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Detection of Glaucoma and Microaneurysm in Retinal Fundus Images Based on Optic Disk and Optic Cup Segmentation

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Abstract-Diabetes cause's metabolic and physiological abnormalities in the retina and the changes suggest a role for inflammation in the development of diabetic retinopathy. The occurrence of micro aneurysms, a small red dot in retinal layer in the eye, is one of the early signs of diabetic retinopathy. To serve this purpose, various automated systems have been designed which includespreprocessing methods and candidate extractors. The objectives of this paper are to classify different stages of diabetic retinopathy as mild, Moderate, and Severe.

Glaucoma is an irreversible chronic eye disease that leads to vision loss. In this paper, we propose a method for cup to disc ratio (CDR) assessment using 2-D retinal fundus images**.** In the proposed method, the optic disc and optic cup is segmented using thresholding algorithm. The cup to disc ratio (CDR) is computed based on the measurement of the segmented optic disc and optic cup. The Cup to Disc Ratio (CDR) of the color retinal fundus camera image is the primary identifier to confirm Glaucoma for a given patient.

Keywords: MA detection, Cup to disc ratio, Thresholding

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I. INTRODUCTION

Diabetic retinopathy is the serious eye disease which is seen in diabetic patients.This results in blindness. Diabetes causes a spread in a tissue of the eye which includes a change in an iris also. It is important, nowadays to classify the grades of diabetic retinpathy,because the grade of the disease not only gives an indication of visual prognosis but it may also be a guide to the life expectancy of the patient.MA which are tiny out pouching from the blood vessel wall suggest the possibility of diabetic retinopathy.

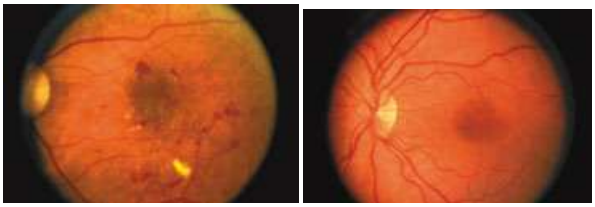

Fig 1: A retina showing signs of diabetic retinopathy. Fig 2:A normal retina.

Fig 3:Normal Vision

Fig 4:Glaucoma Vision

Glaucoma is a disease where the optic nerve dies. Due to glaucoma, loss of eyesight occurs in periphery first where the loss is less noticeable. Generally central vision is spared until very late stage of glaucoma.

II. EXISTING METHOD

Glaucoma and Micro aneurysms can be detected by pixel classification, mathematical morphology, the fusion of the two, template-based and supervised learning. From the literature survey on the references, we have concluded some points, consideration of the noise or the image normalization in the input retinal image is not given of much importance.The methods which was proposed earlier does not show high contrast image for the output image and also selection of features and classification strategy is difficult and challenging.Manual assessment is subjective, time consuming and expensive.As a result of previous technique, we get Poor and inaccurate segmentation.All MA like objects are misclassified since it is hard to distinguish from fragments of the vascular system or from certain eye feature.

III. PROPOSED METHOD

We segment the Optic disc using the adaptive thresholding method in which first preprocessing such as image filtration, color contrast enhancement are performed which is followed by a combined approach for image segmentation using thresholding and morphological operation for segmenting the Optic Cup. Based on the segmented disc and cup, CDR is computed for glaucoma screening.

As an extension part, we proposed an effective MA detector based on the combination of preprocessing methods and candidate extractors. During testing stage, the selected best combination of preprocessing and candidate extractors is applied for the given input image to detect MA's.

i)RGB to Gray Conversion

Retinal image is converted to green channel image, since in green channel the pixel value is high. The image can be process clearly.

ii)Pre-Processing

CLAHE-Contrast limited adaptive histogram equalisation is applied.

This operates on small regions and each region is enhanced. This technique combined with bilinear interpolation eliminates artificial boundaries

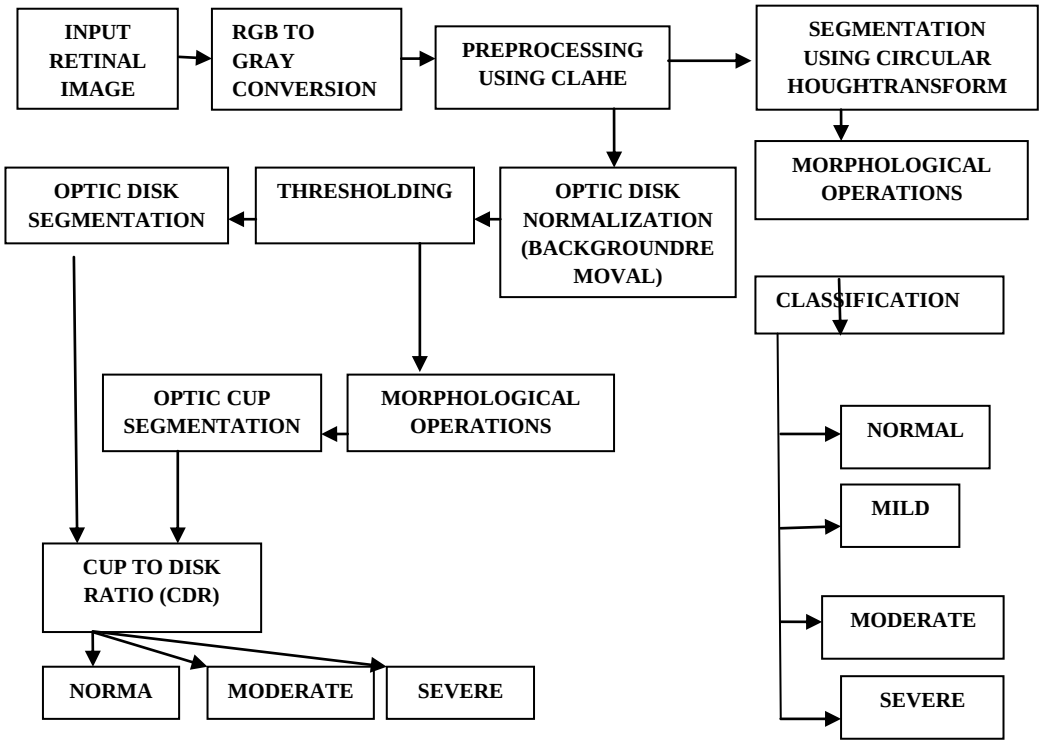

Fig 5: Block diagram

iii) Optic disk and Optic cup segmentation

Canny edge detection is performed on the enhanced image. Compute the mean of green channel image.

Compute the difference between green channel image and mean image. The optic disk and optic cup are segmented by providing a threshold value.

CDR=Area of optic cup/Area of optic disk

iv)Based on the count of CDR,

CDR< 0.5 Normal, CDR-0.5 – 0.7 Moderate, CDR > 0.7-Severe

v)MA detection

By circular Hough transform the candidates are extracted ie set of circular objects are extracted. Morphological operations are done to extract microanerysm.

Based on the count of MA,

Grade 1=1<MA<5-Mild, Grade 2=5<MA<15-Moderate.

Grade 3=MA>15-Severe

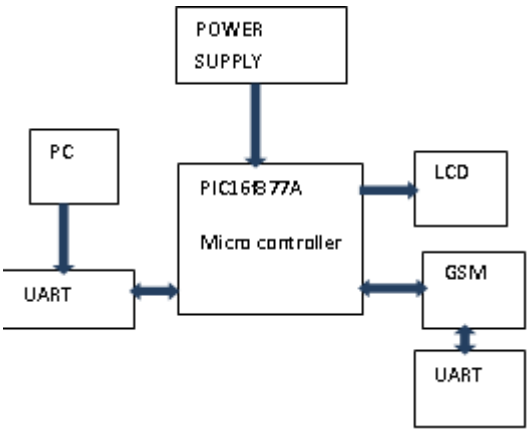

Fig 6-Hardware Diagram

We have tried to implement the MA detection in Hardware. The simulation output was transferred to embedded kit via serial port by using MAX 232 IC. We implement the PIC16f877A based microanerysm detection using diabetic retinopathy screening with intimation system. This system consists of PIC microcontroller, RS232 communication, MAX232, LCD and GSM modem and PC. Here MATLAB based red lesion detection and screening done in personal computer. The PC detects four conditional outputs like normal, mild, moderate and severe. PIC microcontroller continuously monitors patient status and displays via LCD. In severe condition, controller will automatically send SMS to patient relatives via GSM sim900.

IV. CONCLUSION

In this paper, we have proposed an MA and glaucoma detector with preprocessing technique and candidate extractor technique. Our novel framework relies on a set of preprocessing and candidate extractors pairs. Since our approach is modular, we can expect further improvements by adding more preprocessing methods and candidate extractors. We have implemented hardware for MA detection; in future it has to be modified for glaucoma detection also. However, a proper screening system should contain other components, which is expectedto increase the performance of this approach, as well.

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