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Retinal Disorder Detection and Identification of Disease Using Diabetic Retinopathy

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Abstract - *The medical image processing has vast importance in the field of medicine. It is mostly useful for the clinical study and also in non-invasive treatment. In this paper, fundus photographs or retinal images are used. These are broadly used in the treatment of various eye diseases, which occurs in diabetes patients. Generally specially trained ophthalmologist grade the fundus images manually which is, time overriding. Therefore this paper helps in the early recognition of diabetic retinopathy and deals with classifying retinal images as normal, mild and severe.*

Key Words: **diabetic retinopathy, retinal images, normal, mild, severe**

1. Introduction

The quick development of diabetes is one of the chief difficulties of existence health apprehension. Diabetes or diabetic mellitus is a situation where the person's blood sugar (blood glucose) level becomes high due to too little production of insulin or the body's cell does not react properly to the insulin. Glucose is a natural carbohydrate, which is used by our body as a source of energy. Blood glucose is controlled by means of a number of hormones. The cells in the human body which send messages from cells to other cells are the Harmones and a sort of hormone made with the aid of the pancreas in beta cells is the insulin. When we consume, the pancreas makes insulin make an impression on different cells to take up glucose from the blood, and afterward this glucose is utilized by the cells for vitality

Diabetic retinopathy (DR) is a common retinal complication associated with diabetes. The prevalence of Diabetic Retinopathy is high and the incidence is growing in step with worldwide increases in diabetic retinopathy. Patient's retinal image has to be analyzed for detection of disease. Retinal images are usually known as fundus images. These images have usually red tint due to rich blood supply. Fundus image contains optical disk, macula and blood vessel, which are important for diagnosis of disease. Diabetic screening programs are necessary in addressing all of these factors when working to eradicate preventable vision loss in diabetic patients.

2. Overall Approach

In this paper, we propose to design automated detection of diabetic retinopathy using feature extraction from the fundus image. Here feature extraction is done using MATLAB. The extracted features would be blood vessels, exudates and microanuerysms. After that classification of images through abnormality recognition in macular region.

There are separate steps carried out to extract features from fundus images. Output of paper is depends on the success rate of each step. These steps are listed in following block diagram.

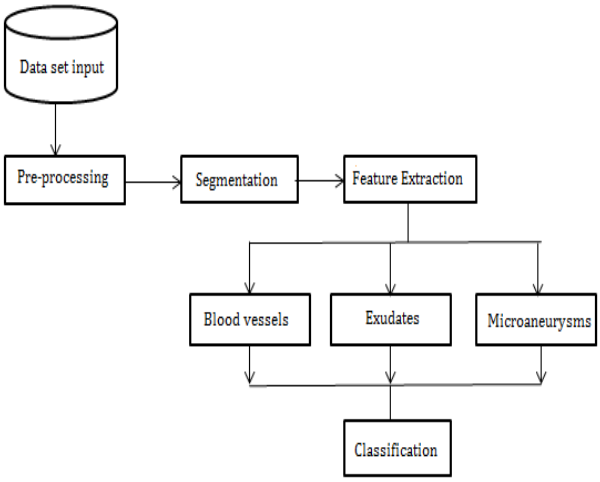
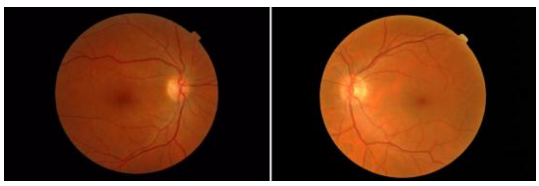


Fig.1 Block diagram of proposed work

Fig.1 describes the sequence of steps in recognition of diabetic retinopathy.

Pre-processing

Input retinal images are taken from the dataset. The preprocessing of the images is essential since for the identification of the abnormalities and the attributes, the eminence of the fundus images should be good. Preprocessing is implemented to boost the probability for accomplishment of the succeeding steps. Resizing of the image, Gray scale conversion and Contrast improvement are the phases of the preprocessing.



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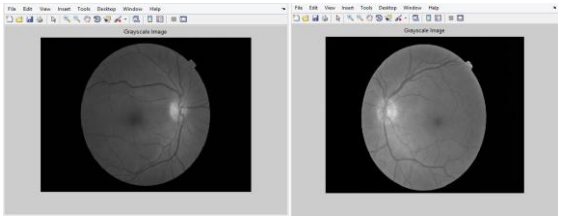

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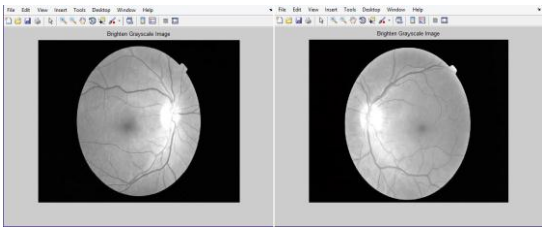


(c)

Fig. 2 Preprocessing (a)Original images, (b)Grayscale images, (c)Contrast adjusted images

Segmentation

Image segmentation is the process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in images. After image segmentation features of retinal image features are extracted.

Feature Extraction

Feature extraction in image processing begins with the original set of calculated data. It constructs the features or the resultant values which are intended for informational. Feature extraction is an inclusive term for strategies of building combinations of the variables to get around these troubles; however it portrays the information with sufficient accuracy. Blood vessels, Exudates and Microaneurysms are considered as attributes to detect the defect in the retina. Morphological operations are utilized for extracting the features.

Blood vessel extraction

To accomplish blood vessel fragmentation, the pre-processed image is occupied as input. The contrast of the image is enhanced. Canny edge recognition is applied to find the edges. The erosion chased by dilation are performed for this 'disk' of radius 6 is employed as structuring element. Circular border is obtained by subtracting eroded image from dilated image. Green component is extorted for further processing since blue component have extremely low contrast while in red channel images are roughly saturated. Inverse of the image is obtained by complementing the green component. By using morphological opening blood vessels with noise are obtained. The optic disc center is set up by estimating the brightest point. Then the optic disc mask is superimposed on the image. Blood vessel with noise and mask overlaid images are operated to get the fine-tuned blood vessels. In the end the borders are subtracted to attain final blood vessels.

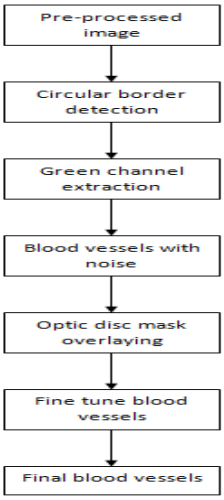
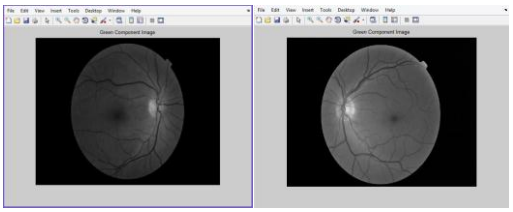


Fig 3 Flow chart of blood vessel extraction



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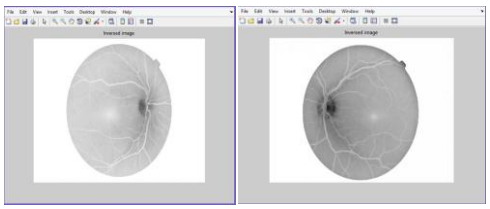

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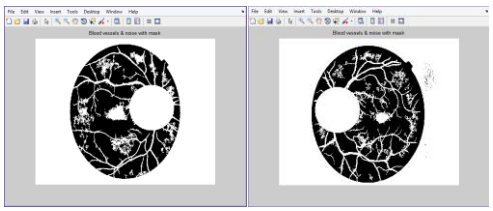

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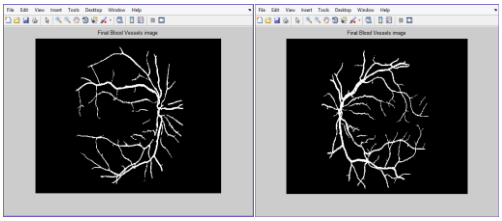


(d)

Fig.4 Blood vessel extraction a) Green channel image, b) Inverse of the image, c) Blood vessel with noise d) Final blood vessels

Exudates detection

The important indicator of diabetic associated eye diseases is exudates. The lipid and protein discharge from the injured blood vessels is the major reason for the exudates. The blood vessels are detached by using closing operation, which is performed by structuring element. Optic disc mask is taken away from segmented image along with borders elimination. Finally exudates are detected by closing operation.

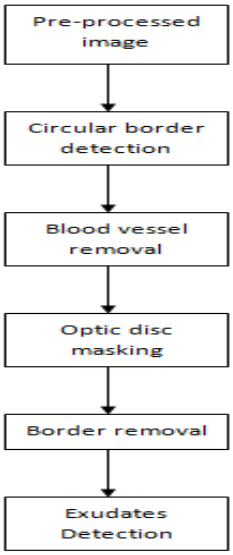
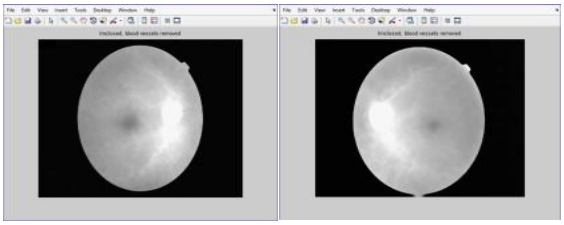


Fig 4 Flow chart of exudates detection



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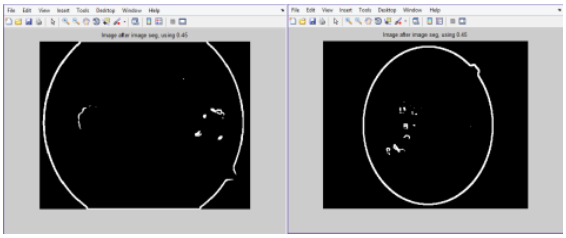

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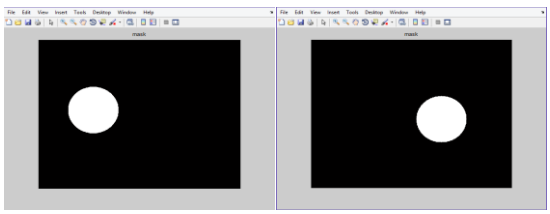

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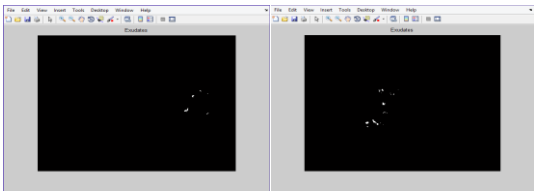


(d)

Fig.5 Exudates detection a) blood vessel removed, b) image after segmentation, c) optic disc mask, d)exudates

Microaneurysms detection

Microaneurysms are tiny blood lumps which arise due to vessel rupture. In this stage Green channel's contrast is augmented with the help of adaptive histogram equalization. Edge recognition and circular boundary confiscation is done. Microaneurysms along with noise are found via 'hole' filling and binary area open output subtraction. Exudates eradication is made twice to increase contrast in green channel. The blood vessel region is removed by thresholding. Finally microanueysms are detected through optic disc overlaying.

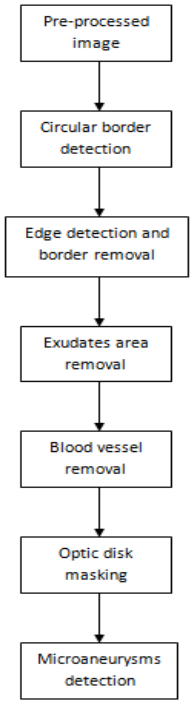
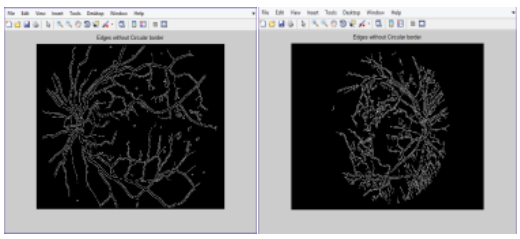


Fig 6 Flow chart of microaneurysms detection



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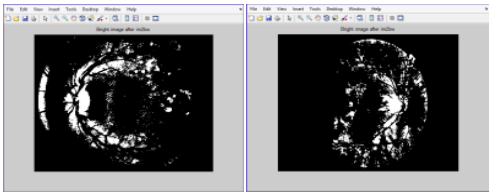

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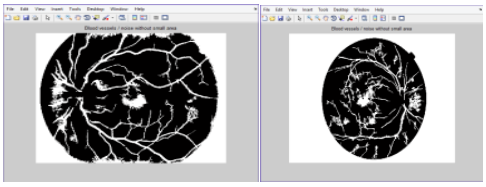

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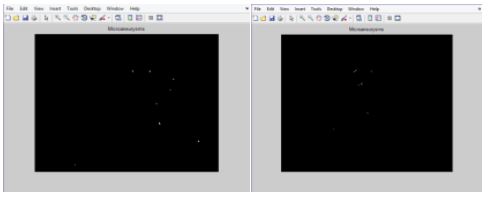

(d)

Fig. 7 Microaneurysms detection a)edge after circular border removal, b) binary conversions, d)microanuerysms after exudates removal, c)blood vessel and noise without small area, d) microanuerysms

Classification of images

Making use of Graphical user interface the image grouping is revealed. For the abnormal images macula detection and macular region are spotted in order to demonstrate the abnormality classification as normal, mild and severe.

Result Analysis

Tested with 6 retinal images of patients. Table 1 shows test cases for retinal images. Blood vessel, exudates, microaneurysms area is calculated and retinal images are classified as normal, mild and severe.

Test cases	Retinal Images	Eye	Blood vessel	Exudates	Micro aneurysms	Classification
01		Right	19742	0	0	Normal
02		Right	22566	0	90	Mild
03		Right	26027	59	339	Severe
04		Left	22898	0	0	Normal
05		Left	29386	6	39	Mild
06		Left	20095	666	786	Severe

Table 1: Test cases for retinal images

3. Conclusion

Today, the number of people suffering from diabetes is increasing rapidly. The image processing of fundus images has a significant role in the medical field. In this paper, a novel method is approached for the early recognition of diabetic retinopathy. Finally retinal images are classified as normal, mild and severe. This is very useful in medical imaging department for the treatment of diabetic retinopathy. The purpose of this system is to prevent vision loss in diabetic patients.

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