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Extracting Salient Brain Patterns for Classification of Neurodegenerative Diseases

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ABSTRACT: An accurate diagnosis of Alzheimer's diseases based on saliency map characterization is carried out on thirty two database images. This paper gives fully automatic image analysis method and attempts an approach for classification of brain images to find out pathology and normality part of brain by extracting salient features of input brain image and the region of interest is identified using kernel k-means algorithm. A support vector machine (SVM) a supervised learning process is used for classification of AD, which is identified as blue color is normal brain part and red color is pathology related.

KEYWORDS: Support vector machines(SVMs); Alzheimer's disease(AD); Anatomical patterns; normal controls (NC)

I. INTRODUCTION

Neurodegenerative diseases affect central nervous system. Neurodegenerative is combination of two words those are Neuro means 'nerve cell' and Degeneration means 'progressive losses'. Overall definition of Neurodegenerative diseases is progressive loss of memory that includes loss of neurons and death of neurons intern that leads to loss of structure of nerve and functions of nerve.

An Alzheimer's diseases start as small or mild and progressively it will get worse. The symptom of this disease includes loss of thinking skills, memory and behavioral changes. It starts in late middle age around 45 to 65 age groups or in old age and even it can affect any age group as well.

The diseases is characterized under four stages based on functional impairment or differences, those are Pre-dementia, moderate and advanced. In Pre-dementia, those are more observable like short time memory loss; in this it shows that to difficult to remember the recent happened facts. In early stage the patient faces difficulties with perception and language. In moderate stage the performance of most common activities of daily living is forgotten and speaking difficulties also occurs. In advanced or final stage the patient is completely depend upon others or caregivers and language is reduced to phrases or even one single word this leads continuous loss of speech. Neuroimaging is a valuable mat lab tool for diagnosis of this type of neurodegenerative disease such as Alzheimer diseases. Neuroimaging includes the extraction of anatomical patterns of database images; the extraction of anatomical patterns is based on visual saliency maps. Used to differentiate between normal controls (NC) and Alzheimer's disease (AD) [4].

II. RELATED WORK

The section represents the previous methods those used for classification of Alzheimer's diseases. In this paper of classification of Alzheimer diseases is carried out by "Chupin M , Geradin E and boutet C"[1]. The method uses a fully automatic segmentation method. The results are compared with eight patients with AD. The classification proved accuracy is 60 to 80 percentages.

In second method "Zhang D, wang Y"[2] proposes a method that uses different learning parameters and uses maximum like hood method to classify the data images and the accuracy is 74 percentage in classification process.

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In[3] ""Christos Davatzikos.,Yong Fan" proposes a method that leads to cross validation of Alzheimer diseases differentiation via pattern classification method using mci group images uses a detection of patterns of brain diseases that leads to 90 percentage of classification accuracy.

III. PROPOSED ALGORITHM

A. *Block Diagram:* The proposed method contains two sections one is trained section another one is test section. In trained section all the images to be trained first and stored in database as database images. After that test one by one image for further classification process of Alzheimer diseases.

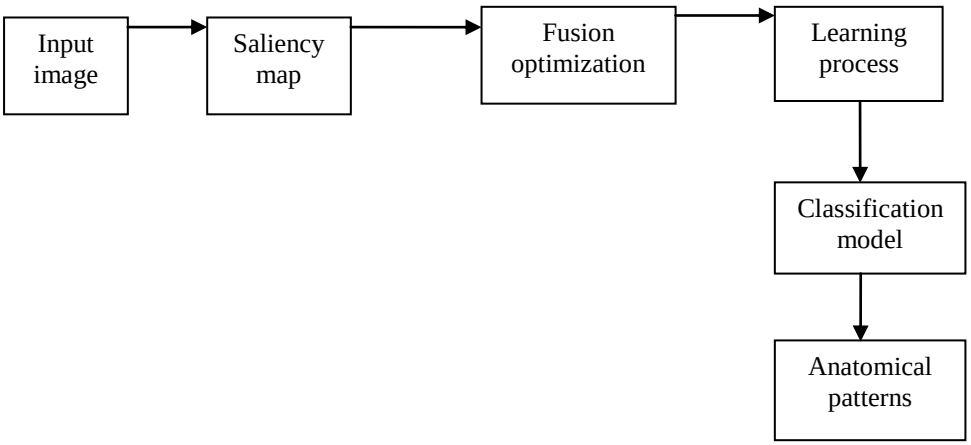

Figure 1.Block diagram of proposed system

Figure 1 shows the proposed system. Brain images from the database are given as input then the given input image is converted into Gray image so that computation in mat lab is reduced. All images should be processed in Gray format. The converted Gray image is passed through saliency method to get saliency map. After getting saliency map it compares with some predefined threshold values which is stored in dot mat file and gives saliency map of input image. After getting saliency image the normalization process is carried out so that range of pixel intensity values changes. After saliency calculation the fusion method is carried out to get master saliency of each scaled images. Using kernel K-means clustering method depending on feature values the relevant information is extracted, classified using SVM classifier and anatomical pattern analysis is done. Support vector machines are supervised learning model that associated with learning algorithms that used to analyse the data and identify the patterns which is used for classification process and map the trained data to classify accurately. Red regions are pathology and blue regions are normality for identification of brain diseases. In this way anatomical interpretation is done. Performance analysis is based on accuracy, sensitivity and specificity is done.

There are three methods for calculation of saliency maps first one is feature extraction fallowed by activation maps and combination. In figure 2 the saliency map construction is shown. The input brain image is divided into multiple of three scales and based on intensity orientation and contrast the features are extracted of each scaled images and saliency calculation is done using above three methods and kernel k-means method and all three images summed together to get master saliency map

The main method is to get saliency map of given input image, based on orientation, intensities and contrast as shown in figure 2

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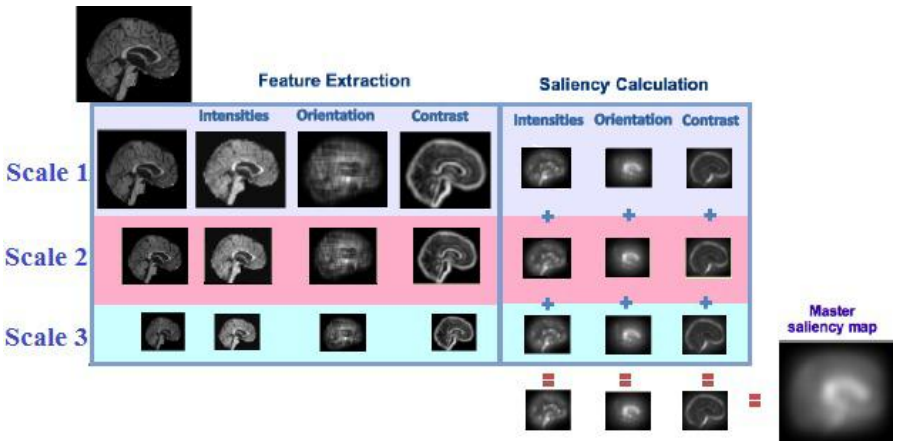

Figure 2. Saliency maps Construction

B. Modules and modules description

Modules

- saliency map
- normalize
- kernel feature extraction
- svm classifier
- anatomical interpretation
- performance analysis

C. Modules description

- saliency map

This module gives the saliency map of given input image that maps the each feature into its neighboring pixel feature so that degree of difference is calculated using Euclidian function. Each feature maps into a complete measure using saliency map that combines related information from single information into a global measure. Saliency typically calculated from contrasts between the given location and their neighbourhood.

- Normalization

To changing the Intensity, Coordinates values, etc…., Normalization is process of changing the pixel intensity values. It is also called contrast stretching or histogram stretching. In normalization process same constant dimensions are identified and differentiated, so that it is used to produce anatomical regions.

- Kernel Feature Extraction

Due to the increased popularity of the learning method which is known as Support Vector Machines uses kernel method for feature extraction. It is calculated in terms of kernel k-means method so that features can be extracted.

- SVM Classifiers

Support vector machines are supervised learning model that associated with learning algorithms that used to analyse the data and identify the patterns which is used for classification process and map the trained data to classify accurately.

- Anatomical interpretation

Red regions are pathology and blue regions are normality for identification of brain diseases. In this way anatomical interpretation is done.

- Performance analysis

Performance analysis is based on accuracy, sensitivity and specificity is done.

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IV. EXPERIMENTAL RESULTS

Screen shots: GUI Creation

The below screen shots shows output for the experimental results.

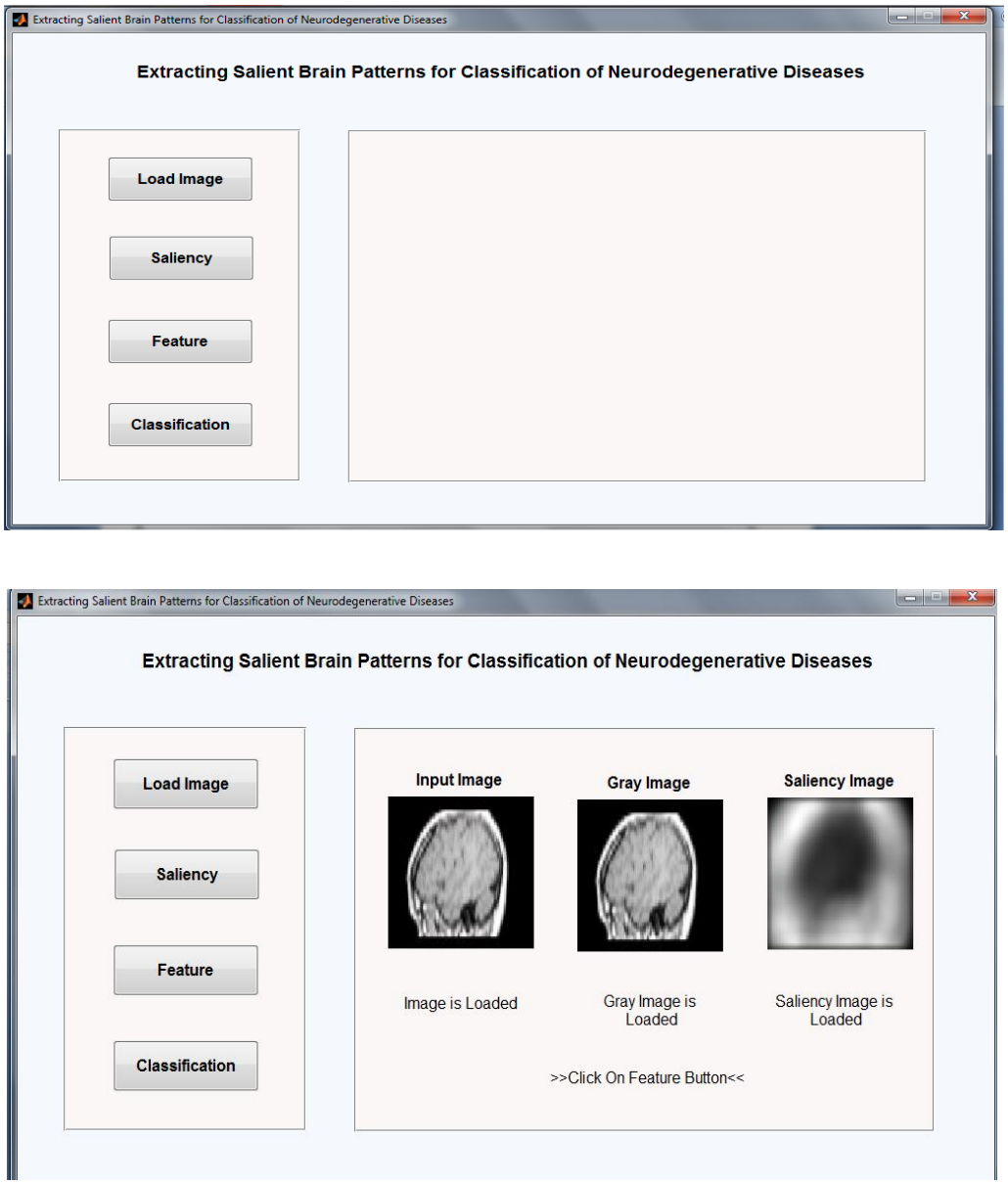

Figure 3. Saliency maps output

Load image from database choose any image after that convert input image to gray image. Then click saliency image. Then we will get saliency image. After that click feature button, then we will get one feature extraction window as shown below, before click normalize button then normalize image will loaded. Then click the test features here we will display some feature values as shown in figure 4.Before that Click next button to further process.

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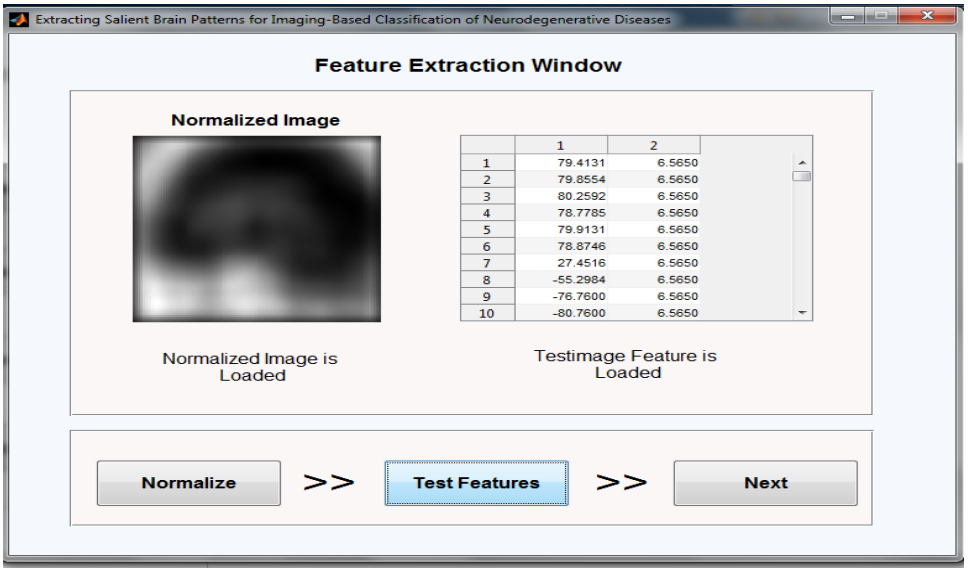

Figure 4. Feature extraction output

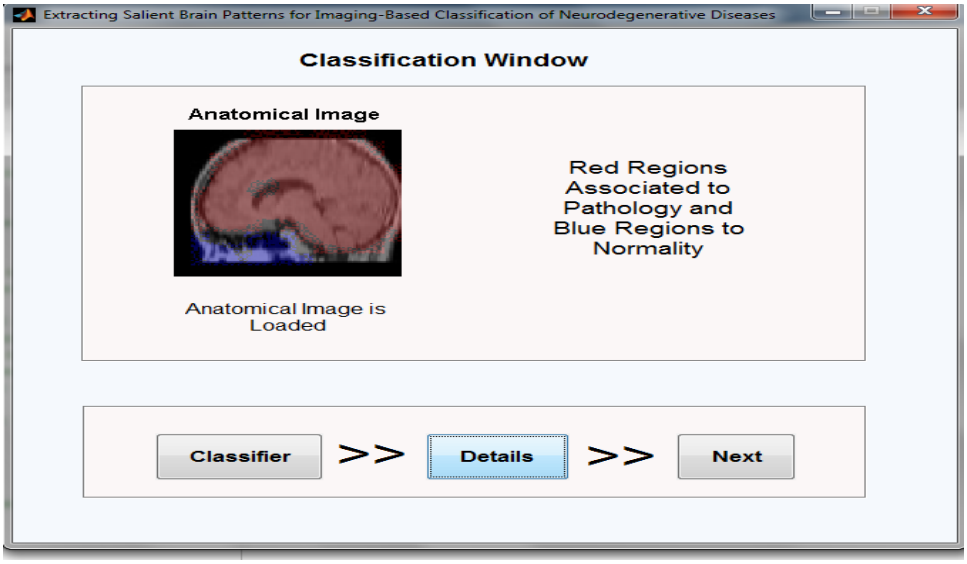

Figure 5. Classification window

After getting feature values for given input image as shown in figure 4, it will load the test features and compare it with trained image feature values. In figure 5 it will classify and give details as red regions associated with pathology and blue regions are normality.

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V. CONCLUSION

TABLE1. REPRESENTATIVE METHODS IN THE LITERATURE OF AD CLASSIFICATION

Reference	Methods	Percentage of accuracy
[1]	Fully automatic segmentation method	60-80%
[2]	Maximum like hood method	74%
[3]	Pattern classification method	90%

In this paper the accuracy of 97% is achieved using saliency map characterization and kernel k-means method is adapted which is very useful in differentiation of Neuro degeneration diseases with better accuracy.

REFERENCES

1. Chupin, M., et al.: "Fully automatic hippocampus segmentation and classification" in Alzheimer's disease and mild cognitive impairment applied on data from ADNI. Hippocampus 19(6), 579–587 (2009).
2. Zhang, D., Zhou, L., Wang, Y., Yuan, H., Shen, D.: Multimodal classification of Alzheimer's disease and mild cognitive impairment. NeuroImage,856–86 55(3),2011.
3. et al., Davatzikos, C: Detection of prodromal Alzheimer's disease via pattern classification of MRI. Neurobiology of Aging 29(4), 514–523 (2008).
4. Andrea Rueda, Fabio A. González, Senior Member, *IEEE*, and Eduardo Romero "Extracting Salient Brain Patterns for Imaging-Based Classification of Neurodegenerative Diseases" IEEE Transactions On Medical Imaging, No. 6, Vol. 33, June 2014.
5. J. Górriz, J. Ramirez, D. Salas-Gonzalez, and I. Álvarez, P. Padilla, M. López, "NMF-SVM based cad tool applied to functional brain images for the diagnosis of Alzheimer's disease," IEEE Trans. Med. Imag., pp. 207–216, vol. 31, no. 2, Feb. 2012.
6. A. Chincarini et al.,"Local MRI analysis approach in the diagnosis of early and prodromal Alzheimer's disease," NeuroImage, no. 2, pp. 469–480, vol. 58, Sep. 2011.
7. C. Brechbuhler, M. Styner, G. Szckely, and G. Gerig, "Parametric estimate of intensity inhomogeneities applied to MRI," IEEE Trans. Med Imag., vol. 19, no. 3, pp. 153–165, Mar. 2000.

BIOGRAPHY

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