Diagonizing Diseases by Retinal Images Using Image Processing

[1]V.Surya, [2]A.Vajitha Parveen, [3]I.S. Suganthi
[1,2]UG Student, [3]Assistant Professor
[1,2,3]Department of Electronics and Communication
[1,2,3]Mohammed Sathak A J College Of Engineering
[1]suryavaratharajan@gmail.com, [2]vajitha6@gmail.com, [3]ece.suganthi@msajce-edu.in

Abstract : Digital image processing plays a vital role in medical field for detecting and identifying various diseases through digital processing techniques. Retinal images are used to diagnose various diseases like cardiovascular, diabetes, hypertension, stroke, tumors. Retinal blood vessels are difficult to detect, so segmentation of retinal blood vessels is important. In this paper we proposed a K-Means Clustering algorithm for retinal blood vessels segmentation based on neural networks using DWT, GLCM as features. The proposed algorithm was tested on mat lab versions. Thus, from this the disease is identified with various retinal images.

***IndexTerms* - Retinal blood vessel, image segmentation, k means clustering, classification, features selection.**

I. INTRODUCTION

Your eyes could be the window to your health .The blood vessels in human eye is very useful in diagonizing diseases. Its segmentation in retina is a difficult task due to intrinsic blood vessels and bad contrast of imaging. The Project proposes the Retinal image analysis through K-means clustering and neural network. It plays a vital role in detecting some major diseases like cardio vascular diseases, cancer, eye tumour, hyper tension, etc in early stage of disease which can be performed by comparing the various states of retinal blood vessels like contrast, correlation, entropy, etc. As seen earlier intrinsic characteristics of retinal blood vessel makes the detection process difficult. Here, we proposed an algorithm of K-means clustering to segment the affected retinal blood vessels effectively. The green plane will be selected because of its high contrast to extract vessels accurately. The Daubachies wavelet transform is used to enhance the contrast of image for effective vessels detection. A simple thresholding method is used in the existing method for segmentation. Experimental result proves that the blood vessels and exudates can be effectively used to detect the diseases effectively.

II. PROPOSED WORK

Detection of blood vessels in retinal image is by using the block diagram as given below. In this block diagram input image is the retinal image of a normal or abnormal retina. The combination of multi structure morphological process and Segmentation technique used effectively for retinal vessel and exudates detection in previous paper. In this we used neural network technique; The Daubachies wavelet transform is used to enhance the contrast of image for effective vessels detection.

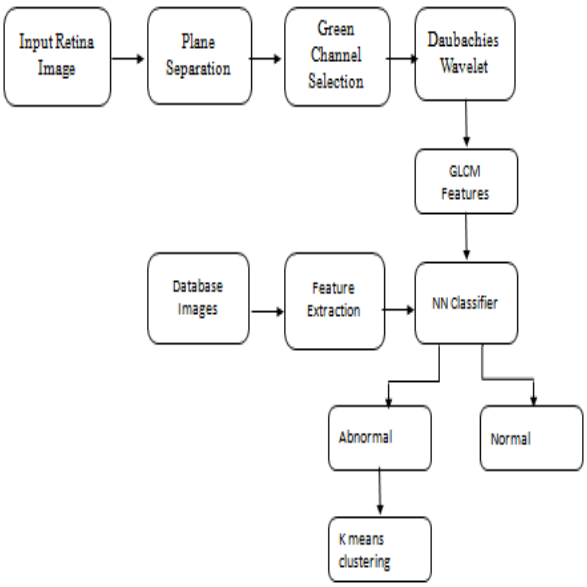


Fig1. Basic block diagram of detecting diseases

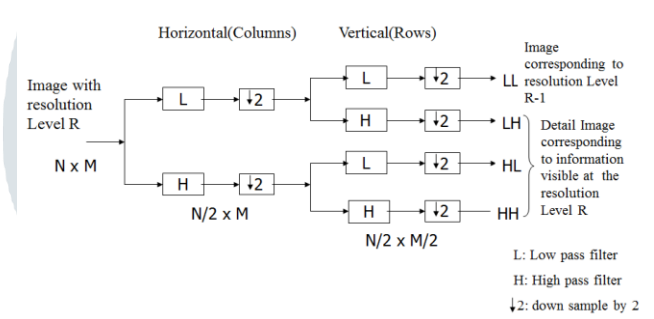
2.1 Extracting the Green Channel from the Input Image

An RGB image represents the primary colour of the image, representing the red, green, and blue colour. These pixel values are stored directly in the array of image. In MATLAB, the red, green, and blue component of an RGB image resides into a single i-by-j-by-3 array. The i and j are the numbers of rows and columns of pixels in the image, and the third dimension consists of three planes, i.e., red, green, and blue plane values. For each image the red, green, and blue colour elements combine to create the pixel's actual colour. For further processing, the green plane of the RGB test image is extracted.

Fig 2: Green Channel Separation

The Daubachies wavelets is a family of orthogonal wavelets used under a discrete wavelet transform this function is called as the **father wavelet**. This generates an orthogonal multi resolution analysis. It is a local transformation from time and frequency domain. It separates **t**he image into four sub band images LL, LH, HL and HH. Multi Resolution Analysis is designed to give poor time resolution and frequency resolution at high frequencies. Good frequency resolution and time resolution at low frequencies. Good for signal having high frequency components for short durations.

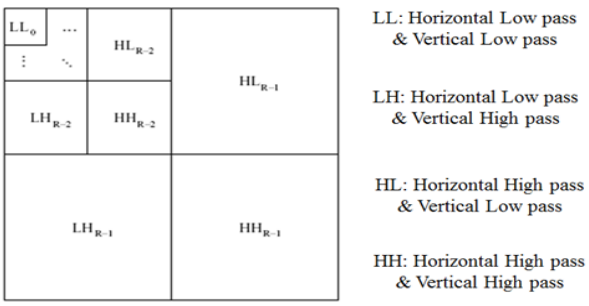
Block diagram



A high-frequency sub band contains the edge information of input image. LL sub band contains the clear information about the image. Enhancing the appearance of the image with help of this sub bands information for retrieval process. The wavelet transform is computed separately for different segments of the time-domain signal at different frequencies. A wavelet is very useful in image compression. This wavelet is similar to the Fourier transform. The wavelet transform can be expressed by the following

$$W(a, b) = \int_{-\infty}^{\infty} x(t)\psi_{a,b}(t)dt$$

We get no redundant information in this.



Gray-Level Co-Occurrence Matrix:

In statistical texture analysis, texture features are computed from the statistical distribution of observed combinations of intensities at specified positions relative to each other in the image. According to the number of intensity points (pixels) in each combination, statistics are classified into first-order, second order and higher-order statistics.

The Gray Level Co occurrence Matrix (GLCM) method is a way of extracting second order statistical texture features. The approach has been used in a number of applications, Third and higher order textures consider the relationships among three or more pixels. These are theoretically possible but not commonly implemented due to calculation time and interpretation difficulty.

A GLCM is a matrix in which the number of rows and columns is equalled to the number of gray levels, G, in the image. The matrix element P (i, j | Δx, Δy) is the relative frequency with which two pixels, separated by a pixel distance (Δx, Δy), occur within a given neighbourhood, one with intensity 'i' and the other with intensity 'j'. The matrix element P (i, j | d, ɵ) contains the second order statistical probability values for changes between gray levels 'i' and 'j' at a particular displacement distance d and at a particular angle (ɵ). Using a more number of intensity levels G implies storing a n number of temporary data, i.e. a G × G matrix for each combination of (Δx, Δy) or (d, ɵ).

Entropy

It is useful to determine the significant information from the image based on the probability of pixel values

$$S = -\sum_{x}\sum_{y} p(x,y)\log p(x,y)$$

Where, p(x, y) is the probability of each gray level.

Correlation Coefficient: It gives similarity in the small structures between the original and reconstructed images. Higher value of correlation means that more information is preserved. Coefficient correlation in the space domain is defined by:

Correlation = sum (sum (B.*A))/Sqrt (sum (sum (B.*A))*sum (sum (A.*A)));

Where, B is difference between fused image and its overall mean value.

A is difference between source image

These are some features of GLCM used in proposed method.

2.2 Architecture of Neural Networks

1. Feed-forward networks:

Feed-forward, sometimes written feed forward, is a term describing an element or pathway within a control system that passes a controlling signal from a source in its external environment, often a command signal from an external operator, to a load elsewhere in its external environment. A control system which has only feed-forward behaviour responds to its control signal in a pre-defined way without responding to how the load reacts; it is in contrast with a system that also has feedback, which adjusts the output to take account of how it affects the load, and how the load itself may vary unpredictably; the load is considered to belong to the external environment of the system.

In a feed-forward system, the control variable adjustment is not error-based. Instead it is based on knowledge about the process in the form of a mathematical model of the process and knowledge about or measurements of the process disturbances.

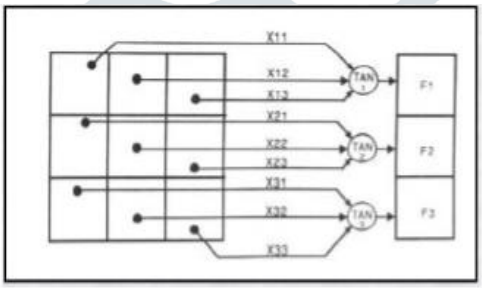


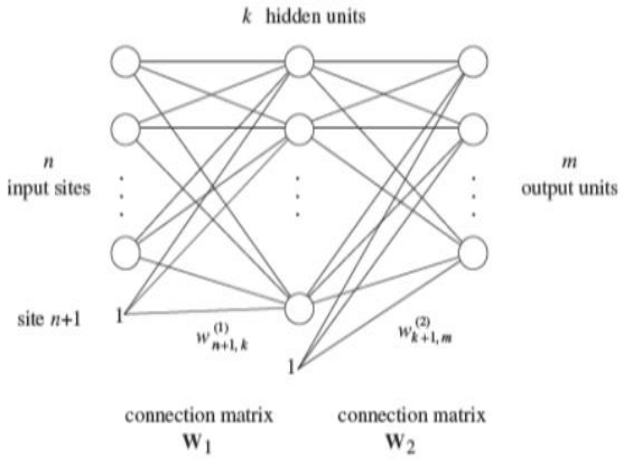
Fig3. Neural Network classifier.

2. Feedback networks

The performance of the Back Propagation network was evaluated in terms of training performance and classification accuracies.

Back Propagation network gives fast and accurate classification and is a promising tool for classification of the tumors.

Back propagation algorithm is finally used for classifying the pattern of malignant and benign tumor.



3.1 K-Means Clustering Algorithm

K-means clustering is a quantization method; this method is from signal processing, this is mostly used for clustering analysis in image processing. K-means clustering important aim is to partition n number of observations into k clusters in which each observation belongs to the cluster with the nearest mean of image. This results in segmenting the abnormal part of image.

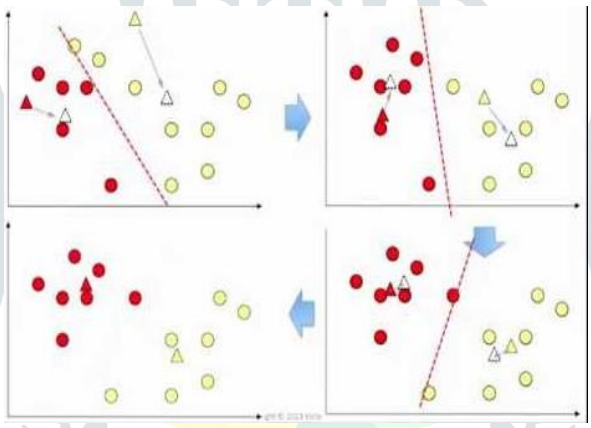


Fig 4: Graphical Representation of K-Means Clustering

Because of the intrinsic characteristics of retinal blood vessel we used the k-means clustering algorithm over other clustering algorithm to segment the affected part of retina effectively.

III. SIMULATION RESULTS

The following are the simulation results of proposed methodology. The MATLAB code is done in GUI.

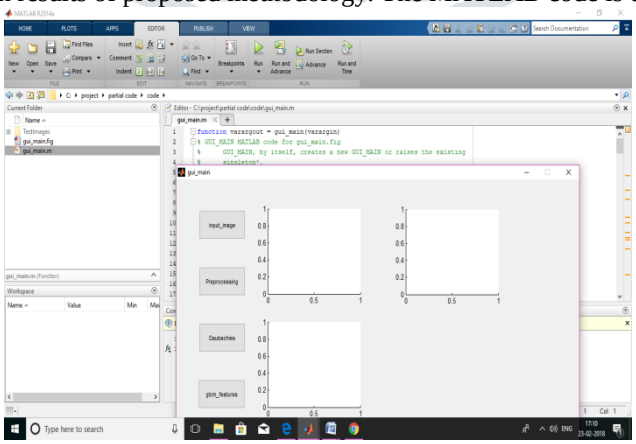


Fig5. GUI for Proposed method.

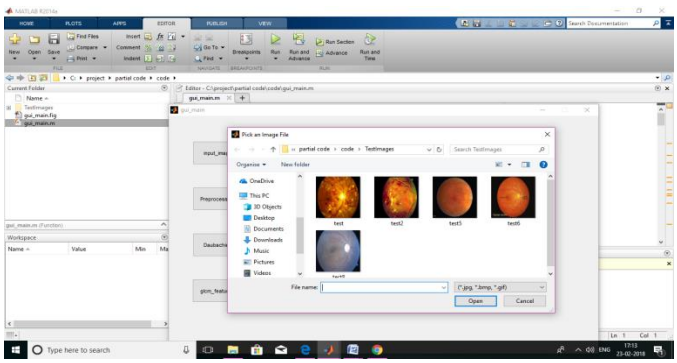


Fig6. Browsing Test image from database.

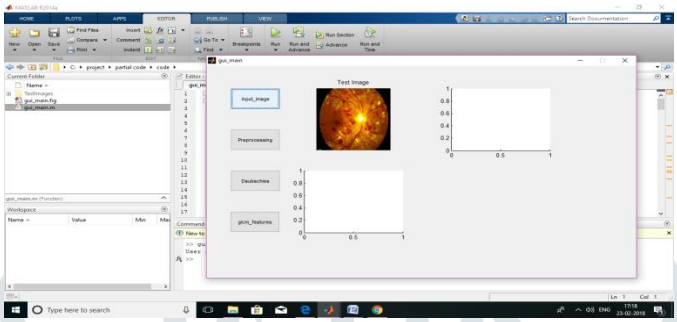


Fig 7: Input Test image.

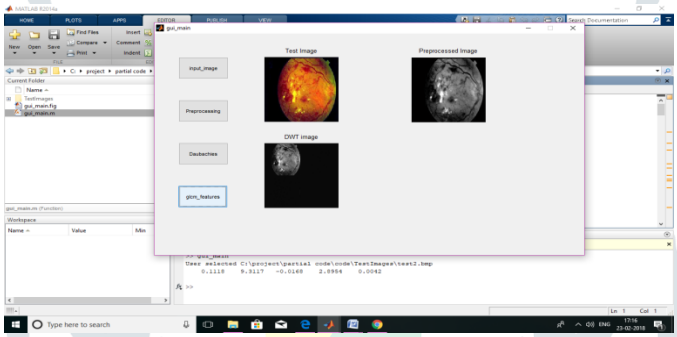


Fig 8: Test image is preprocessed, Wavelet transformed and GLCM values extracted

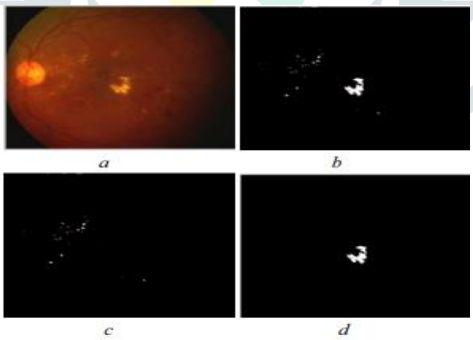


Fig 9: K- Means clustering image

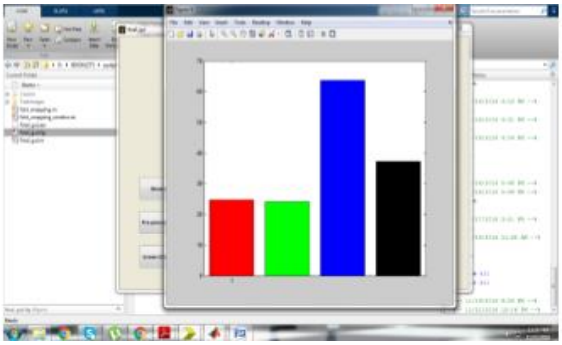


Fig 10: Graph of GLCM Features

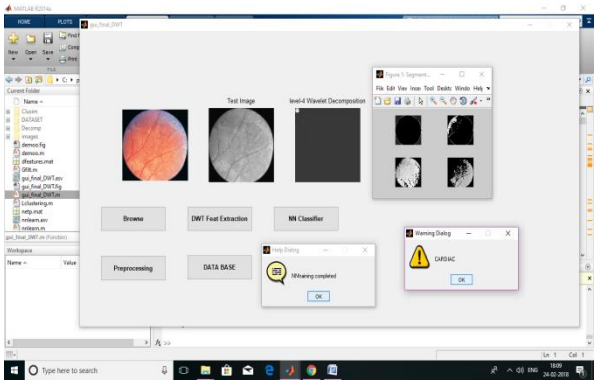


Fig 11: Detection of Cardiovascular disease

By comparing GLCM features of Test image and Database Images using NN Classifier, diseases can be detected.

IV. CONCLUSION

The Paper proposed is used to identify and detect the accurate blood vessels and exudates from the retinal image. It helps to detect some major diseases like blood pressure, hypertension, cancer, tumors and cardio vascular disease. This can be easily performed by comparing the states of retinal blood vessels through GLCM features. Intrinsic characteristics of blood vessel make detection process difficult. Hence, we proposed an algorithm to detect the retinal blood vessels accurately. Experimental result proves that the diseases can be effectively detected by applying NN classifier and K-means clustering for segmenting the affected area in the retinal image.

V. FUTURE SCOPE

1. The proposed method can be implemented as devices.
2. It can be proposed in Internet of Things to get more advantages in medical field.

VI. REFERENCES

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