disease from structural MRI: a comparison of ten methods using the adni database," Neuroimage, vol. 56, no. 2, pp. 766–781, 2011**.**
- F. Falahati, E. Westman, and A. Simmons, "Multivariate data analysis and machine learning in Alzheimer's disease with a focus on structural magnetic resonance imaging," Journal of Alzheimer's Disease, vol. 41, no. 3, pp. 685– 708, 2014.
- E. Moradi, A. Pepe, C. Gasser , H. Huttunen , J. Tohka, A. D. N. Initiative et al., "Machine learning framework for early MRI-based Alzheimer's conversion prediction in mci subjects," Neuroimage, vol. 104, pp. 398–412, 2015.
- S. Liu, S. Liu, W. Cai, S. Pujol, R. Kikinis , and D. Feng, "Early diagnosis of Alzheimer's disease with deep learning," in Biomedical Imaging (ISBI), 2014 IEEE 11th International Symposium on. IEEE, 2014, pp. 1015– 1018.