Automatic Detection of Microanurysms using Split and Merge Technique

Anila Liaqat, Agha Azeem ur Rehman, Nabila Liaqat, Imran Ashraf

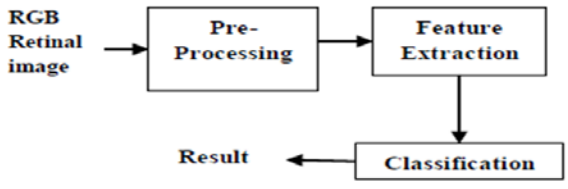
Abstract— The proposed paper describes an automatic method for MA detection is described in fundus images. According to the WHO that 135 million individuals have diabetes worldwide effected with militias and number of people with DR going to be increase 300 million by the year 2030. There is good effort of research community towards development of an automatic diabetic retinopathy detection systems. This technique detects the MA in fundus digital image. Microaneurysms with the help of SM technique. Microaneurysms are first medical sign of DR and they seem like a red small dots in fundus image. Presence of MAs describes the levels of DR. Timely recognition of MAs can reduce the risks of loss of sight. The proposed paper has discussed the systematic approach to detect the Microaneurysms in digital image of fundus using different preprocessing and feature extraction technique.

Index Terms— Diabetic Retinopathy, Microaneurysms, Fundus Image, Sensitivity, Specificity.

1 Introduction

DR is an eye disease if not detected on time can prime to visual capacity towards partial or even complete loss. Retinal injuries are used to estimate different stages related with diabetes. Microaneurysms are earliest signs of DR among the signs of DR they arise due to the high sugar levels in the blood.79 million people will be effected with DR by 2030 according to WHO(World-Health-Organization).
The proposed paper has used retina fundus image for DR. initially the paper divided into preprocessing and features detection.

1.1 Block level diagram for automatic recognition of Diabetic Retinopathy:



Medical images allow scientists and physicians to understand life-saving information using less intrusive techniques. So that we have used fundus images for DR to help ophthalmologist's. Ophthalmologists use rgb images to study DR diseases. MAs and hemorrhages from RGB fundus images are used in automatic DR detection system for microaneurysms detection. Digital image processing technique usage increasing day by day after it was recommended as one method for detecting DR at the conference on DR held in Liverpool UK in 2005. This increases more work to improve some of the existing DR detection methods, meanwhile new methods are introduced to enhance the precision of this method.

2 Preprocessing

The aim of pre-processing is to attenuate the noise, to improve the contrast and to correct the non-uniform illumination.

RGB Fundus Image

2.1 Green Components

In the RGB images, the green image displays the best contrast while the red and blue ones tend to be more noise. So that for advance processing green image is used.

2.2 Gray Components

Pre-processing conversion of image from green channel to a gray scale, as the retinal vessels seem darker in the gray image. To define the vessels and microaneurysms the gray starting point is selected.

2.3 Blood vessels removal and Threshold to Obtain binary image

The last step in the pre-processing step is binarization and removal of blood vessels. The applicant vessels and microaneurysms are then binarized by multi-level thresholding. A correct threshold value is crucial, because smaller threshold value induces more noise and higher threshold value causes loss of some fine vessels. After that output image is ready for feature abstraction. Objective of Feature Abstraction is to first-rate all Microaneurysms present in the pre-processed image. Microaneurysms seem as isolated shapes and are separated from the vessels. The features of MAs can be extracted based on outline, size and concentration level. Microaneurysms are dark reddish in color and act as small red dots of 10 to 100 microns' diameter and are circular in outline. After the image

is pre-processed, the applicant microaneurysms are segmented by splitting them from the blood vessels. Blood vessels and MAs act like reddish in color and it is Mas cannot appear on blood vessels. Blood vessels are large in area and are connected component, so that easily separated and identified from MA based on area. Threshold value is decided by experimentation. Objects appear in digital image of fundus having area greater than threshold value are eliminated and removed the blood vessels.

3 Features Extraction

3.1 Microaneurysms Detection

The proposed method, which is free from user intervention, is designed to detect automatically MAs in fundus image. It uses a SM technique grounded on image features and a statistical suggestion. Region-based separation technique can be classified into pure merging, pure splitting and split-and-merge schemes. In first scheme the image is distributed into small regions and then combined into larger areas grounded on similarity criteria. The split-and-merge is grounded on splitting the image into square sub-regions until similarity is confirmed. After that merging process is applied to adjoining sub regions that satisfy some uniformity standard. In the suggested method we use a SM technique, where the image is distributed into squares parts on image features and a statistical suggestion. To find the best partitions for similar sub-regions, the method suggestions the distribution of illumination in fundus image. To separate shady and bright locations according to their levels and ranges. In this phase the green image is used blood vessels removing, dark background surrounding the retina excluding and smoothing but without shade correction.

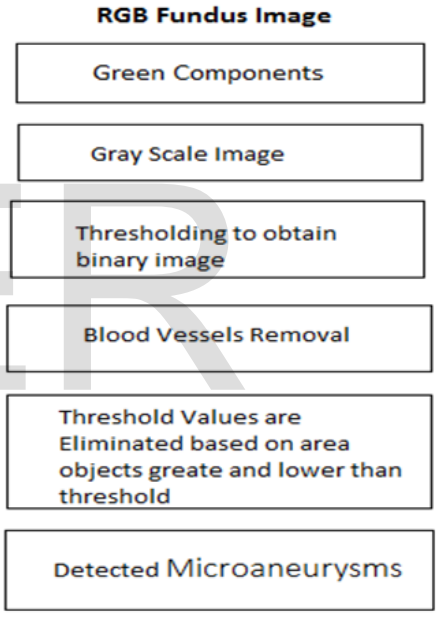
3.2 The following steps describe briefly the split-and-merge procedures

1. ***Average intensity*:** calculate the regular concentration of the complete image described above.
2. ***Image Partitioning*:** select two variables $n1=1\ldots 6$ and $n2 = 1\ldots 6$ for dividing the image into K different partitioning forms, where $K=n1\times n2$. These 36 partitioning forms sometimes have same number and geometric shapes of sub-regions but with different locations on the entire image. *Standard deviation*: for everyone from 36 partitioning forms, calculate the regular concentrations of all sub-images. Hence, we will have 36 values of standard deviation ($\_K$, for $K= 1\ldots 36$) for the 36 partitioning forms.
3. **Optimal partitioning:** It is distributed into two steps: *Step1: Primitive partitioning:* starting from the smallest many partitions ($n1=1$, $n2=1$) ascending to the highest many partitions ($n1=6$, $n2=6$), compare the standard non-conformity of each form with the maximum. A partitioning form with standard nonconformity can be equivalent or greater than ninety percent of the maximum is selected empirically as the primitive partitioning form as below:

((Selected) max) 0.9 s k ³ s k

Step 2: Merging homogeneous sub-images: to perform optimal adaptive thresholding and reduce processing time of segmentation. Homogeneity of any two sub-regions, say X with elements ($x1$, $x2\ldots$, xm) and Y with ($y1$, $y2\ldots$, yn), is assessed by testing X and Y under an assumption of equality in their standard deviation $\_X$ and $\_Y$.

4 Overall Block Diagram for Detection of MA in DR



Microaneurysms Detection using Split and Merg Technique

5 CONCLUSIONS

The proposed paper main concentration on MAs detection in RGB fundus images from DR patients. The automated system is built to help the ophthalmologists in the diabetic retinopathy and its process to detect symptoms is fast and convenient. The proposed technique could detect MAs on every RGB Fundus image. The average sensitivity and specificity is **95.44%** and **85.5%** respectively. There is drawback of this technique that blood vessels can be faint or Mas detected incorrectly. The final result of MA detection depends on the success removal of vessel detection. This indicates the further requirement of improving this task.

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