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ALZHEIMER'S DISEASE DETECTION USING MACHINE LEARNING TECHNIQUES IN 3D MR IMAGES

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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 Alzheimerdisease 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 diagnos- tic 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.

1. INTRODUCTION

Alzheimer's Disease (AD) is a neurodegenerative disease affects primarily the el- derly population. It is a progressive disease and the fact that there is no treatment tostop 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 diseasecan control the degeneration of neurons. In the current context, Computer-Aided Diagnostics uses advanced computer programs and algorithms in the field of imageprocessing and pattern recognition for identification of Features of Interest or Re- gion of Interest (FOI / ROI) in the MR image under observation. The developed programs are expected to highlight the necessary features while keeping a control on the falsenegative rate systems when carefully developed are much better inaccu-racies and can greatly assist the neurologist to understand the physiological changesin the brain.

Objective

Improving the early diagnosis of Alzheimer's disease and other dementias. Developing interventions to delay or prevent the onset of Alzheimer's diseaseand other dementias. Finding better ways to manage dementia when other chronic conditions are present.

2. LITERATURE SURVEY

Paper Name: Use of Non-linear and Complexity features for EEG Based Demen-tia Alzheimer disease Diagnosis

Author: Nilesh. N. Kulkarni1 , Saurabh. V. Parhad2 , Yasmin. P. Shaikh3

Abstract ::- Alzheimer disease is one of the most common and fastest growing neu-rodegenerative diseases in the western countries. Development of different biomark-ers tools are key issues for diagnosis of Alzheimer disease and its progression. Pre-diction of cognitive performance of subjects from EEG and identification of relevantbiomarkers are some of the research problems. EEG signal analysis can be well suited for automated diagnosis of Alzheimer's disease. Although, EEG based tech- niques are helpful in screening of Alzheimer and dementia; still there is a scope of improvement in terms of diagnostic accuracy, sensitivity and specificity. Thus, manyissues 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 EEGsignals with effective increase in diagnostic accuracy. The use of new complexity based features is proposed in this paper which increases the diagnostic accuracy andhelps in early Alzheimer's diagnosis.

3. PROPOSED METHOD

A given 3D MR image is taken and is visualized in three orthogonal directions i.e., Axial, Coronal and Sagittal directions. The grey matter and white matter of the brain are separated from the 3D brain image and single slice extraction is performed. Skull stripping [15] is performed on these 2D slices as a pre-processing step to remove non-cerebral tissues like skull, scalp, and dura from brain images. As part of the feature extraction, first-order statistical features are extracted from the 2D slices, for both white matter and grey matterslices separately. The correlation

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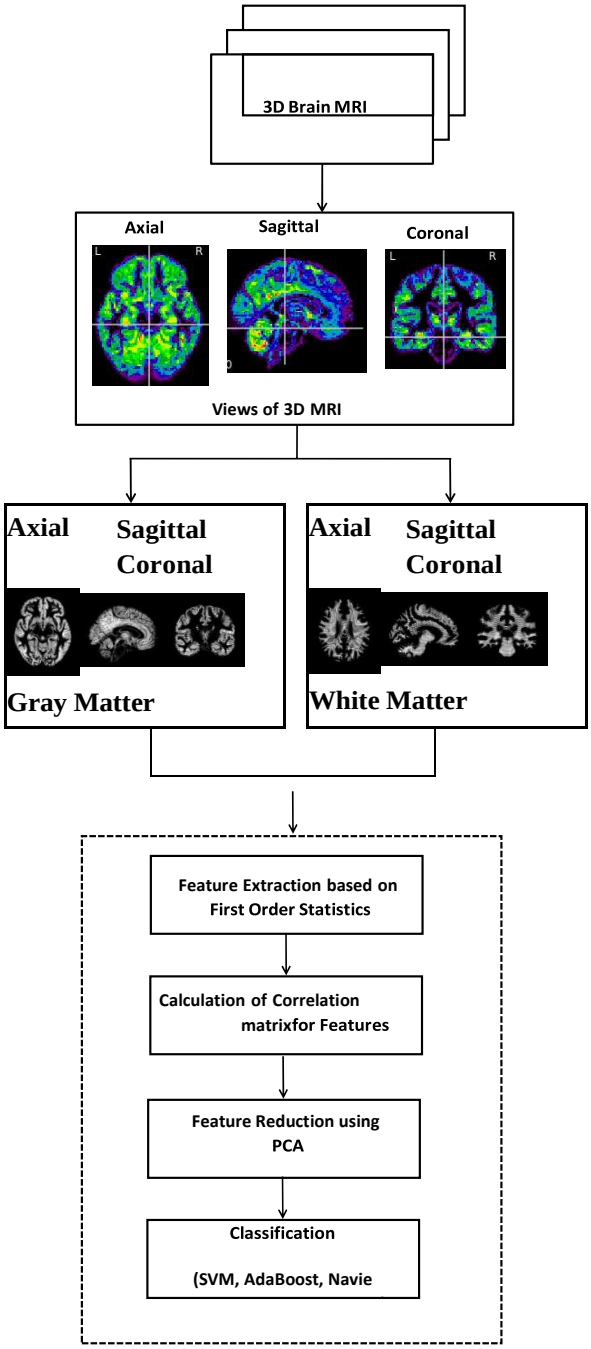
matrix heatmap of all of the features is prepared to represent the interdependence between them. The principal component analysis is applied to these features as part of the feature reduction step to select themost prominent features. Pre-processing of the data is then performed. Four different classifiers are chosen here to classifythe presence of Alzheimer's disease based on the prominent features selected, namely, Logistic Regression, SVM, Naive Bayes and Adaboost classifier on both grey matter and white matter data individually in axial, coronal and sagittal direc- tions. Comparisons between the efficiencies of these classifiersare studied and analyzed in the last section. The schematic view of proposed method.



4. PROBLEM STATEMENT

As Alzheimer's worsens, people experience greater memory loss and other cognitive difficulties. Problems can include wandering and getting lost, trouble handling money and paying bills, repeating questions, taking longer to complete normal dailytasks, and personality and behavior changes.

5. ALGORITHMS

- Select images to train the convolutional neural network.
- Extraction of feature filters/feature maps.
- Implementation of the convolutional layer.

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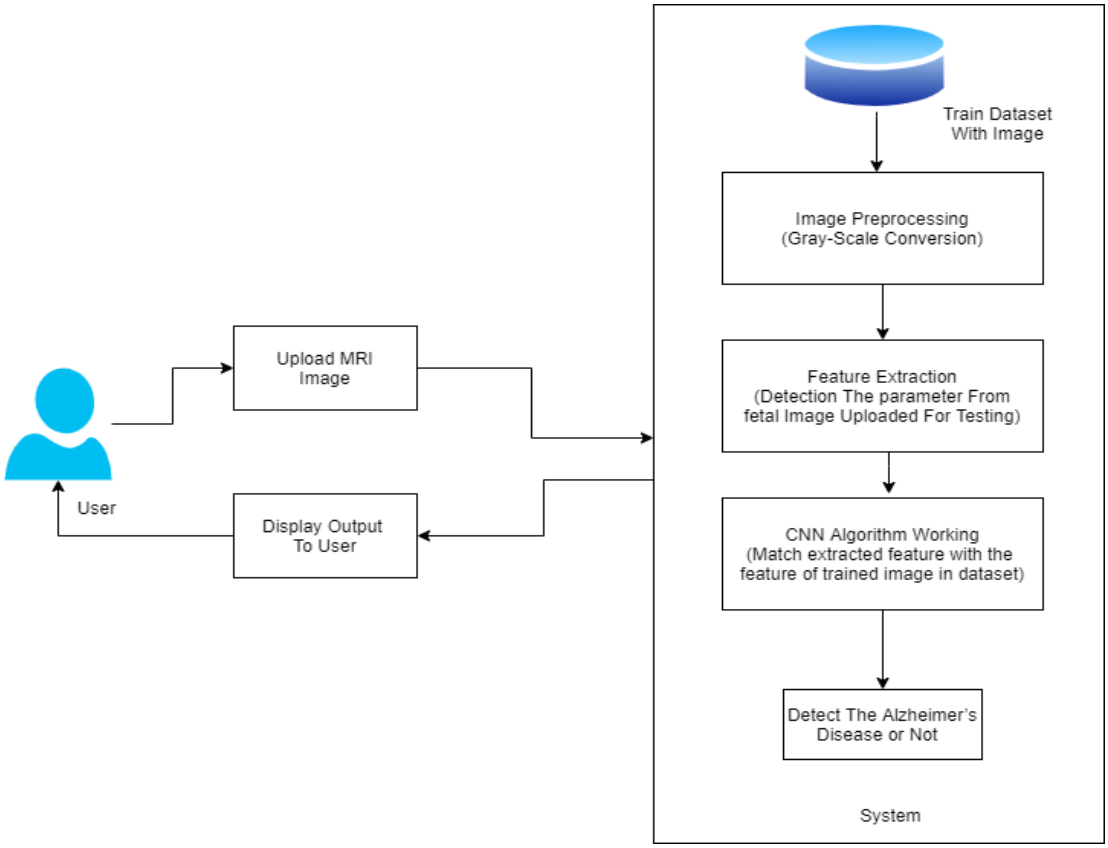
- Apply the ReLu Activation function on the convolutional layer to convert all negative values to zero.
- Then apply max pooling on convolutional layers.
- Next Flatten, This layer used for convert 2D matrix into 1D array.
- Make a fully connected layer
- Then input an image into CNN to predict the image content
- Back propagation to calculate the error rate
- Then Create CNN model. 1. Build a small convolutional neural network as defined in the architecture below.

Architecture



6. RESULTS

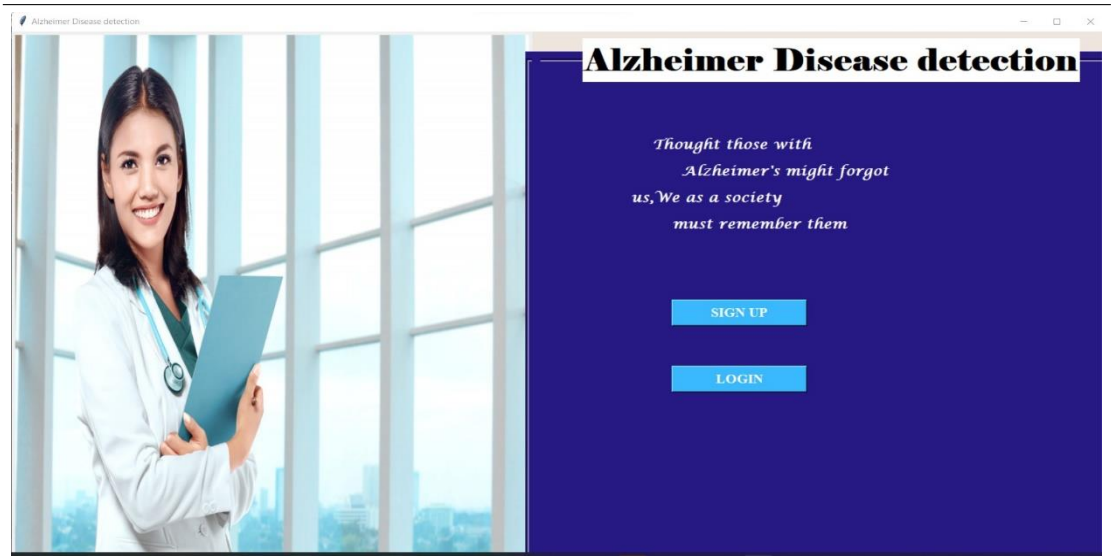


Figure 8.1: main File

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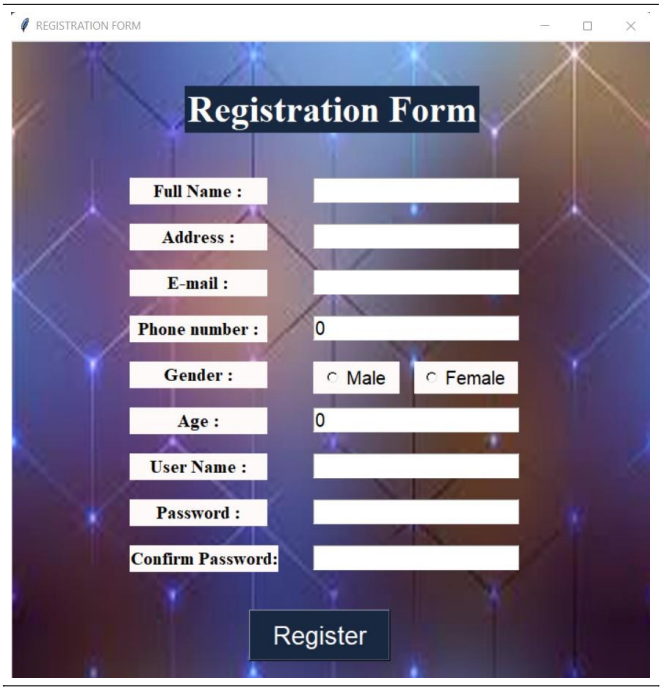

Figure 8.2: Registration File

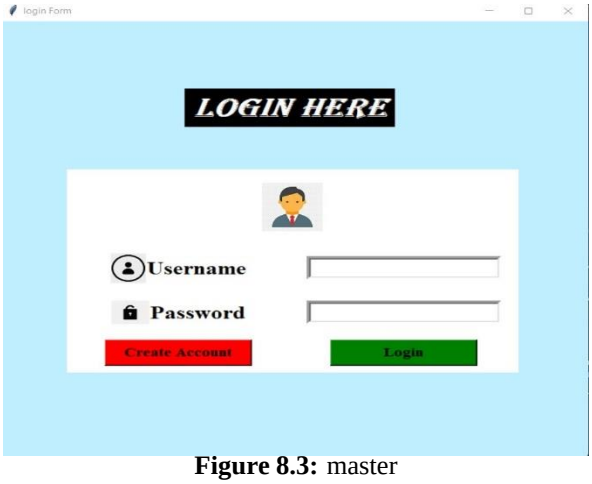

Figure 8.3: master

Figure 8.4: Check File

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7. 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 severalobservations slice number 51 has been chosen and used for further analysis. The first-order statistical feature has been extracted from each slice

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