EXTRACTING THE LESIONS FROM RETINAL IMAGES WITH DIABETIC RETINOPATHY USING MATLAB

Author[1]: VUNDAVALLI HEMASRI
Author[2]:PRATYUSHA KAKUMANU ,
Author [3]:SINKA SANDHYA ,
Author[4]: SEELAM SWETHA ,
Author[5]: KAKARLA SANDHYA RANI,

[1] *Student , ECE, VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY, A.P., INDIA*
[2] *Student, ECE, VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY, A.P., INDIA*
[3] *Student, ECE, VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY, A.P., INDIA*
[4] *Student, ECE, VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY, A.P., INDIA*
[5] *Asst.professor, ECE, VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY, A.P., INDIA*

ABSTRACT

Diabetic Retinopathy is also known as diabetic eye disease (DED).It is a medical condition in which damage occurs to the retina due to diabetes mellitus.It is caused by uncontrolled chronic diabetes which leads to complete blindness if the treatment is delayed.Manual detection of diabetic retinopathy by ophthalmologist takes plenty of time and patients suffer a lot at this time.This model will help us to extract the red lesions and bright lesions with its features using MATLAB.Actually these red lesions and bright lesions are formed due to the blood leakage in retina.This analysis is helpful in the determination of severity of disease.

Keyword: *Diabetic retinopathy, Fusion,Diabetes Mellitus.*

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1. INTRODUCTION

Diabetic Retinopathy is occurred due to diabetes as the name suggests and it is a disease that develops in eye. It results due to the high blood sugar levels which is seeded by diabetes. As time passes by having too much sugar in the blood can damage blood vessels throughout the body, including in the retina. The retina is the membrane in the back of the eye which detects light and sends signals to the brain through the optic nerve. If excess sugar blocks the tiny blood vessels that go into the retina, it can cause them to leak or bleed. The eye may then grow new blood vessels that are weaker and leak or bleed more easily.

Latest survey reveals that it is the fourth frequently occurring chronic disease, which will increase to position of second by the year 2030. Currently there are 52.8 million people who are diagnosed with diabetes that will rise to 64 million in 2030.

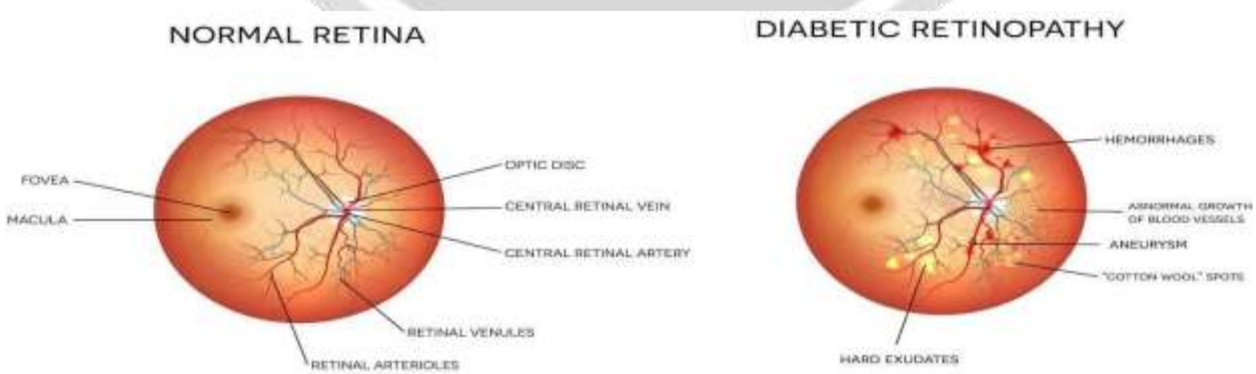
Diabetic Retinopathy is a silent disease which comes in to light only at its final stages where treatment is very difficult and in some cases it is impossible. It can be treated effectively only in its early stages and thus its early detection is very important through regular screening. Automatic screening is highly required so that manual effort gets reduced as expense in this procedure is quite high. To make it cost effective detection of deviations in retinal images should be automated through digital image capturing and image processing techniques. In DR blood vessels which helps in nourishing the retina starts leaking fluid and blood on retina which results in visual features known as lesions like microaneurysms, hemorrhages, hard exudates,cotton wool spots, blood vessel area

FUNDUS IMAGE:

Obtaining the images of fundus which are effected are the pre steps in order to detect the lesions and to know the severity of the problem.These images can be obtained through fundus camera

A fundus camera is a specialized low power microscope with an attached camera. Its optical design is based on the indirect ophthalmoscope. ... The doughnut shaped light is reflected onto a round mirror with a central aperture, exits the camera through the objective lens, and proceeds into the eye through the cornea.

NON AFFECTED VS AFFECTED RETINAL IMAGE:



3. PROPOSED ALGORITHM

The proposed system works on two types of lesions called red lesions and bright lesions

Red lesions:- Microaneurysms and hemorrhages

Bright lesions:-hard exudates (yellow spots seen in the retina) and

Soft exudates (pale yellow or white areas with ill-defined edges)

4. IMPLEMENTATION

PRE-PROCESSING:

STEP-1: Conversion of RGB to YCBCR.

STEP-2: Extracting intensity plane from YCBCR image.

STEP-3: Using adaptive histogram equalization to improve contrast(AHE).

STEP-4: Using median filter to remove noise in the AHE image.

STEP-5: Remap the processed intensity plane to YCBCR image.

STEP-6: The mathematical operation is performed to perform morphological and data operations on Processing image.

DETECTION OF RED LESIONS:

Binirize the processed image with foreground polarity(dark) with sensitivity>0.15. Consider the pixels whose sum are <2 and it is calculated along 3rd dimension, Now we perform closing operation with disc shape of radius 4.The edges of the image are enhanced by using imclearborder() function with 8 connectivity(default).Then we apply bwareafilt() method to identify the connected objects in the edge enhanced image with required area specification.

DETECTION OF BRIGHT LESIONS:

Binirize the processed image is with foreground polarity(dark) of sensitivity>0.85 greater than red lesions.Now we perform AND operation. Consider the sum of pixels of Binirize image whose sum is >=2 along third dimension Again we use imclearborder and bwareafilter for edge enhancement and the required area identification.

FEATURES OF RED AND BRIGHT LESIONS:

From each lesion extract the following features:

1. **Lesions**: - Which is obtained indirectly by using length of regionprops().

2. **Mean area**: - By finding the mean of area of required red lesions.

3. **Max area**: - By finding the max area of required red lesions.

4. **Mean perimeter**: - By finding the mean of perimeter of required lesions.

5. **Mean solidity**:-By finding the mean of solidity of required lesions.

FUSED FEATURES:

Fused features are derived from red and bright features.

The total fused features are:

1. Mean area of red lesions
2. Max area of red lesions
3. Mean perimeter of red lesions
4. Mean solidity of red lesions
5. Number of red lesions
6. Mean area of bright lesions
7. Max area of bright lesions
8. Mean perimeter of bright lesions
9. Mean solidity of bright lesions
10. Number of bright lesions

5. SIMULATION RESULTS

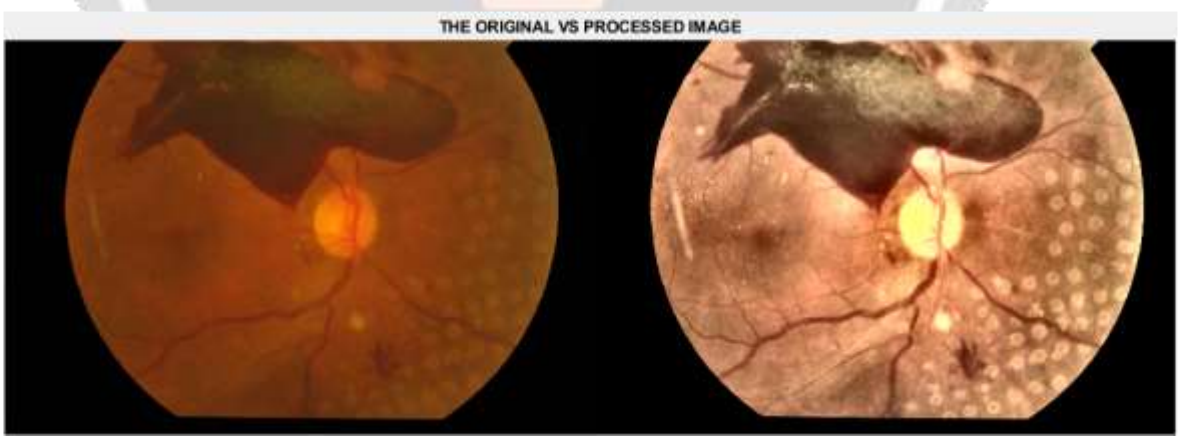


Fig: Original image vs Pre-processed image

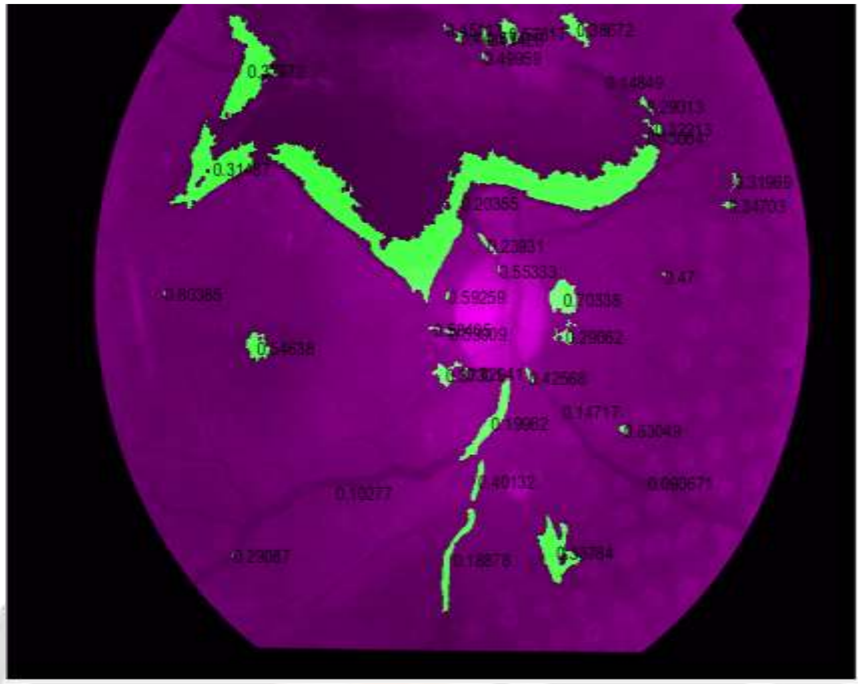


Fig: Disease causing red lesion

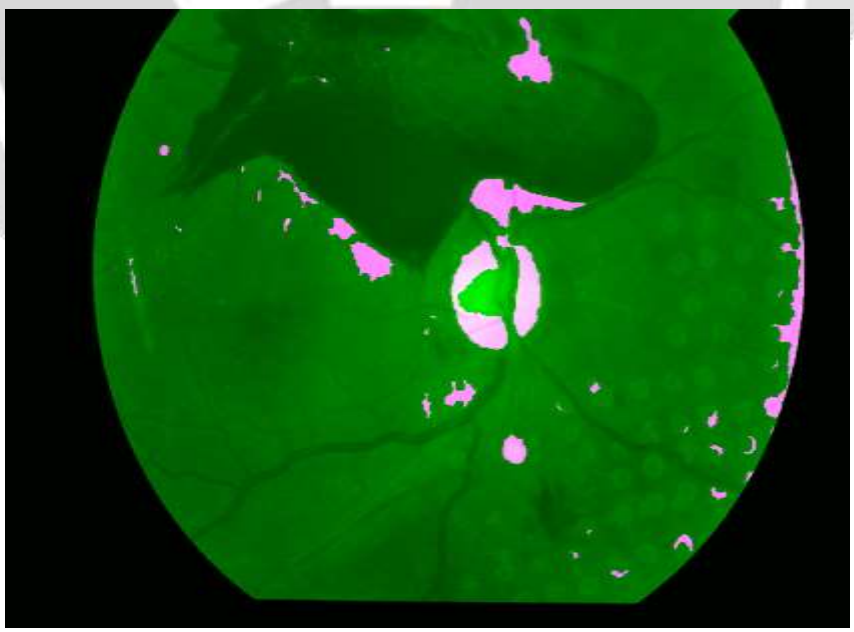


Fig: Disease causing bright lesion

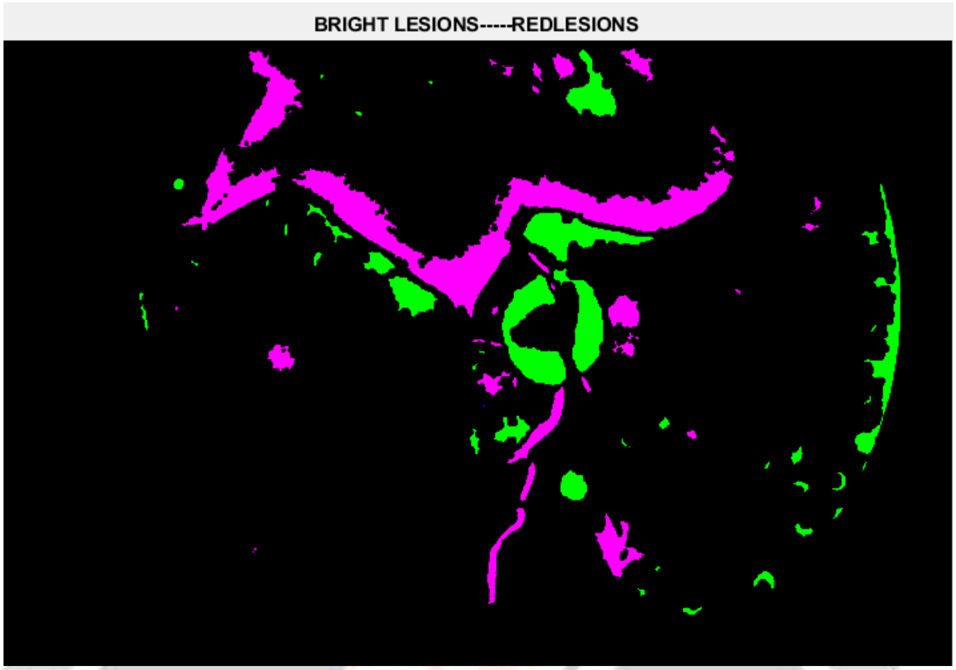


Fig: Fused lesion

Green: Bright lesion **Pink: Red lesion**

6. CONCLUSION AND FUTURE SCOPE

Finally, using this model we extract the features like microaneurysms, hemorrhages, hard exudates etc..using the simple MATLAB functions. These features will easily help to detect the Diabetic Retinopathy(DR).

In Future we will utilize the Deep learning technology. Deep learning will provide efficient results in the health domain. CNN is one of the well- known networks for image analysis.The convolution layer and the primary capsule layer are used for feature extraction. Class capsule layer is used for identifying the probability of a particular class.

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