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Research Article

# AUTOMATIC DETECTION OF MICROANEURYSMS IN COLOUR FUNDUS USING CIRCULAR HOUGH TRANSFORM

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## ABSTRACT

Detection of microaneurysms in fundus images using circular Hough transform has been proposed in this paper. Firstly image acquisition is done by using special fundus cameras. Sharpening technique is used to sharpen the image to remove the noise that is present in image. Sharpened image is then adjusted as per the contrasting limits. Optic disc is detected with edge detection techniques [1]. Using Circular Hough Transform, all possible candidates are identified. Later, on the basis of parameters true candidates are identified amongst them and microaneurysms are detected.



## INTRODUCTION

A retinal Microaneurysm is a tiny area of blood projecting from an artery or vein in the back of the eye. These projections may open and leak blood into the retinal tissue surrounding it. A Microaneurysm does not require any treatment on its own. The underlying systemic disorder causing them needs to be treated. Most Microaneurysms are reversible with treatment of your diabetes, high blood pressure or other disorder causing them [4].

Microaneurysm is a tiny aneurysm, or swelling, in the side of a blood vessel. In people with diabetes, Microaneurysms are sometimes found in the retina of the eye. These miniature aneurysms can rupture and leak blood. The earliest clinical sign of diabetic retinopathy, they appear as small, red dots in the superficial retinal layers. They are of 3 types,

1. MILD- This happens the tiny blood vessels of the retina begin to swell
2. MODERATE-This is a progressive eye disease and damage to blood vessel. Blood vessels get blocked.
3. SEVERE-Blood supply is blocked causing the eye to signal the need for new blood vessels part of retina is deprived of load and nourishment.

### *Need of the Project*

In this paper, an approach for automatic identification of presence of abnormality like microaneurysms in the fundus eye images has been proposed. The main point of this project is to add a framework that will have the capacity to recognize the Microaneurysm spots occurred in Diabetic retinopathy patients, from fundus images which are basically images from either shading picture or dark level picture got from the retina of the patient.

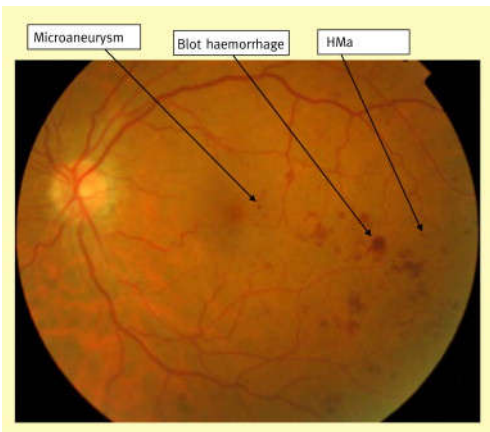


**Fig 1** Marking of Microaneurysms in abnormal fundus image

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This points in incorporating and building up a MATLAB based realistic client interface apparatus to be utilized by the ophthalmologist as a part of detection of Microaneurysm in fundus pictures.

### *Implementation*

Fig.2 illustrates the proposed method for detection of microaneurysms in fundus images. The method is divided into two parts. Firstly the colour fundus image is extracted to components of red, blue and green, given by:
(0.30XR+0.59XG+0.11XB)

This green channel extracted image is sharpened by using unsharp masking filter. The contrast of the image it then adjusted using the intensity segmentation method. Using the circular hough transform all possible circular candidates are identified which might be microaneurysms. Considering the parameters in the following steps true circular candidates which are microaneurysms are identified [2].

**Table 1** Stepwise Features for identifying true microaneurysm candidates

| Feature Number | Description |
|---|---|
| 1 | Thearea ‘a’ of the candidate. Microaneurysms have a small area compared to other objects in the retina. |
| 2 | The perimeter ‘p’ of the candidate. Microaneurysms have a small perimeter compared to other objects in the retina. |
| 3 | The aspect ratio r= l/w where l and w are the major and minor axis lengths of the candidate. |
| 4 | The circularity $c = (4.\pi.a)/p^2$.True microaneurysms are circular in shape. |
| 5 | The total intensity $i_{green}$of the candidatein $I_{green}$. True microaneurysms have higher intensities. |
| 6 | The total intensity of the candidate. |
| 7 | The average intensity $i_{green}$. |
| 8 | The average intensity of$i_{SC}$ |
| 9 | The normalized intensity in $I_{green}$, $NI_{green}=(1/\sigma)\,.\,(\text{igreen} - x)$. |
| 10 | The normalized intensity in $i_{SC}$, $NI_{SC}==(1/\sigma)\,.\,(i_{SC} - x)$. |
| 11 | The normalized average intensity in $I_{green}$, $NM_{green}=(1/\sigma)\,.\,(\text{mgreen} - x)$. |
| 12 | The normalized average intensity in $i_{SC}$, $NM_{SC}==(1/\sigma)\,.\,(m_{SC} - x)$. |
| 13 | The intensity of $I_{darkest}$in $I_{match}$. |
| 14 | The compactness is the distance of each boundary pixel of the candidate to its center, is the mean of all these distances and is the number of boundary pixels. True microaneurysms are compact. |
| 15 | The difference between the average pixel values of the candidate and a circular region (not including the candidate) centered on it in the red channel (RGB colorspace). The circular region is calculated by dilating the candidate with a disk of radius 6. Since microaneurysms have a Gaussian distribution when examining its gray-scale values, the contrast of the microaneurysm with its background should be high |
| 16 - 18 | Repeat feature 15 but in the green channel, blue channel and hue channel from the HIS colorspace. |
| 19 - 22 | The average Gaussian filter response of $I_{green}$ with $\sigma = 1, 2, 4$ $and$ $8$ |
| 23 - 26 | The standard deviation response of $I_{green}$ after Gaussian filtering with $\sigma = 1, 2, 4$ $and$ $8$ |
| 27 - 29 | The maximum, minimum and average correlation coefficient of the candidate. Candidates with a higher coefficient are more likely to be true microaneurysms. |
| 30 | The major axis length of the candidate. Generally, microaneurysms do not have a significant major or minor axis length. |
| 31 | The minor axis length of the candidate. |

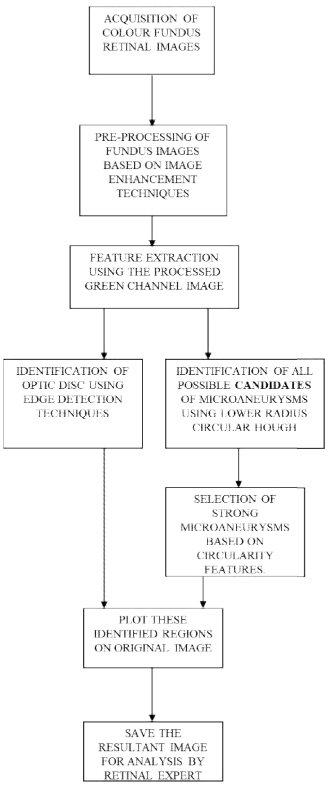
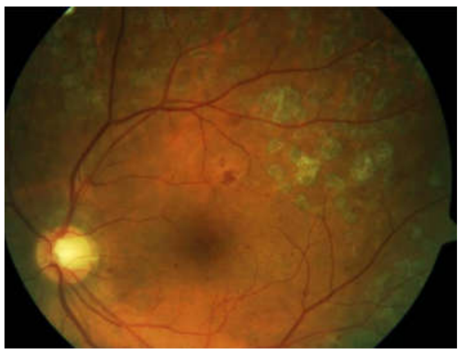
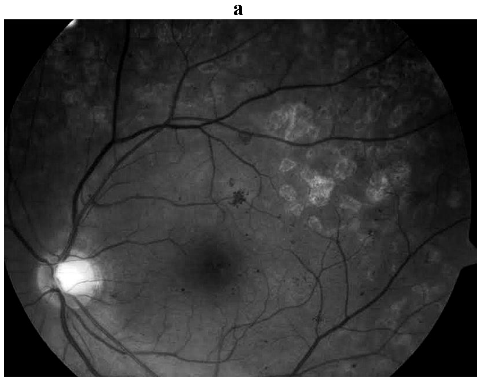



**Fig 2** Flowchart

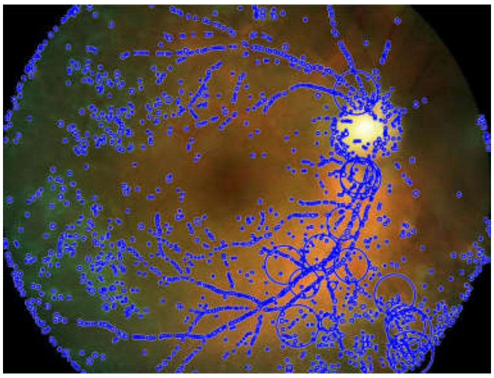
## RESULT



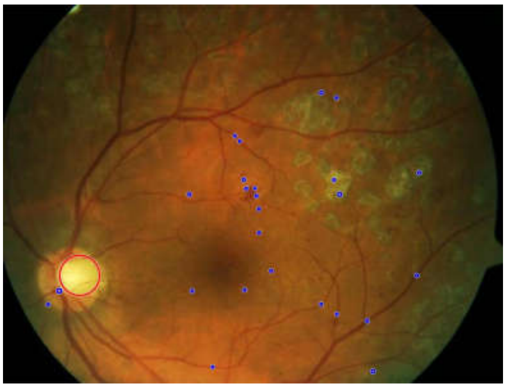
a



b



c



d

**Fig 3** (a) Original Image (b) Green Channel Extracted image (c) All possible candidates detected using Circular Hough Transform (d) Final Result- Detected Microaneurysms (marked in Blue) along with Optic disc (marked in Red).

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## CONCLUSION

Microaneurysms were detected by the algorithm. The early diagnosis and timely treatment can reduce the risk of vision loss[3]. Microaneurysms would be helpful for early diabetic retinopathy screening. This feature was specifically chosen since the contrast between a microaneurysm and its surrounding background is known to be high (in the green channel).The remaining candidates whose feature values are between minimum and maximum are the final detected microaneurysms.

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