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DIABETIC RETINOPATHY DETECTION USING IMAGE PROCESSING TECHNIQUES

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***Abstract*— Diabetic retinopathy (DR) may be a condition associated to diabetes that happens as blood vessels within the eye swell and fluid spills, which may lead to vision loss. Based on the features such as blood vessels, exudates, haemorrhage and micro aneuryms the DR can be detected and many image processing strategies were designed, including image improvement, segmentation and classification. Our paper summarizes our study with more detail and accuracy for Diabetic Retinopathy detection using image processing techniques on the use of image processing techniques. Based on their performances the image processing techniques can be analyzed.**

Index Terms- Diabetes, Microaneuryms, Hemorrhages, Exudates, Neural Network, Diabetic Retinopathy.

I. INTRODUCTION

Diabetes becomes the commonest condition that affects people when their glucose or sugar content in the body is extremely high. Blood glucose is one of the biggest energy sources in the food we consume. The body resists the effect of insulin released during the diabetic stage Diabetic retinopathy is the effect of diabetes on the retina. One of the most common reasons for the blindness of the working humans is Diabetic Retinopathy (DR). Efficient treatment may be available in order to avoid vision loss, but the asymptotic retinopathy is as late in the progression of the disorder. Diabetic screening will minimise blindness by 50 percent for the development of diabetic retinopathy. The number of eye care practitioners is not adequate to cope with a wide range of patients, particularly in rural areas or when there is considerable workload on the part of local eye doctors. If it is treated early on, damage caused by DR may be avoided.Automatic or early treatment of DR reduce the severity of the disease and it will help the opthalmologists to manage and investigate the disease effectively. Microaneurysms (MA), bleeding from the retina of the eye and haemorrhaging will be the degree of DR. MA are retinal capillary focus dilations which appear as tiny dark red dots. Blood leakage from the retinal vessels occur when haemorrhages appear as circular red dots or blots that do not differentiate themselves with the MA. Exudates are the blood vessel's leakage of proteins or lipids and are found to be yellowish. MA is hard to detect since its pixels are comparable to the vessels in the blood. MA is difficult to discern from the changes in sound or context, because it has less contrast. In our paper, our main focus is on the early detection and treatment of the Retinopathy. This can be used for detecting the DR phase in four phases which are no DR, mild DR(stage 1), moderate DR(stage 2) and heavy DR(stage 3). Many methods for the detection of MA have been written. T. Spencer will keep the Gaussian matched filters with MA nominee for classification. Gardner utilises a network for background image propagation (20x20 or 30x30 pixel windows). The automated retinopathic detecting machine C. Sinthanayothin provides. The pixel detection system and new features of T. Spencer and A.Frame are proposed. Most techniques list earlier colour images taken from patients with expanded pupils with clearly visible MA and other retinal features. Time for analysis and impact on the patient may be minimised, if we can detect the images with non- dilated pupils. The quality of the pictures, however, is worse and has a significant impact on results. The aim of this work is to provide decision support, in addition to reducing the work load for ophthalmologists, in the automatic MA detection of images acquired without pupil dilation. We introduced automated exudate detection methods using an FCM clustering technique in our previous work. An MA detection method has been released in advance. A MA method of detection is proposed to enhance the overall capacity of the DR detection system.

II. METHOD

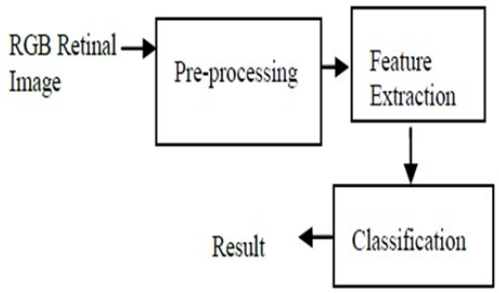


Figure 1: Method

Pre-processing

The images used in this experiment with retinals include low contrast, noise and irregular illumination. The image preprocessing stage is very important for every image as it improves the quality of the image which will be useful in detection stage. In the RGB plane, the green channel or plane

of the original image contrasts the background with red lesions such as MA and vessels in the blood. The original RGB, red, green and blue plane imagery is shown in Fig.1. In green planes, a median filtering technique is used to attenuate noise before an adjustable histogram equalisation is applied to increase contrast. An algorithm is used to eliminate sluggish background variations from the green band due to the uniform illumination. Low spatial frequencies provide just a difference in lighting.

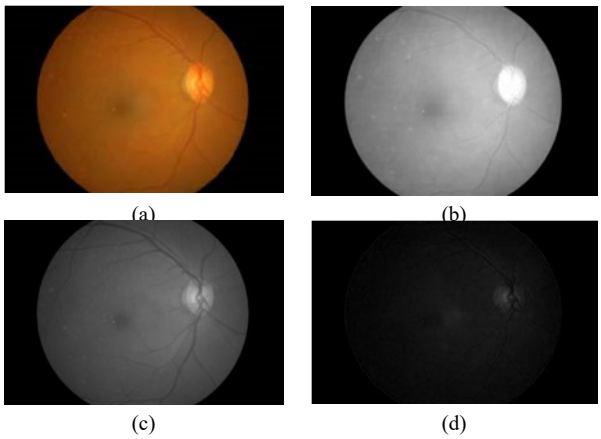
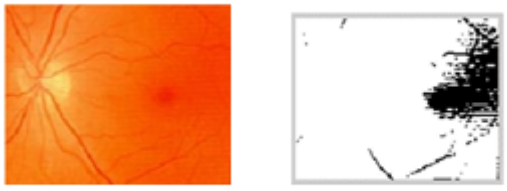


Figure 2: Image of Retina (a) RGB plane (b) Red plane of the RGB plane (c) Green plane of the RGB plane (d) Blue plane of the RGB plane

Feature Extraction

The aim is to pick all the micro-aneurysms in the pre-processed image. As isolated patterns, micro-aneurysms occur and are separated from vessels. Micro-aneurysm characteristics can be extracted on the basis of form, size and strength. They appear as small red points of 10-100 microns in diameter and are circular. Micro aneurysms are dark reddish in colour. MA identification is our principal goal, but before the procedure we need to remove clear lesions such as exudates since small islands are created and can be mis-detected as MAs when they lie close together. Before the identification of the MA, vessels are another part of the picture that must be removed, as MA and vessels are both in reddish colour and MA are not available in the vessels. The MA is between 10 and 100 µm in diameter but it is smaller than the µ < 125 µm in diameter. Retinal MA is a focal expansion of the capillaries of the retinal retinal. It is a reddish circular pattern with diameter β <125 µm, in line with the medical concept of MA. In the green plane, we can find Microaneuryms which are linked with red pixels and constant intensity by calculating its diameter. We have to transform the picture to a binary picture bitwise to search this picture. Our images are divided into two bits in the binary image, black and white. The black part shows that the eye part is faulty.



Cropped Image Binary Image

Figure 3: Cropped and Binary Image

The instructions for cutting the image into a matlab are below. I1 is the grey picture that I'm transforming into a binary picture (I, level). Output I1 replaces the pixels above 1 in the input image with all other pixels above 0 in the input image (black). The level is specified in [0,1] regardless of the image form. The graythresh function is used to determine the grade declaration automatically. If the level is not set, the value of im2bw is 0.5. To scan the binary image, we mark a variable 'c.' The colour black on the binary is 0. We measure the value of 'c' depending on this value. The following steps are given to the scanning process. We must first find the binary image size to search. The number of rows and binary image columns is given from the size found. The vector 'c' would then be assigned to 0. By scanning first and first rows, we scan the entire image to the final image column. Increase the previous value of 'c' by one if the scanned value is zero. The value of 'c' remains the same if it isn't empty. Next we scan the second row and first column up to the last column of graphic. Increase the previous value of 'c' by one if the scanned value is zero. The value of 'c' remains the same if it isn't empty.

- The above procedure is repeated to the last row of the image. As this way we get the final value of ‘c’.
- The second and the first column are then scanned up to the last picture column. Increase the previous value of 'c' by one if the scanned value is zero. The value of 'c' remains the same if it isn't empty.
- Repetition of the above procedure to the last picture row.
- We get the final value of 'c' like this way.

We determine the form of diabetic retinopathy, depending on the importance of 'c.' The Diabetic Retinopathy form is Hemorrhage if the value of 'c is larger than 5000. If 'c' is less than one, the Diabetic retinopathy form is normal. We use a 'Neural Network Toolbox' to find the exudate form of diabetic retinopathy. Neural Network Toolbox offers functions that are not readily modelled on a closed-form equation, applications for simulation of complex non-linear structures.

For the form of exudates the mean of the grayscale image will be calculated first.

- After that, we will find the default matrix element variance, which computes the default grayscale image deviation.
- We form a matrix according to the value of 'c,' mean, standard deviation.
- Initialization and simulation of the Neural Network Toolbox.
- Hence we get the value that is more rounded off from Diabetic Retinopathy.
- If this value exceeds one then this is the kind of exudate

III.CLASSIFICATION

The diabetic retinopathy classification is based on the 'c' value. There are three forms of diabetic retinopathy.

1.Normal

If 'c' value is lower than one, it is normal DR.

2. Haemorrhage

If 'c' is more than 5000, so it is Haemorrhage DR.
3. Exudates
This is Exudate DR, if the rounding value is greater than one.

The identification of patterns offers valuable observation-based knowledge. We have to trace a coherent area from the measuring space to construct a pattern recognition device, where different points have different definitions. Preprocessing, attribute extraction are the fundamental components of a pattern recognition system. The MATLAB software tests data collection of 30 non-dilated retinal images. The MAs that have been detected are compared to the hand-drawn image for clarification by the ophthalmologist. A first draught of the ground-truth picture is produced by us, so that experts can generate an image of ground-truth.This first draught picture is shown along with the original picture by two ophthol experts. The ophthalmologists then modified them by adding certain absent MA pixels or by deleting certain misunderstood non-MA pixels before all experts agreed. Sensitivity, specificity, precision and precision are chosen as a measurement of the efficiency of the algorithm. All measures can be measured on the basis of four values. All calculations are possible. These are principles that have been developed. Accuracy is the number of MA pixels detected. The average classifier output rating is pixel accuracy. Sensitivity, sensitivity, accuracy and accuracy are calculated.

Sensitivity = TruePositive / TruePositive + FalseNegative

Specificity = TrueNegative / TrueNegative + FalsePositive

Precision = TruePositive / TruePositive+FalsePositive

Accuracy = TruePositive + TrueNegative / TruePositive + TrueNegative + FalsePositive + FalseNegative

This experiment has 81.61, 99.99, 63.76 and 99.98 percent of sensitivity, specificity, precision and accuracy; For an automatic grading of the magnitude of the DR and the number of MAs was counted.

IV. CONCLUSION & FUTURE SCOPE

Develop a system for classifying patients with a colour fundus representation. Red spots and leaks are the most interesting diseases of diabetes retinopathy, both between NPDR and PDR periods. Development of a MATLAB-based graphical user interface (GUI) tool that the eye doctor can use to collect fundus images. The fundus images will be used to progress the work of DR detection and database system today and in the future. In line with the goals and objectives of the study, this research group will construct a MATLAB GUI-based system. In the current study, diabetic retinopathy is detected. Additional disorders must also be included in the work to complete the entire diagnosis of DR. In the diabetic retinopathy testing procedure, the device aims to allow ophthalmologists to diagnose symptoms more quickly and easily. On bad images, the algorithm could detect MAs. Any inaccurate MA detections, too little MA, too distorted MA, faint, undetected/removed blood vessels or very fainted MA are affected by these objects. Any lack of MAs near or near the blood vessels was so badly found that they are extracted like blood vessels. They are also faint blood vessels, not separated during the identification of the vessel; on such vessels MA could be identified incorrectly. Though further improvement is still necessary, the results are satisfactory. With sensitivity and specificity of 81.61% and 99.99%, respectively, the result is quite successful. It also supplied the number of MAs for the classification of the stage DR for the ophthalmologists.

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