# Detection of Roi for Classifying Alzheimer's Disease Using Mr. Image of Brain

**M. Latha, S. Arun**

***Abstract:*** ***The Alzheimer's disease is a brain disorder that affects human memory, thinking and behavior. The brain damage can be detected using brain volume and whole brain form. The complete cure has not been discovered yet and the detection of AD in an early stage helps to slow down the disease. Its progression develops in various stages as MCI, Dementia and AD. A CAD tool for diagnosing AD using structural Magnetic Resonance Image (MRIs) has been proposed. It uses information from Gray Matter (GM) and White Matter (WM) tissue distribution in the brain. Images have been resized and Median filter has been used for removing noise from images and as a preprocessing step. Morphological operations has been done and shown as a binary image and ROI analysis were performed on both white and grey matter tissues. It can be analyzed by the image resulting from the registered image.***

***Keywords:*** ***Alzheimer's disease, Classification, MRI, segmentation, Feature Extraction, Support Vector Machine.***

## I. INTRODUCTION

The human body has various complex and integral parts like brain and the nervous system which has billion of nerves connected together. Since brain is the center of the nervous system, abnormal behavior will cause changes leading to Alzheimer's, advanced form of dementia. Alzheimer's is a neurodegenerative disease that occurs in adults above 65 and risk factors include head injuries, depression and hypertension. Brain area involved in the memory will get affected and slowly spreads out to the other parts of the brain. Morphometric pattern analysis creates multiple patterns from multiple templates which can be used for feature representation. The class can be represented by a single cluster while we create multiview methods and then cluster them into subclasses. SVM classifiers were used for the selected features and the results were combined [1]. The dropout technique to improve classical deep learning method was used which also focuses on multi task learning strategy. Data were collected from ADNI and features were extracted using ROI for each subject. PCA is used for reducing the dimensions after which feature selection was done. If there is no correlation between the features selected and class then it will be assigned zero weight where we select only features having non zero weights. Then deep learning was applied using unsupervised method foe better classification [2].

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The brain is a complex network obtained with neuroimaging techniques which is obtained using tools from graph theory via heuristically defined "graph space". Factors such as graph constructions methods can be considered for future research [3]. The AD patients care will be increasing as machine learning methods were used for the diagnosis. The multimodal neuroimaging features requires less labeled data and shown better performance in both binary classification and multiclass classification of AD [4]. There are several methods to find out the relevant feature of brain image to classify them between healthy and unhealthy. The important features from brain MRI can be extracted and the general framework procedure is followed by preprocessing, feature extraction, feature selection, classification [5]. Deep neural network assigns the voxel to the MR image of the brain with its corresponding anatomical regions for the brain. The anatomical segmentation for the brain requires the segmentation protocol and delineated results are compared between brains [6].

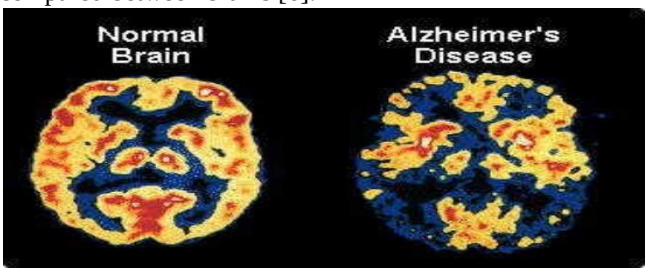


**Fig 1. Normal vs AD Image**

## II. LITERATURE SURVEY

Binary classification and multiclass classification for the groups were done choosing volumetric features and computing grey matter for each image. PCA was used for dimensionality reduction and 3 different classifiers like SVM, IVM and RELM in which RELM has shown high effective. [7]. AD is not related to age concerns or stress and it basically relates with behavioral symptoms. Data were extracted from ADNI and after normalization few images were reduced. Wavelet transforms for feature extraction and PCA for feature reduction is used followed by SVM classifiers. Large Computational cost for training the classifiers has been a drawback [8]. Local and global topological properties using network based models revealed the patterns of disease propagation and its disadvantages of need priori segmentation.

The brain structural connectivity using multiple networks was developed along with its classification score (AD) [9]. The diagnosis of Alzheimer's disease among older adults related to clinical and research applications and its high-level features were not properly extracted due to unique patterns of brain and intensities. Patterns from neuroimaging data can be retrieved using methods like statistical learning and machine leraning. Cutting-edge deep learning was used and CNN was used for scaling-shifting features [10]. Random forest classifier was used which selects the class having majority votes in the forest. Inputs were extracted from OASIS database and feature extraction is done for both input images and transformed images. Various features were extracted and compared with SVM classifier showing Random forest classifier performed better [11].

## III. MATERIALS AND METHODS

Data were collected from ADNI database for processing. Both normal and AD images were selected for processing. The input data was preprocessed and further segmented where Regions of Interest was computed for easier processing.

- Pre-Processing
- Image segmentation
- Region of Interest (ROI)
- Classification

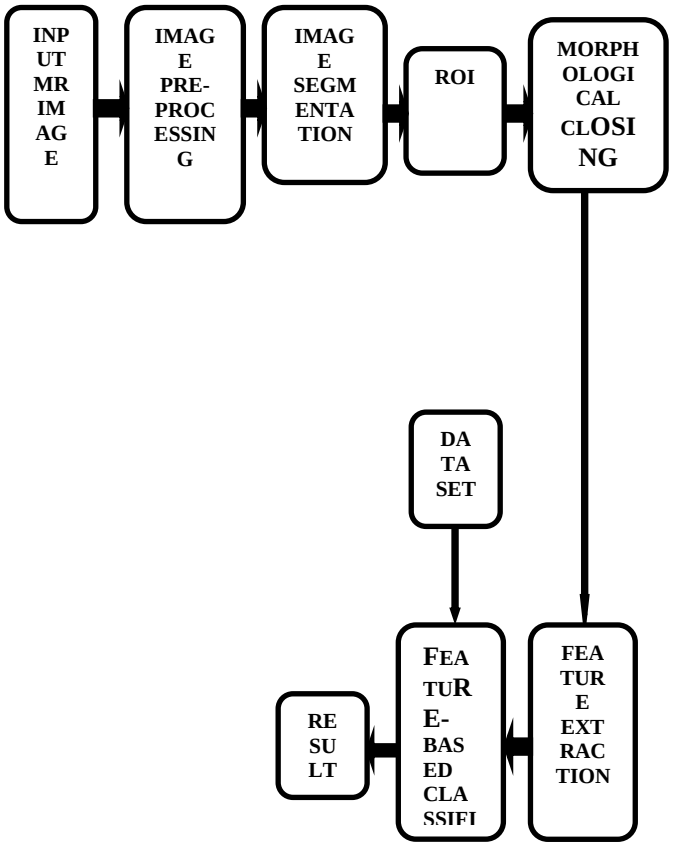


**Fig 3.1 Architecture Diagram**

Image pre-processing is the conversion of gray scale process of removing noises from input image to enhance quality. It includes extraction of MRI images and image enhancement can be done with help of standard ADNI pipeline. A segmentation technique is used to detect the Alzheimer's disease by partitioning a digital image into multiple segments. It changes the representation of an image by processing label to every pixel in an image.

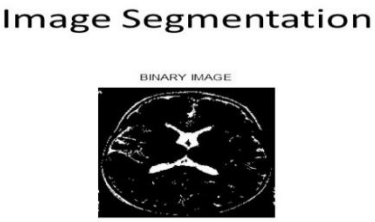


**Fig 3.2**

A region of interest (ROI) is a subset of an image where filtering and other operations are carried out by binary mask in which the binary image is the same size as the input image.


**Fig 3.3**

Machine learning and pattern recognition for Feature extraction builds features from the data which is informative and non-redundant. We propose the use of classifiers and machine learning technique to retrieve required data from datasets and classification results in extracting information classes from multiband raster image.

## IV. RESULTS AND DISCUSSION

Input data was selected from the ADNI database and median filter was applied for the selected image and output is shown below. Noise coefficient data was calculated and median filter is applied for removing noise from the image. Original image and filtered image has been compared and displayed. Morphological values of image were extracted and displayed as binary image and finally calculating the regions of Interest. ROI extraction is very important as it forms the base for further analysis and interpretation containing all the edge details of an image. ROI outputs for various images have been shown below.

**Fig 4.1. Input image & Resized Image**

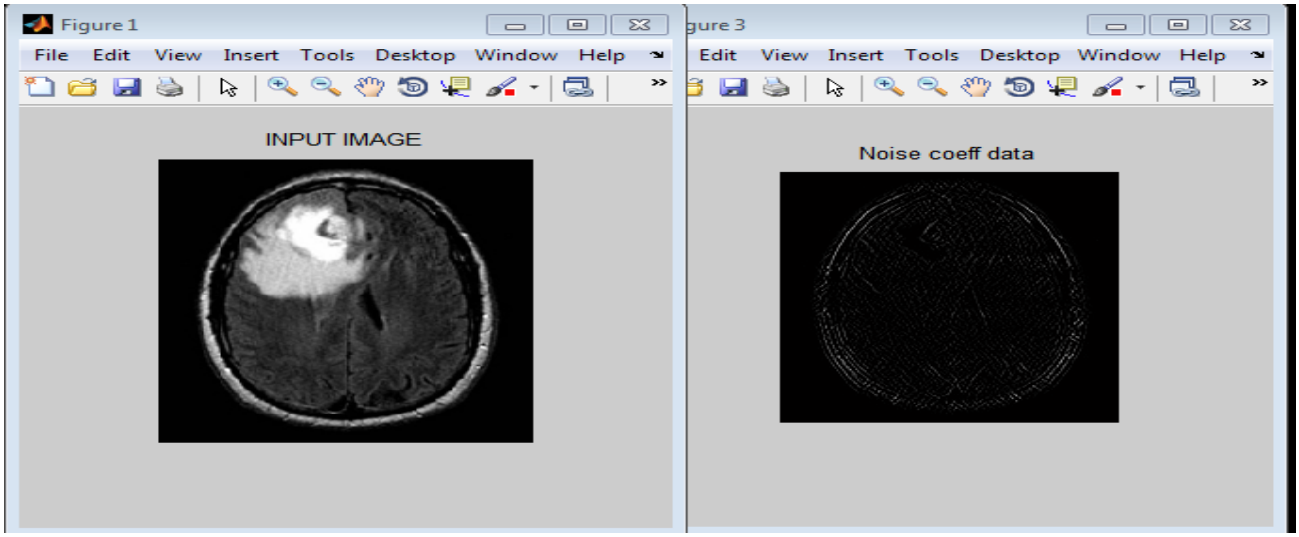


**Fig 4.2. Noise Coefficient Data**

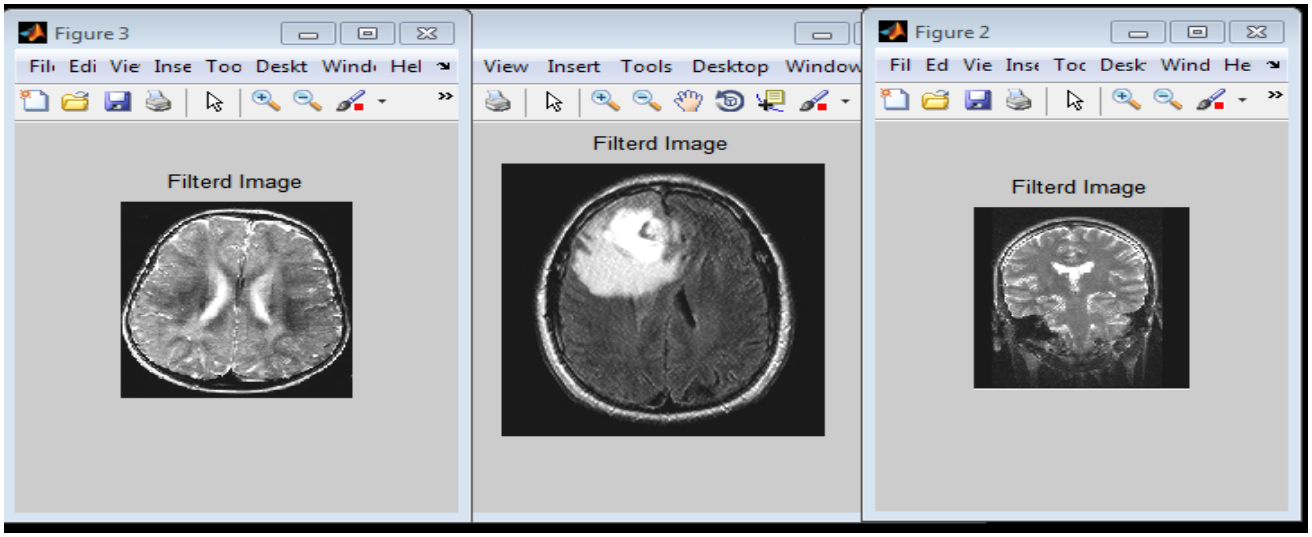


**Fig 4.3. Various Filtered Images**

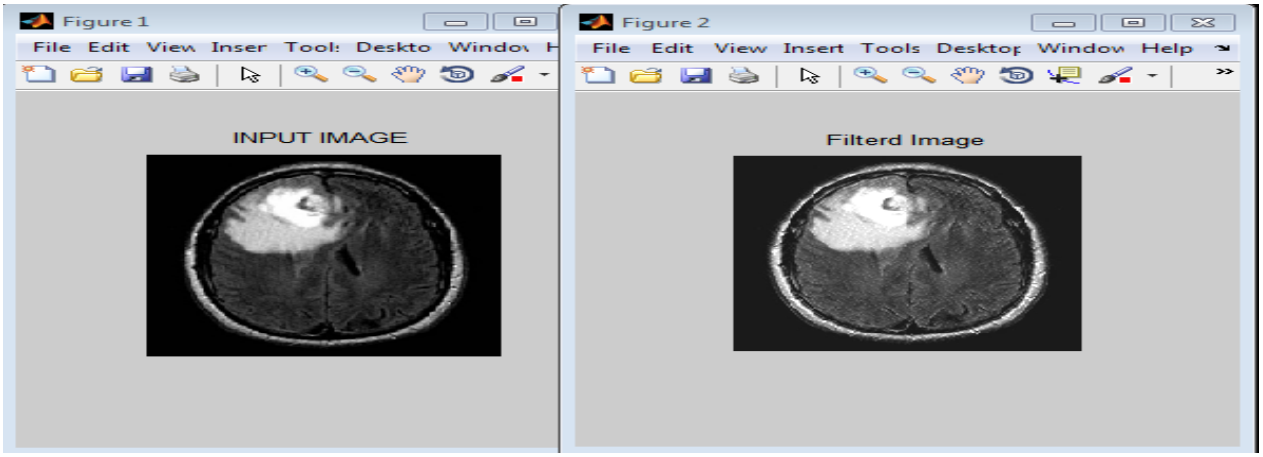


**Fig 4.4 Median Filtered Image**

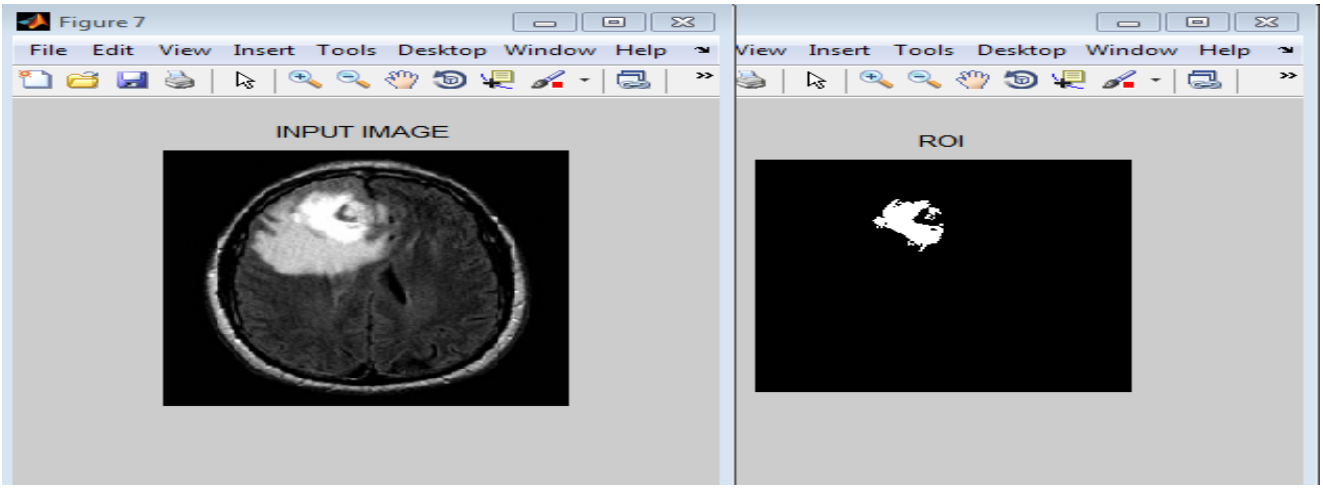


**Fig 4.5 ROI Extracted Image**

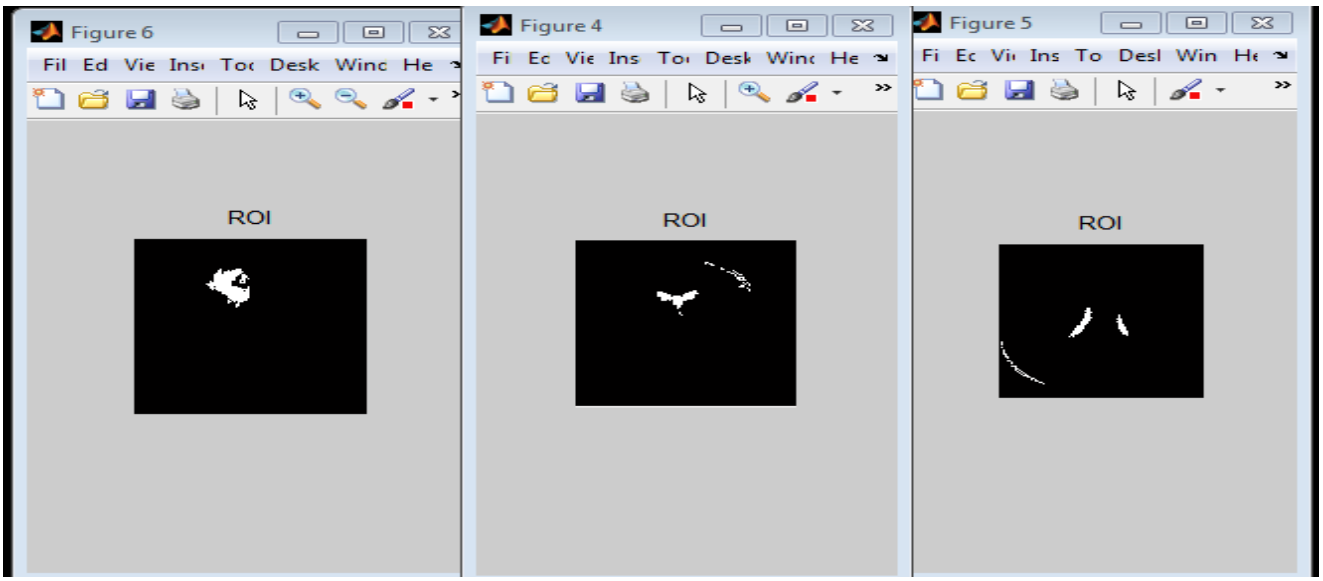


**Fig 4.5.1. Different ROI Images**

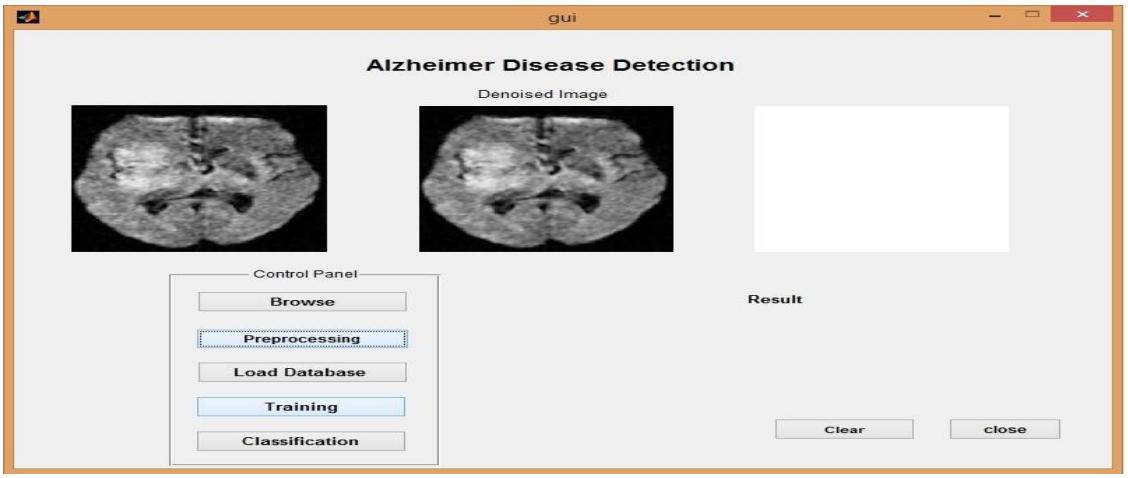


**Fig 4,6. GUI for AD**

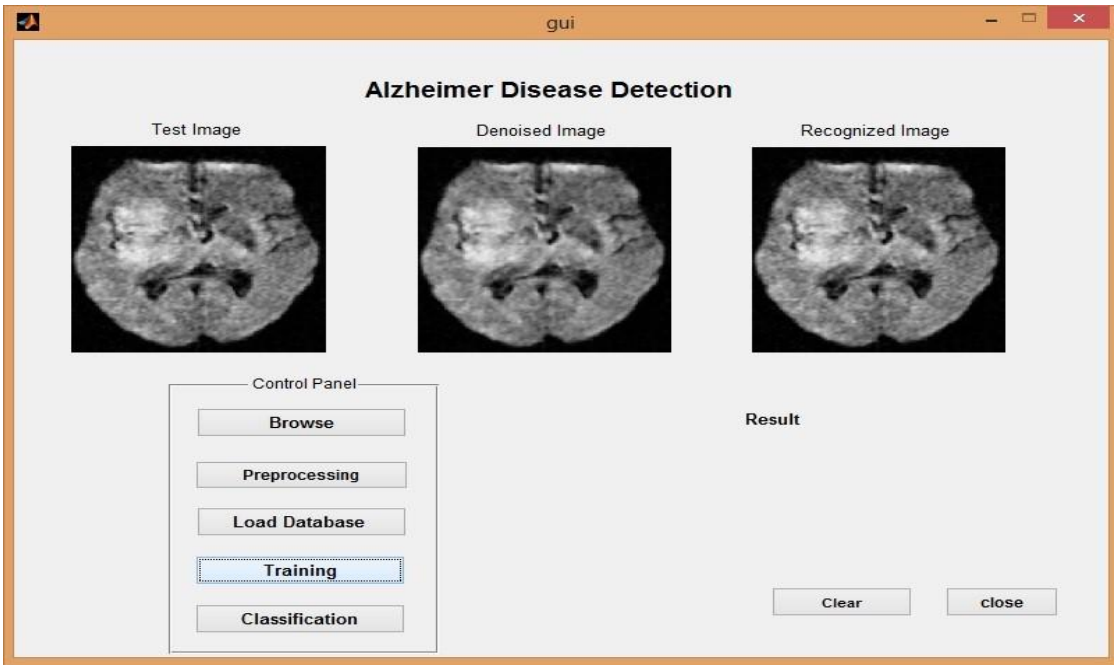


**Fig 4.6.1. Preprocessed Images**

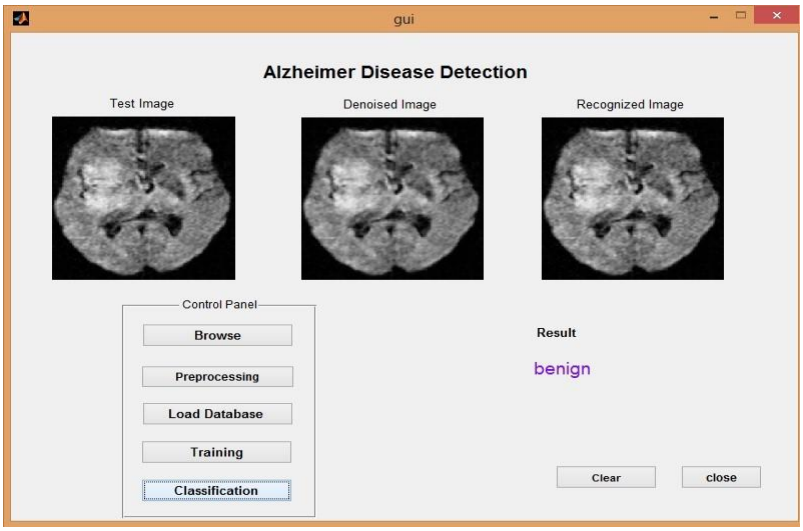


**Fig 4.6.2. Classification result**

## V. CONCLUSION

The MRI image of both normal and Alzheimer's affected person are collected and parameters like white and gray matter volume, cortex area, brain density were calculated. The ratio of gray and white matter volume will be more for person having brain abnormality. Related works were done to classify the Alzheimer's disease using the different methods for MRI like preprocessing, feature extraction, feature selection. Median filter has been applied in preprocessing and ROI has been used which finely detects the edges of an image which makes it easier for feature selection. Various ROI outputs have been shown which has detected the regions of interest required for the input images.

Further the detection of AD using the watershed principle for image segmentation and Independent component analysis is a method which is proposed for finding underlying components from multivariate statistical data and Support vector machine can be used for data analyzing and pattern recognizing.

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