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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 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 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.*

**Keywords:** Neurodegenerative, Cognitive, Dementia, EEG, Diagnostic

## I. INTRODUCTION

Alzheimer's Disease (AD) is a neurodegenerative disease 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 programs and algorithms in the field of image processing and pattern recognition for identification of Features of Interest or Region 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 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.

## II. MOTIVATION

Recent studies use voxel-based brain MR image feature extraction techniques along with machine learning algorithms for this purpose. Grey and white matter of the brain gets affected and damaged due to AD and so studying these both prove to be more effective in predicting the disease.

## III. OBJECTIVES

- Provide an overview Alzheimer's disease
- Understand the Importance of focusing on the caregivers of people with Alzheimer's
- Increase the number of people talking to doctors about warning signs
- Improving the early diagnosis of Alzheimer's disease and other dementias.
- Developing interventions to delay or prevent the onset of Alzheimer's disease and other dementias.
- Finding better ways to manage dementia when other chronic conditions are present.

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## IV. SYSTEM ARCHITECTURE

### 4.1 System Architecture

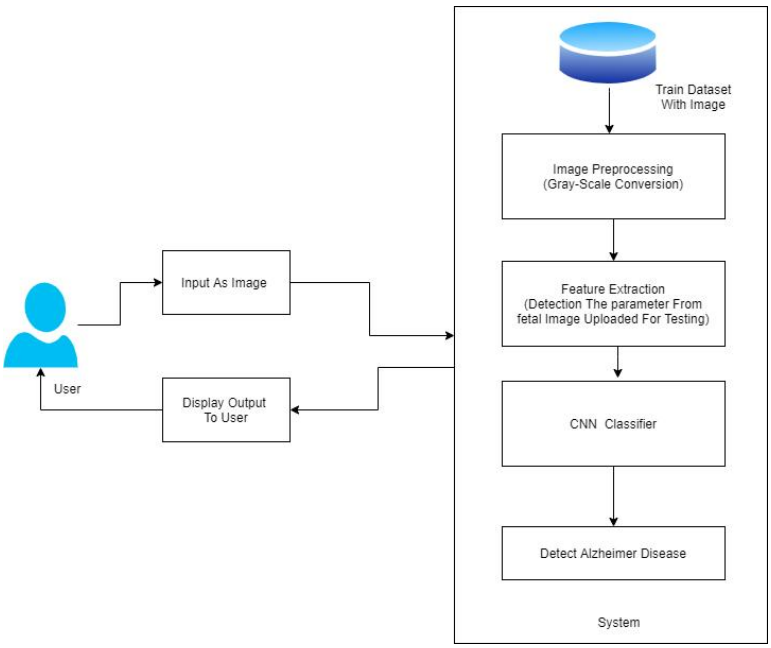


**Figure 4.1:** System Architecture

### 4.2 Data Flow Diagrams

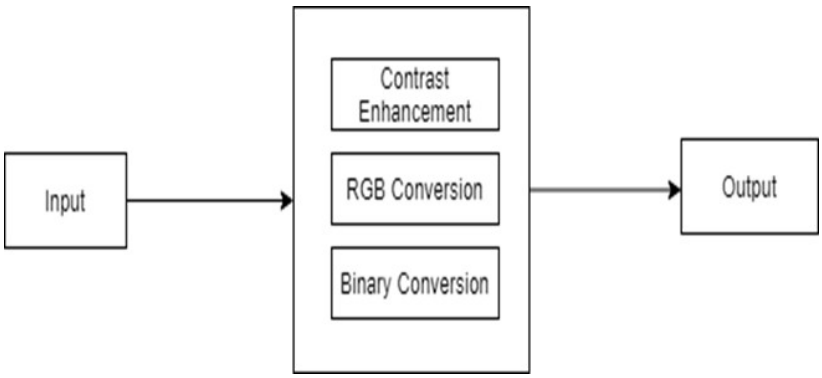


**Figure 4.2.1:** Data Flow (1) diagram

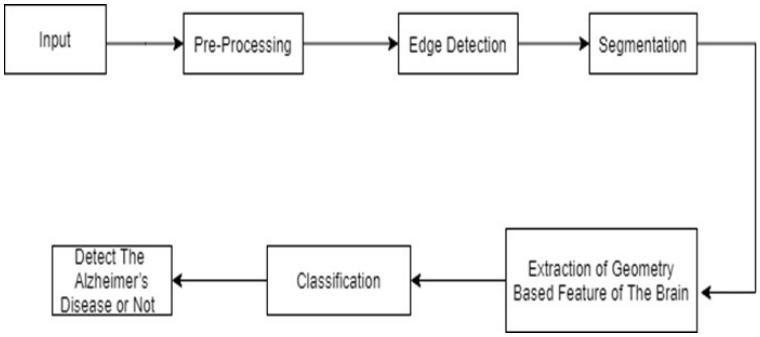


**Figure 4.2.2:** Data Flow (2) diagram

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## V. UML DIAGRAMS

The UML diagrams consist of the class diagram, use case diagram, activity diagram, sequence diagram.

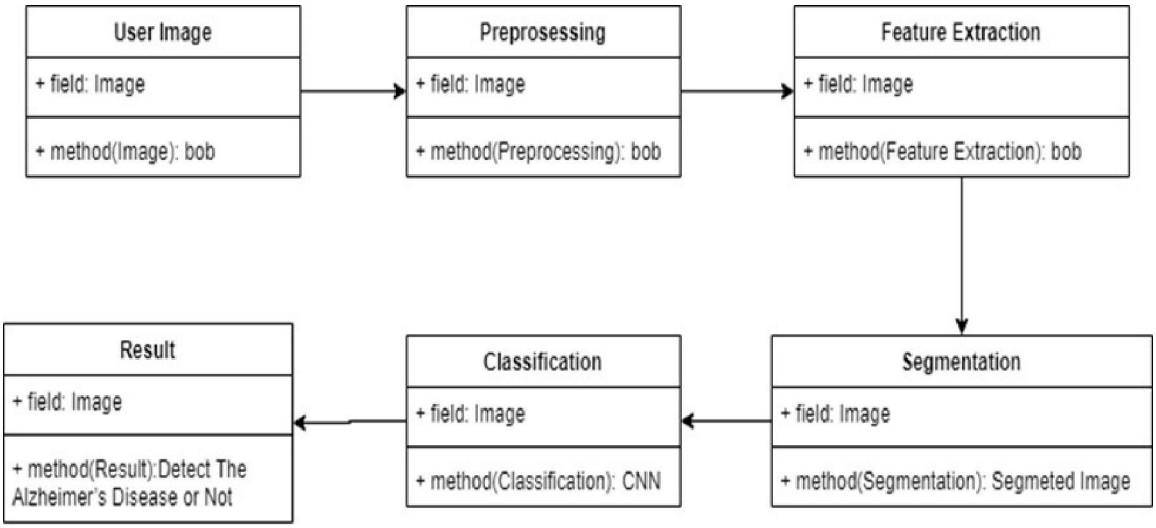


**Figure 5.1:** Class diagram

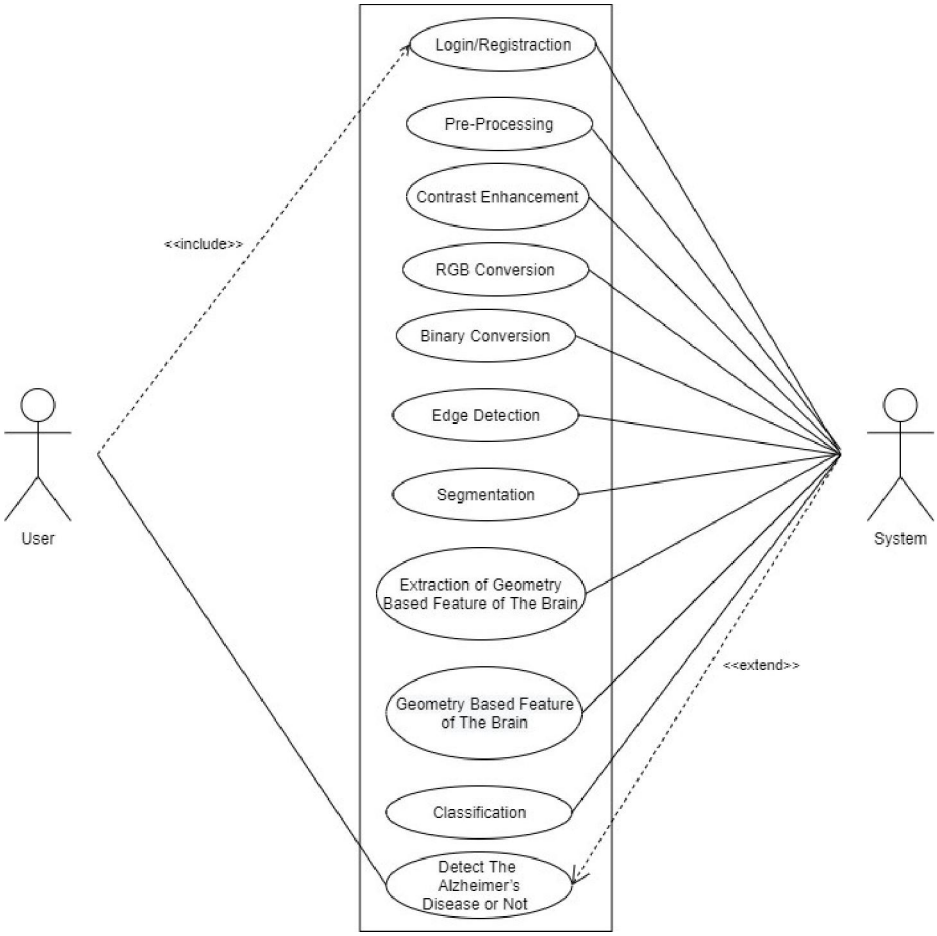


**Figure 5.2:** Use case diagram

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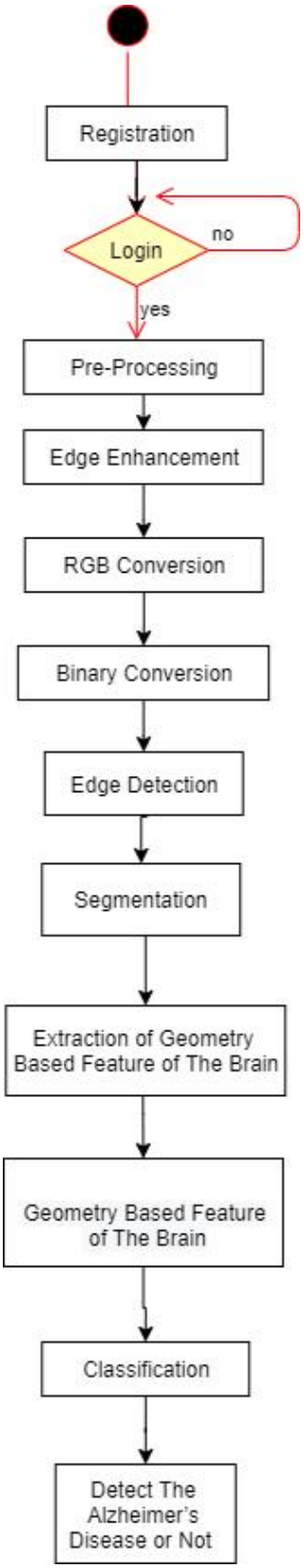


**Figure 5.3:** Activity diagram

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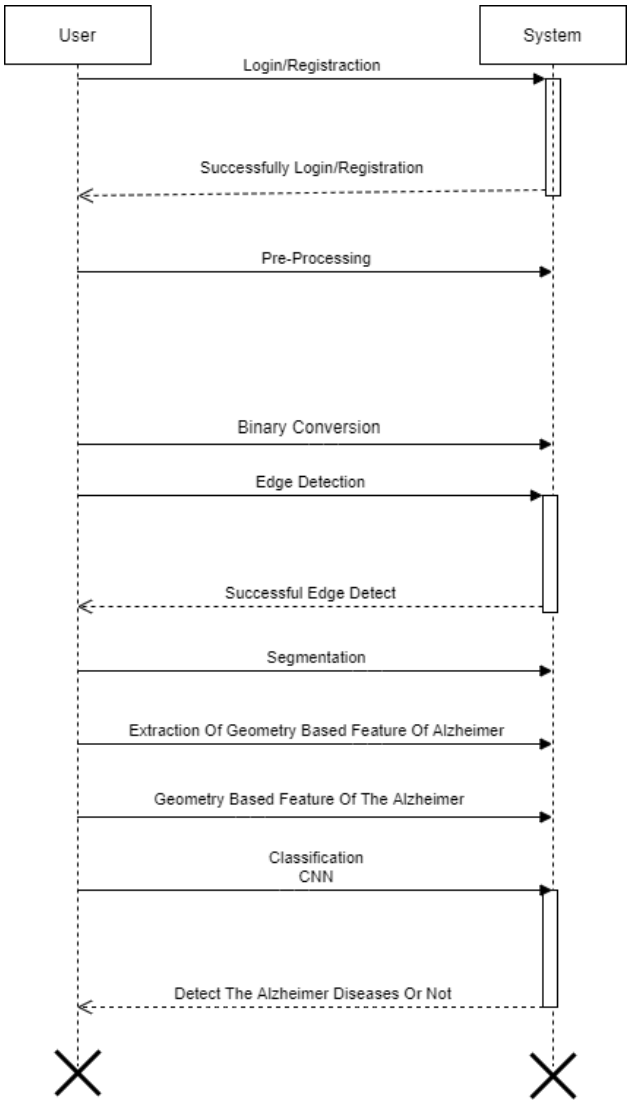


**Figure 5.4:** Sequence diagram

## VI. HARDWARE AND SOFTWARE REQUIREMENTS

### 6.1 Software Requirements Specification:

- Operating system: Windows 10.
- Coding Language: Python
- IDE: Spyder
- Database: SQLite.

### 6.2 Hardware Requirements Specification:

- System: Intel I5 Processor.
- Hard Disk: 40 GB.
- Monitor: 15
- RAM: 8 GB

## VII. APPLICATIONS

- This system can be used for scientific study and research on Alzheimer's disease
- It can be used in hospitals, medical centres for detecting Alzheimer's.

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## VIII. 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.

## ACKNOWLEDGMENT

It gives us great pleasure in presenting the preliminary project report on 'Alzheimer's Disease Detection using Machine Learning'. I would like to take this opportunity to thank our internal guide and head of Department, Dr. R. V. Babar for giving us all the help and guidance we needed. We are really grateful to him for his kind support. His valuable suggestions were very helpful.

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