Detection of Exudates and Optic Disc by Mathematical Morphology from Retinal Images

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Abstract- Diabetic Retinopathy is one of the primary cause of blindness in the world. It is a common disease and usually occurs when there is a change in the blood vessels of the retina. Exudate detection is our primary aim. Exudate detection is our primary aim. Exudates are found to be the most prevailing sign of retinopathy. detection complication of diabetes that is caused by the changes in the blood vessels of the retina .The symptoms can blur or distort the patient's vision and are a main cause of blindness. The performance of the proposed algorithm is estimated using the test images of STARE and DRIVE databases. In this method, the retinal images preprocessed and optic disc and blood vessel are identified prior and then they removed from the image. Finally exudates are segmented from the image. Comparing to other automatic method available, our method obtain acceptable exudates detection result.

Keywords- *Optic Disc, Morphology, Retinal Images.*

I. INTRODUCTION

Diabetes is the one of the common disease leading to blindness in the working age group. Usually this condition occurs in patients who had diabetes for more than 4 years or more. Diabetic retinopathy is a retinopathy caused by complications of diabetes, which can eventually leads to blindness. Patient's sight can be affected by diabetes causing cataract, glaucoma and most important damage to blood vessels inside the eye a condition known as "Diabetic Retinopathy". Despite statistics, research indicates that at least 90% of these new cases could be reduced if there was proper and automatic treatment and monitoring of eyes. The longer a person has diabetes, the higher his or her chance of developing diabetic retinopathy.

Diabetic Retinopathy is defined by the development of micro-aneurysms, haemorrhages and exudates. Exudates occur when lipid or fat leaks from abnormal blood vessels, or aneurysms. Micro-aneurysms are tiny aneurysm, or swelling in the side of a blood vessel.

This paper focuses on exudates for the reason that exudates contribute a lot to the diabetic retinopathy .In the screening process of diabetic retinopathy involves dilation of pupil which affects patient eye. Hence there was an immediate requirement for the method that can automatically detect exudates. So we have presented an easiest and fastest method for detection of exudates from fundus retinal images with the help of morphological methods.

Youssef, Solouma et al, proposed a new method based on detecting the areas of higher intensities, yellow colour and high contrast by exposing their contours. Firstly they will eliminate blood vessels and optic disc from the image resulting from edge detection, and hence therefore we are going to get exudates. The optic disc is localized and we are going to take out the optic disc with the help of Hough transform. Then opening and closing operation is applied to segment exudates. Exudates are identified by open and close operation of distinct size. The optic disc is attained by subtracting the blood vessel and exudates distinguished image.

Zheng et al recognized exudates with the help of thresholding and region growing algorithm.

The fundus photographs were taken with the help of non mydriatic fundus camera and investigated by using a flat bed scanner.

K. Ram et al proposed clutter rejection method to identify the Microaneurysms. This method has two clutter rejection stages in which MAs are distinguished from Non-MA with the help of similarity computation. C. Agurto et al described the novel technique for lesion detection using the instantaneous amplitude and instantaneous frequency characteristics of an image. Keerthi Ram and Jayanthi Sivaswamy implemented multi space clustering technique to differentiate hard exudates and soft exudates. Alireza Osare et al recommended a new method that combines computational intelligence and pattern recognition with machine learning techniques to analyze diabetic retinal images.

Akara Sopharak used FCM clustering technique for detecting exudates pixels. Wang et al used median filter to calculate an intensity difference map and dynamic clustering was used to determine lesion clusters. Domain knowledge was practised to detect true exudates. Sai Prasad Ravishankar proposed morphological process to find exudates and blood vessels. David Rekha Krishnan implemented thresholding techniques to identify the lesions, optic disc and vascular network and neural network classifier.

II. METHODOLOGY

The proposed methodology is shown below in figure 1. The process starts with image acquisition, pre-processing, and then morphological operations are applied on the preprocessed image for locating the optic disc and identifying the exudates.

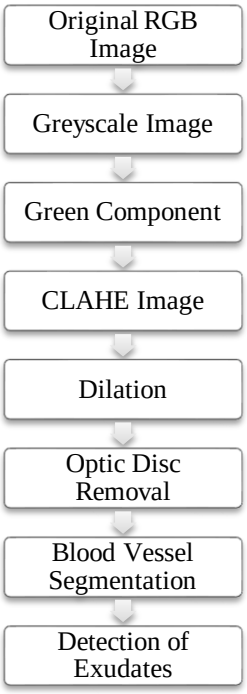

Fig.1: Proposed methodology

A. *Preprocessing*

The input retinal images needs to be pre-processed before they are applied to segmentation process. Images before pre-processing are blurred and they normally have low contrast. Hence problems arising due to blurredness and non-clarity can be rectified. This stage normally colour conversion, image enhancement and component analysis. Several pre-processing and important techniques are employed for automatic segmentation of exudates. In this application, images are first converted into 8-bit greyscale images. Pre-processing with gray scale conversion is more significant than colour images and intensity adjustment should also be done on gray images.

As we have blue, green and red components in an image. Green channel among the three components contains good contrast between the bright and background retinal components, it is efficient to work on the green channel of the RGB colour space in order to localise the optic disc and exudates.

The image is then enhanced to make the bright object features distinguishable with the help of CLAHE. The main purpose of Contrast Limited Adaptive Histogram Equalization (CLAHE) is to operate on small regions in the image. The contrast of each small region is enhanced with the help of Histogram equalization.

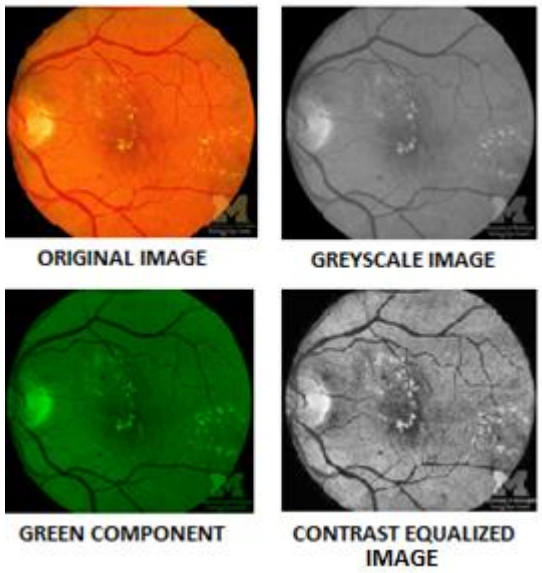

Fig.2: Preprocessing

B. *Optic Disc Localization*

The optic disc removal has a significant role in retinal image analysis because it appears with similar intensity, colour and contrast to other features on the retinal image. The optic disc usually appears in bright yellowish in colour and is specified by the largest high contrast among circular shape areas. If we apply a closing operator on the grey scale image it will remove the blood vessels. A flat disc shaped structuring element was used.

The resulting image was dilated and binarized by thresholding. Thresholding is used to remove undesired details from the image to focus on essentials. Thresholding is useful in the image region which is occupied by similar grey levels. Thresholding is done until we acquired an appropriate region for optic disc removal. After acquiring appropriate region, the optic disc can be removed with the help of connected components.

The resulting thresholded image can be superimposed on the original image and can be used as a mask.

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se=strel ('disk', 1);
v=imdilate (b, se);
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closing: $f \cdot B = (f+B)-B$

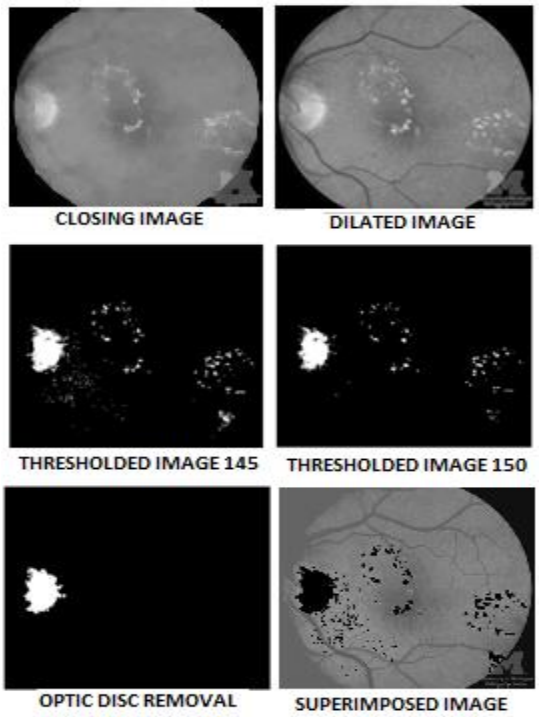

Fig.3: Optic Disc Localization

C. *Blood Vessel Segmentation*

Many methods have been proposed for detecting and segmenting vessels in retinal images. The method can also used in segmentation of DR lesions. As we know optic disc and vessels they have similar contrast with respect to exudates .Therefore optic disc and blood vessels should be removed. While vessels also appear with high contrast, but the size of the area is much smaller than optic disc. If the blood vessels are not eradicated properly they can be assumed as DR. In this problem, these areas should be segmented from vessel structures. Blood vessels can be removed by subtracting the image obtained after contrast limited equalization after closing image. In the resulting image the vessels were not seen clearly. Hence we applied again histogram equalization on the resulting image. A flat disc shaped structuring element of fixed radius was used.

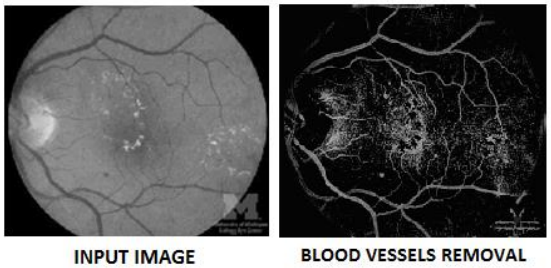

Fig.4: Blood Vessel Segmentation

D. *Exudate Detection*

Exudates emerge as bright yellow white spots on the retina and usually occur when there is a leakage of blood from abnormal blood vessels. Exudates become difficult to identify, as the diabetic retinopathy stage changes. Hence to detect exudates id our main aim, therefore it is essential to recognize it properly.

After removing the optic disc and blood vessels from the image, exudates can be identified by impixel operator. Impixel info operator creates a pixel information tool in the current figure.Im pixel info operator will be performed on the thresholded image. By altering pixels and by getting the desired area, exudates can be localized.

The resultant image showing clearly the exudates region.

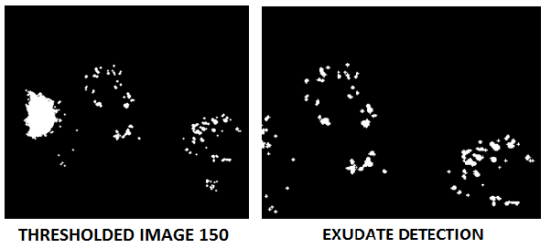

Fig.5: Exudate Detection

III. DISCUSSION

In this work, we have found a fast and efficient method for extracting and segmenting optic disc, exudates and blood vessels. The optic disc was detected and removed prior to exudates detection because of the similar intensity features. The morphological operation dilation is used to detect the location of optic disc. The resulting image shows the location of exudates conforming the disease Diabetic Retinopathy. As we all know that some portion of the optic disc coincides with the exudates region, but in this paper we have tried to solve this problem. The optic disc and exudates are correctly detected and separated. The realizations were remarkable to those achieved with median filtering.

IV. CONCLUSION

The objective of our method is to propose a good method for automatic analysis of retinal images for the objective of detecting and recognition retinopathy diseases. The work of this proposed method has been found good. This method can work on any computing system. At this time we are not able to distinguish between hard exudates and soft exudates. This method can also work very efficiently on low contrast images. The optic disc centres obtained with the help of above proposed method are more accurate and vigilant as compared with the above methods. Algorithm was performed in MATLAB 7.11. Images were taken from DRIVE and STARE database.

V. REFERENCES

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