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# AUTOMATED MICROANEURYSMS DETECTION IN FUNDUS IMAGES USING IMAGE SEGMENTATION

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**Abstract** - *Diabetic retinopathy is one amongst the complicateddiseases whichoccurs indiabetic patients when theaffects damage the retina. The eyes vision can cause be lost just incase currentlytreatment. Microaneurysms are the earliest detectable abnormalities ofdiabetic retinopathy, therefore the automated detection of the lesions is crucial anduseful task. This paper proposed aneasy method to detect microaneurysms supported its characteristics in fundusimagesusingsome techniques in image segmentation.*

***Key Words*: Haemorrhage; Red Lesions; Morphological operations; Micro-aneurysms;Diabetic retinopathy.**

## 1. INTRODUCTION:

Diabetes is one among the well-known diseases within the world. When it affects on the attention, we called Diabetic Retinopathy(DR). The effected eyes vision can cause blindness just in case currently treatment. Microaneurysms(MIs) are the primary sign of DR, that the early detection and timely treatment of the lesions can save the patients' visions. Therefore, timely examination atleast once once a year should be in dire straits all people with diabetes.

Generally, diabetic retinopathy is assessed into two main stages, namely non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR). NPDR is further classified to mild, moderate or severe stages[5]. Signs of diabetic retinopathy are red lesions like microaneurysms (MA), intraretinal hemorrhages and bright lesions like exudates, plant fibre spots and blood vessels. Red lesions are the primary clinically observable lesions indicating diabetic retinopathy.

[4].Microaneurysms are small saccular pouches that are caused by local distension of capillary walls and seems to be small red dots on the surface of the retina. this could also ends up in big bloodclots called Hemorrhages [5]. Intra-retinal lipid exudates (hard exudates) are triggered by the breakdown of the blood-retinal barrier, which turns to fluid rich in lipids and proteins to depart the parenchyma causing retinal edema and exudation [6].

Most of techniques used for MAs detection are color detection or defining other components, but within the real diagnosis, the colours and components in retinal images also MAs are different per personal heredity. during this paper, HSV color space is employed with the eccentricity technique to seek out out the abnormality of MAs.

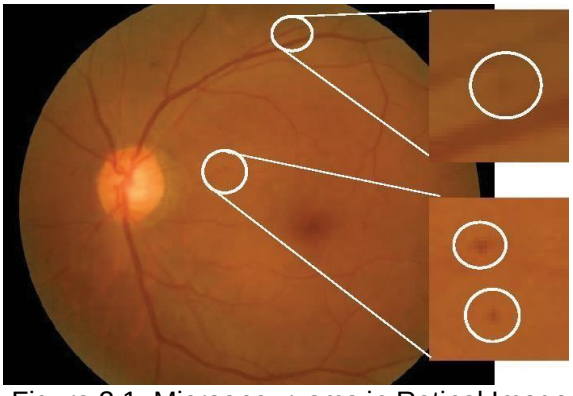

Figure 2.1: Microaneurysms in Retinal Image

## 2. OBJECTIVE:

Diabetes is one among the well-known diseases within the world. When it affects on eye, we called Diabetic Retinopathy (DR). The effected eyes vision can lead to blindness just in case currently treatment. Microaneurysms (MIs) are the primary sign of DR, therefore the early detection and timely treatment of the lesions can save the patients' visions. Therefore, timely examination at least once each year should be done all people with diabetes.

## 3. EXISTING WORK:

According to [1], the report from Novo Nordisk Pharma (Thailand) Ltd, there are about 382 million people worldwide have some forms of diabetes. Among all of them, the estimated 3.2 million Thai adults have diabetes; 6.4 percent of the adult population. This number will increase to 4.3 million by 2035. the overall amount around 6 million people are suffering by diabetes in Thailand supported the survey in [2], and 30 percent of them are plagued by DR. With this amount, the quantity of eyes must be examined are a minimum of about 12 million for every year. However, the numbers of ophthalmologists are limited in Thailand. There are approximately 1000 people within the whole country, and most of them live in Bangkok[3].this suggests that it's quite difficult to seek outthe ophthalmologists within the provinces, especially within the country. Therefore, the automated system for primary screening of DR is so useful during this task to assist the ophthalmologists.

Morphological operation to get rid of the blood vessels. In the correct threshold value was selected first, then the optic disk area and blood vessels were eliminated by applying morphological operation. Finally, the MAs candidates were classified by support vector machine algorithm. The above proposed methods seem complicated and take time to proceed. So, this project develops an easy method to detect Microaneurysms supported its characteristics with four processing steps. First, preprocessing step is applied tocut backnoise and improve the contrast of the image then canny edge detection is employed to define the lesions containing within the retinal image. Since these lesions contain alsobright lesions, maximum entropy thresholding method is suitable to define these bright lesions for substracting from the result. After that, the areas of MIs are selected supported the eccentricity and area methods.

## 4. LITERATURE SURVEY:

**Literature survey table for Automated Microaneurysm Detection**

| S. NO | Paper/title journel | Authors name | Modality | Data bases | Methodology | Soft ware Used | Key Finding | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | **Thailand Diabetes Registry Project: Prevalence,characteristics and treatment of patients with diabeticnephropa thy** | T.Chettha kul,c.Deeroch anawon,s.Suwan w alaikor,n.,Kosach u nhanun,c. Ngarmu kos, p.Rawdaree | To evaluate adquacy ofglycemic and bloodvess el control | Drions db,HRf glaucoma cotton wool spot images[5] ,Microan eurysm[10 ]. | Diabeticnephropat hy | Matlab software | Diabeties registry,n ephropat h y,revalan ce | Since the enhancment result of the proposed method is very close to the expected |
| 2 | **Clinical Guideline s for Type 2 Diabetes** | Hutchin son a, mcintos peters j, home p, feder g, baker r,forresterj, alexand rweltringha m-cox a,greenwood | Fundus images, retinal image, messid or, colour image. | Diaretd b2,messido r. | Multi-orienta tion SumofMatched Filter(MSMF), Gaussi an Match | Matlab software | Image processin g medical image analysis, retina | redlessionssv m ,classifier whichclassifie s sharp. |

## 5. FEATURES OF DIABETES:

Microaneurysms are the starting clinically visible changes of diabetic retinopathy. they're localised capillary dilatations which are usually saccular (round).They appear as small red dots which are often in clusters but may occur in isolation.

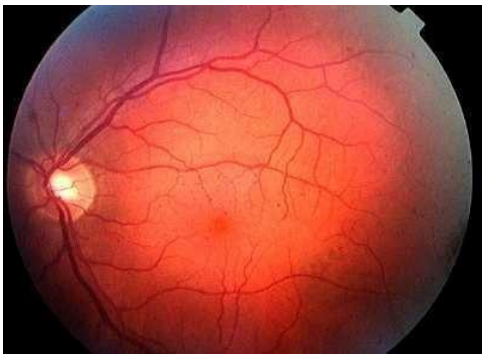

Fig:5.1 Intraretinal haemorrhages

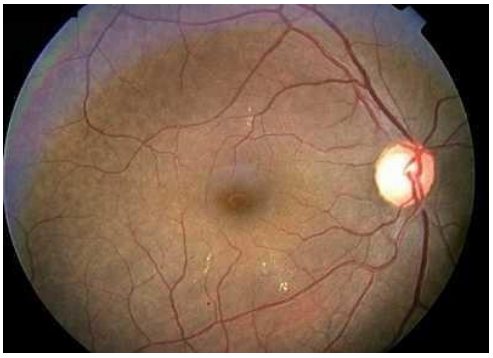

Fig:5.2Characteristic of pre-proliferative retinopathy

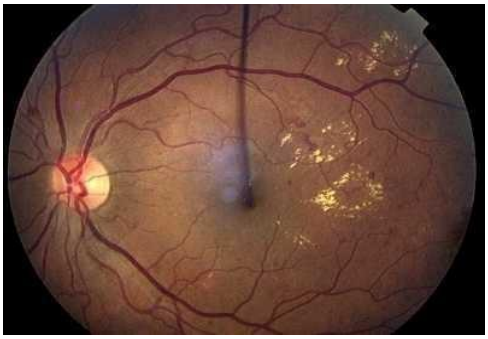

Fig:5.3 Cluster of microaneurysms

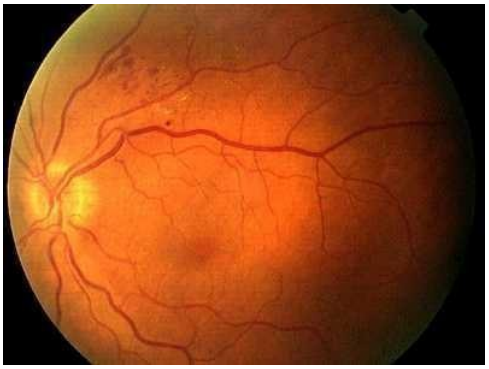

Fig:5.4 Intraretinal microvascular abnormalities

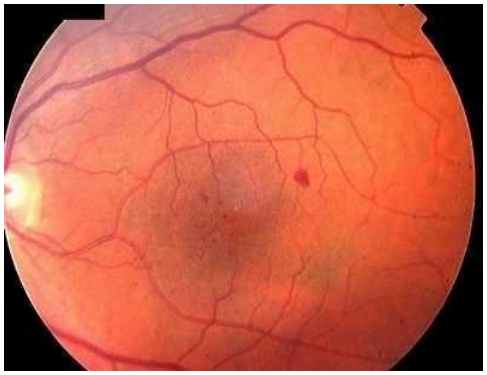

Fig:5.5: Ischaemic retina

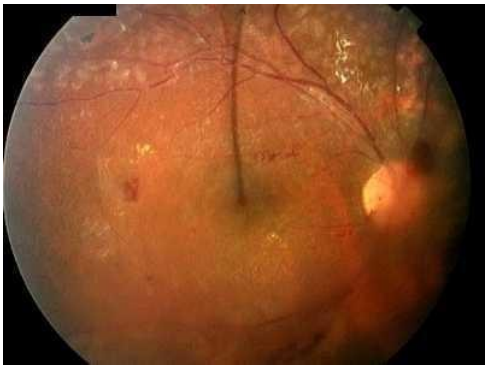

Fig:5.6 Haze effect which impairs vision

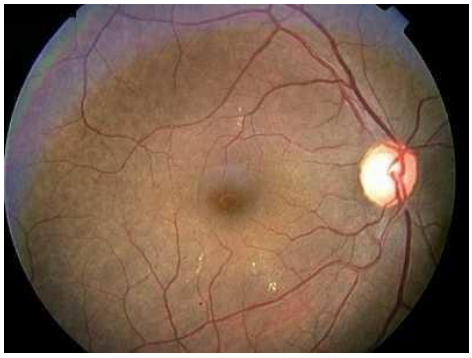

fig5.7:Haemorrages within the nerve fiber

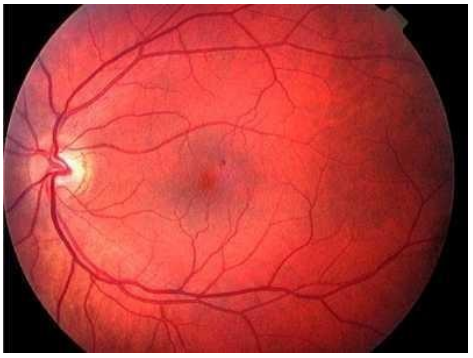

Fig:5.8: Greyish-white patches of discoloration

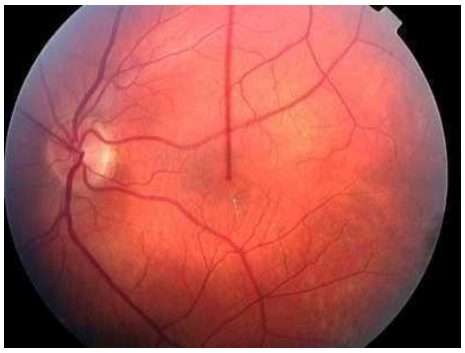

Fig:5.9: Fluorescein angiography

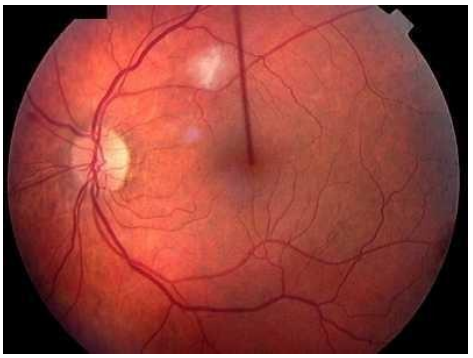

Fig:5.10: Mild venous dilatation

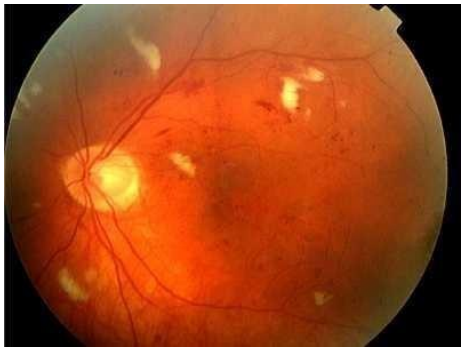

Fig:5.11: Multiple dot and blot haemorrhages

Fig:5.12: Venous changes

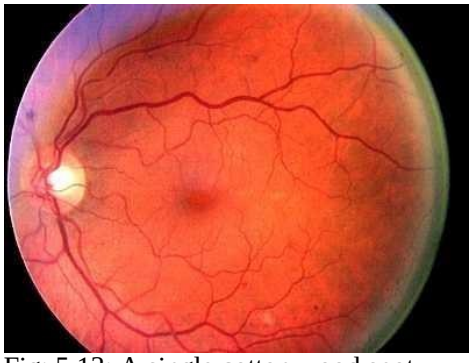

Fig: 5.13: A single cotton wood spot

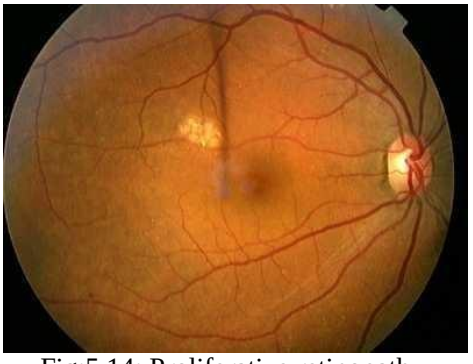

Fig:5.14: Proliferative retinopathy

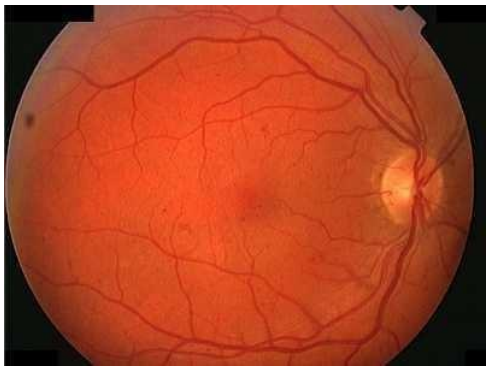
Fig:5.15: Flame-shaped haemorrhages

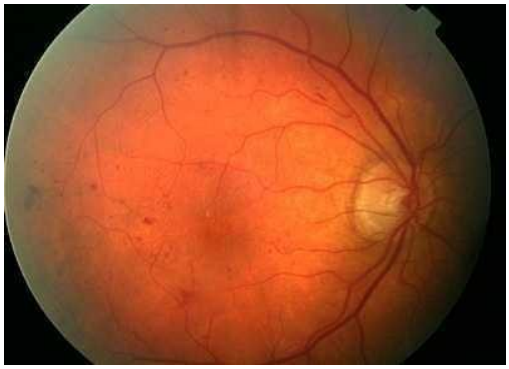
Fig:5.16: Temporal aspect of the optic

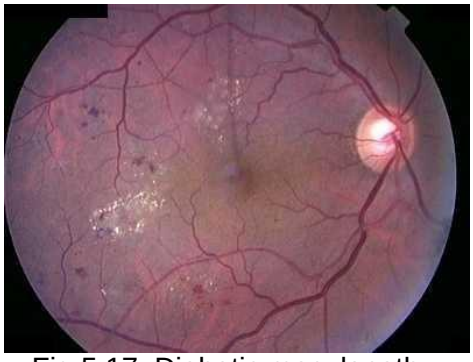
Fig:5.17: Diabetic maculopathy

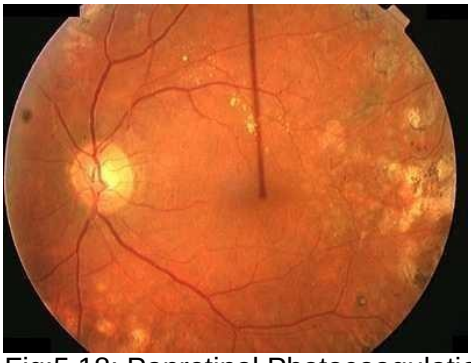
Fig:5.18: Panretinal Photocoagulation, PRP

## 6. DETECTING DIABETIC RETINOPATHY:

Microaneurysms are, because the name suggests, small saccular outpouchings that involve capillaries of the many vascular districts like heart, kidney and eye. Ophthalmologists knowthat although they occur in several pathologic conditions l ike hypertension, venous occlusion and hemorologic diseases, including methemoglobinemia and anemia, they're the hallmarkof diabetic retinopathy.

### 6.1 : Mechanism of formation:

The mechanismfor the formation ofmicroaneurysms isn't completely understood. it's known that diabetes is characterized by vessel basement membrane thickening and selective degeneration with pericyte loss,which ends up in local structural weakness within the vessel wall with subsequent dilatation and,as secondary effect, focal vascular endothelial cell proliferation.

### 6.2 : Diabetic retinopathy development:

Based on several studies that investigated the pathogenesis of the initial phases of diabetic retinopathy, loss ofpericytes is that the most significant factor, together with change of hydrostatic pressure and impaired tissue oxygenation.A molecular view of this process reveals that chronic hyperglycemia results in glycation of retinal capillary basement membrane and formation of toxic products like sorbitol or advanced glycation end products. This ends up in decreased adhesion and proliferation inhibition of pericyte.

### 6.3 : Microaneurysm size, type:

Microaneurysmsize ranges from 14 mm to 136 mm. Ultrastructural examination enabled Stitt and colleagues to differentiate four arbitrary stages of microaneurysm formation. Type 1 is that the only type with intact endotheliumand is characterized by a rather thickened basement membrane and leucocytes and monocytes that occlude the lumien.

## 7. IMPLEMENTATION OF THE PROJECT:

### 7.1 :Algorithm:

**Input:** RGB fundus image.

**Output**: Binary image with microaneurysms and 4 feature values representing area occupied by microaneurysms in 4 quadrants.

**Step 1: Pre processing:**

i. Normalize the image with relation to size.
ii. Extract green channel of the RGB image.
iii. Apply adaptive histogram equalization thrice, to enhance the image.

**Step 2: Segmentation:**

i. Apply canny edge detector to find the edges of blood vessels and pathologies.
ii. The candidate microaneurysms are selected by filling them supported on their shape and size.

**Step 3: Morphological operation:**

morphological opening with large ball shaped structuring element of size 11 is used to eliminate blood vessels.

**Step 4: Boundary of optic disc:**

It is marked using an active contour method and is eliminated by converting the pixels inside the boundary to back ground.

**Step 5: Area Calculation**:

The resultant image is split into four quadrants and also the area occupied by microaneurysms in each quadrant is calculated.

## 8. RESULTS:

The simulation results are verified from the selected input images using the MATLAB platform. The following figures shows the MATLAB figures generated during the simulation of the program for the Microaneurysms detection in the Fundus images.

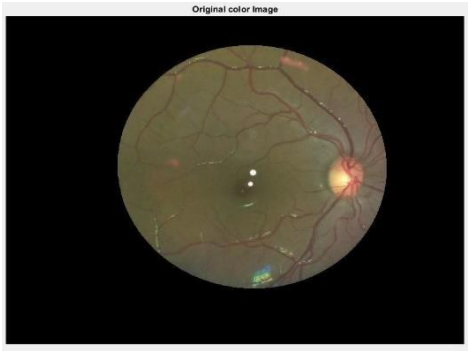


Figure 8.1:input image

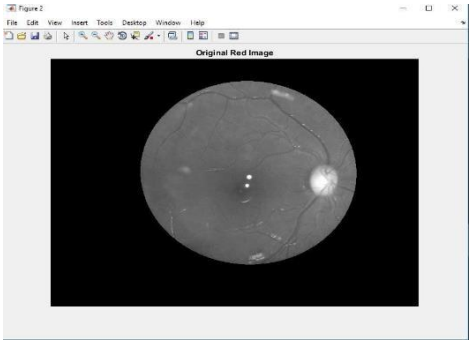


Figure 8.2: Red Plane Extraction of the Input image

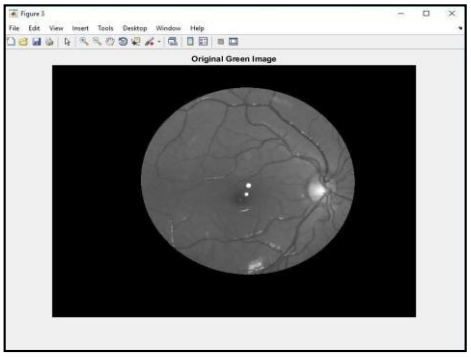


Figure 8.3: Green Plane Extraction of the Input image

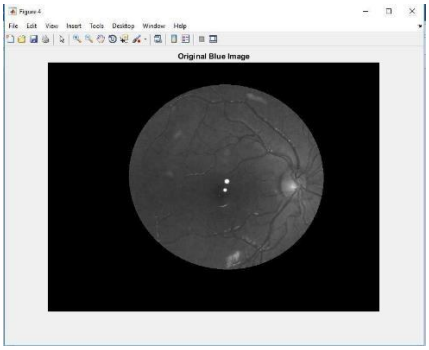


Figure 8.4: Blue Plane Extraction of the Input image

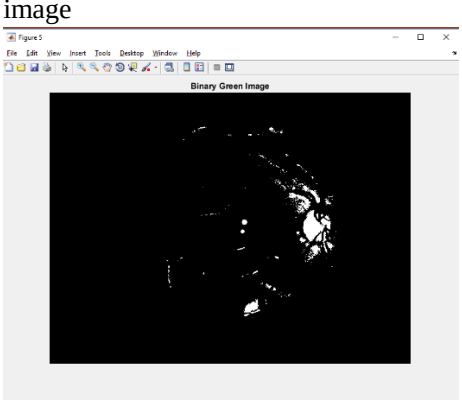


Figure 8.5: Binarized Image

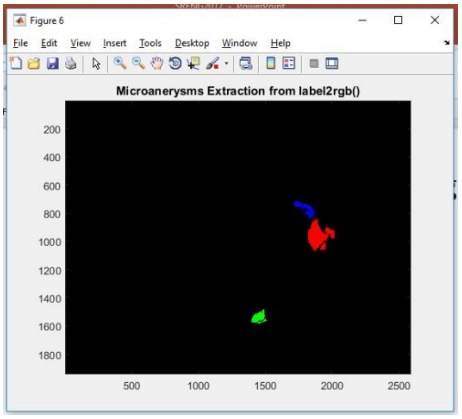


Figure 8.6: Pseudo colour Assigned Image

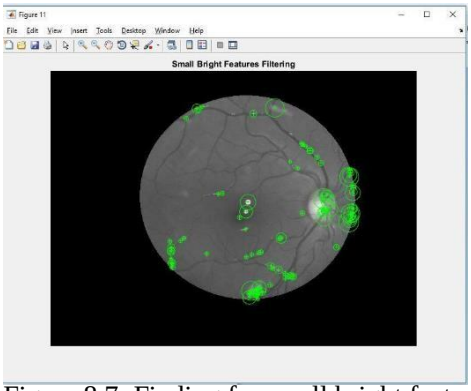


Figure 8.7: Finding for small bright features

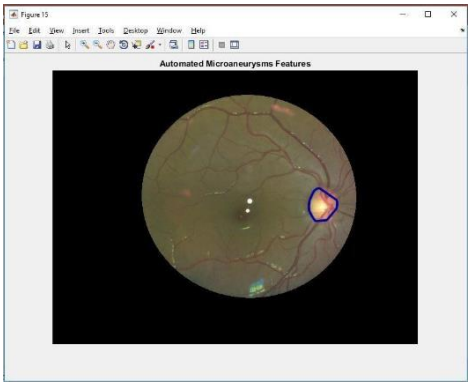


Figure 8.8: Detection of Microaneurysms

## 9. CONCLUSION:

This project proposed a straightforward method for automated Micro Aneurysms detection in fundusimages. it'san element of Diabetic Retinopathy lesions detection system which is incredibly important to assist the ophthalmologists for primary DR screening. we've got tested the Matlab segmentation code on normal and abnormal retinal images.

To analyse the segmentation process we used different sub figures like input images, haemorrhages, cotton wool spots and healthy images. In this paper, the performance evaluation has been done over all the images by the verification of an ophthalmologist.The ophthalmologist verifies the detection results for all test image sets supported the values of sensitivity and specificity.

## 10. REFERENCES:

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