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A Novel Algorithm for Exudates Detection Using Matlab

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Abstract--- Diabetic retinopathy is a disorder occurs due to high blood sugar level. This disorder affects retina. Diabetic Retinopathy (DR) is the major cause of blindness. However, it has been recorded that approximately 3,000 people have lost their vision following the onset of Diabetic Retinopathy. FUNDUS photographs obtained by the FUNDUS camera are used to diagnose Diabetic Retinopathy. The presence of exudates is a main hallmark of diabetic. Hence, detection of exudates is an important diagnostic task which plays a major role.

Keywords— Diabetic Retinopathy, FUNDUS image, Exudates.

I. INTRODUCTION

One of the common diseases now a day is Diabetes. It's a complex disease in that it can affect many parts of our body. It's a complex disease in that it can affect many parts of our body. Diabetic retinopathy (damage to retina) is a disease caused by the complications of diabetes leads to the blindness of an individual. It is an ocular manifestation of diabetes, a systemic disekase, which affects up to 80% of all patients who have had diabetes for 10 years or more. The longer a person has diabetes, the higher his or her chances of developing diabetic retinopathy.

Fig.1.1 Left eye without EXUDATES and right eye with EXUDATES deposition

II. RELATED WORKS

Ahmed Wasif Reza & C. Eswaran & Subhas Hati et al. [1], proposed an algorithm which is capable of detecting the boundaries of bright objects sharply with exact contours in one shot. It gives better sensitivity and predictive values. This approach is quite time consuming and it relies on conditions about the shape of the optic disc that are not always met. The images drawn by human expert are taken as the reference images.

Hussain F. Jaafar, Asoke K. Nandi and Waleed Al-Nuaimy et al. [2], an automated method for the detection of these EXUDATES in retinal images is presented. It uses a split-and-merge algorithm based on image features and a statistical hypothesis. A limitation in this work is that it occasionally fails to exclude some non-EXUDATE objects particularly those that have similar features to real EXUDATES.

Shraddha Tripathi, Krishna Kant Singh, B.K.Singh, Akansha Mehrotr et al. [3], the method involves of three main phases. Pre processing tasks like Gaussian smoothing, DMP (Differential Morphological Profile) and feature extraction based on location of optic disc, shape index and area is done to obtain actual EXUDATES. The proposed method gives better results than the other conventional methods and confirms that the proposed method detects EXUDATES quite efficiently and accurately but process becomes lengthy and complicated since filtering of the detected EXUDATES is an important task, due to similarity spectral properties features OD (optic disk) is also detected as EXUDATES.

Brigitta Nagy, Bálint Antal, Balázs Harangi, András Hajdu et al. [4], an ensemble based system is proposed to improve the detection. Optimal combination of pre-processing methods and EXUDATE candidate extractors are found and organized into a voting system for this aim. As a voting rule, pixels which are selected as EXUDATES by more than 50% of the pairs will be marked as EXUDATE. This method is completely dependent of energy function as the energy function minimizes the selected –F Score increase sensitivity. Creation of ensemble pool is an extra job.

G.S.Annie Grace Vimala, Dr.S.Kaja Mohideen et al. [5], they gave an approach for an automatic and efficient method to detect the EXUDATES is proposed via. Contrast Limited Adaptive Histogram Equalization (CLAHE) using K-Means Clustering technique. The segmented images establish a dataset of regions. To classify these segmented regions into EXUDATES and Non-EXUDATES, a set of features based on colour and texture are extracted. Classification is done using support Vector Machine This method appears promising as it can detect the very small areas of EXUDATES.

III. PROPOSED METHODOLOGY

Manual analysis and diagnosis requires a great deal of time and energy to review retinal images which are obtained by FUNDUS camera. In preventing loss of sight the detection of bright objects such as optic disc (OD) and EXUDATES in colour FUNDUS images is an important step in the diagnosis of eye diseases.

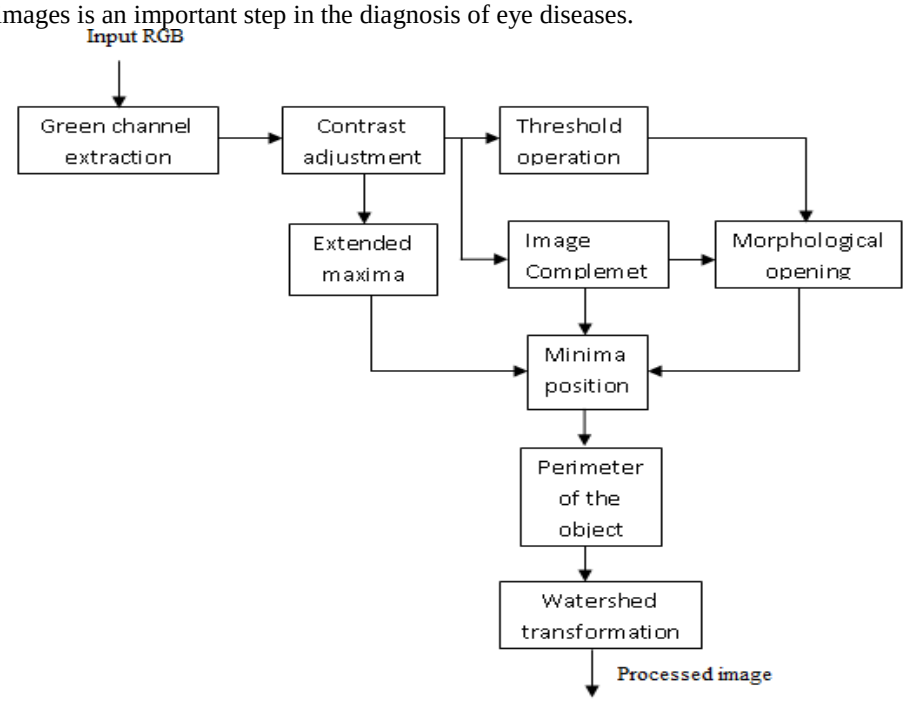

Fig.2. Block Diagram

A. Input FUNDUS image

In the original FUNDUS image as shown, the intensity variation between the bright objects (i.e. the optic disc and the EXUDATES) and the blood vessels is relatively high and the vessels usually have poor local contrast with respect to the background. To isolate the optic disc and other bright parts is a tedious task and hence, pre-processing of the image for subsequent analysis becomes indispensable.

Fig.3. FUNDUS image

B. Contrast Adjustment

From the RGB image all three planes are separated among them green plane is considered as green channel. Contrast adjustment transformation is applied on green channel, only the darker regions have their intensity values enhanced slightly while the brighter regions of the image remain more or less unchanged.

$$Y = \beta * X^{n} \quad \text{..... (1)}$$

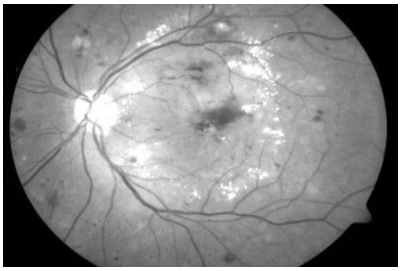

Fig.4. Image after contrast adjustment

Where X and Y represent the input and output pixel intensity values respectively, $0 \leq n \leq 1$, and $\beta = \text{inmax}^{1-n}$, Where in max is the desired upper limit intensity which is less than or equal to 175.

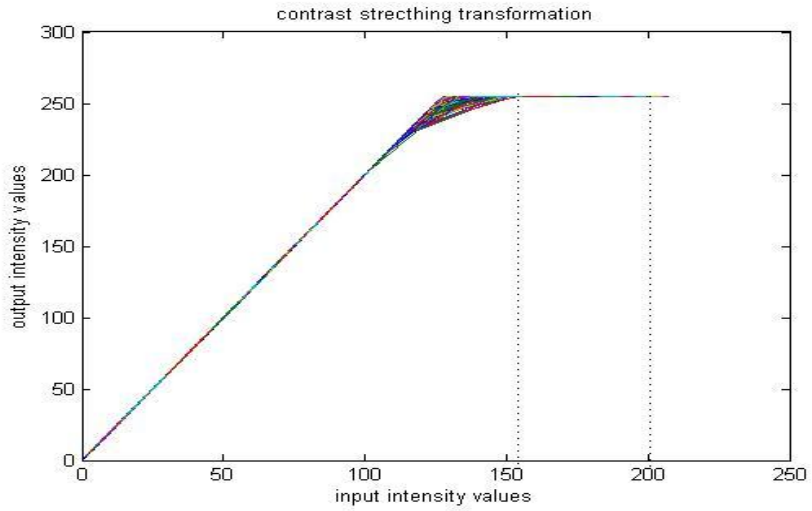

Fig.5. Contrast stretching Transformation

C. Thresholding

A threshold value T is chosen to obtain a binary image from image after contrast adjustment that isolates the bright parts from the background. The binary image obtained with T=245.

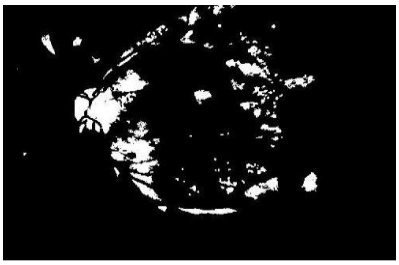

Fig.6.Image after Thresholding

D. Morphological opening

This is done to determine the connected components and to smoothen each component after thresholding by generating another binary image BW. The opening of A by B, denoted A○B, is simply erosion of A by B, followed by dilation of the results by B is defined as follows.

BW = A○B = (AΘB) Exor B…….....…….. (2)

Where A is the binary image after thresholding and B is a circular shape structuring element with 28 pixels.

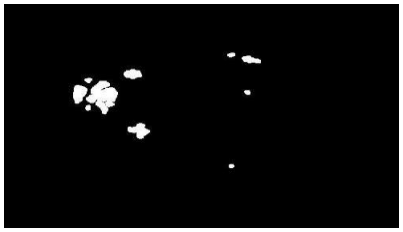

Fig.7. Morphologically open binary image

E. Extended maxima

After the morphological operator at least a particular group of connected pixels inside each bright object to be segmented. The extended maxima operator is used to identify groups of pixels in image after contrast adjustments that have significantly higher values compared to their immediate surroundings and the resulting image is regional maxima.

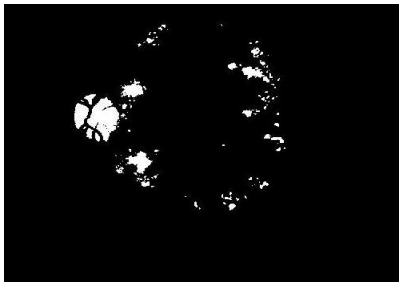

Fig.8. Regional Maxima

F. Minima imposition

In this phase, they have complemented the image got after image contrast adjustment to obtain negative image. This is because they are about to apply watershed transform in the next phase, which identifies low points, not high points. Given both extended maxima 'em' and morphologically open image 'BW', the image I(x,y) of negative image is modified using a procedure called minima imposition $f_{imposemin}$.

$$I_m = f_{imposemin}(I(x,y),(\sim BW|em)) \quad \ldots\ldots(3)$$

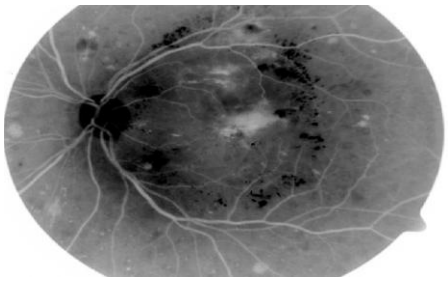

Fig.9. Complemented image

G. Perimeter of the exudates

The image containing the perimeter pixels of bright objects is obtained by applying morphological gradient technique to BW of morphologically open binary image. This is done by taking the input image of contrast adjustment and a binary mask of perimeter of bright objects to produce an output image of as overlay perimeter whose masked pixels have been replaced by a specified colour. After that, it superimposes the extended maxima locations of regional maxima and perimeter pixels of bright objects to produce a binary mask, and finally overlay the binary mask on to the input image of contrast adjustment using a specified colour to obtain an image of overlay of maxima locations. It is easy to see from overlay of

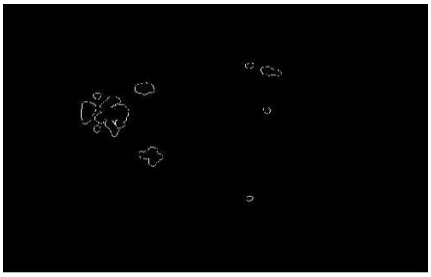

Fig.10. Perimeter of the exudates

Maxima locations. Perimeter pixel is to be considered as bright objects of interest.

H. Watershed transformation

They have finally computed the watershed transform of I_m. The obtained image is then converted into an RGB image as segmentation result in RGB for getting a better view of the objects of interest.

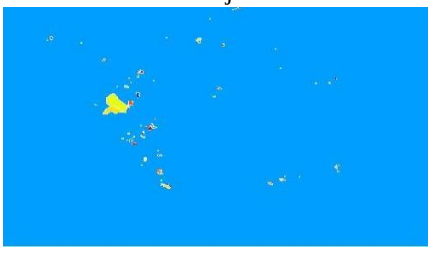

Fig.11.Segmented result in RGB

IV. CONCLUSIONS

This new algorithm has been presented for tracing of OD and exudates in FUNDUS images. The detection of these features is essential for diagnosing eye diseases such as diabetic retinopathy and glaucoma. The proposed algorithm is capable of detecting the boundaries of bright objects sharply with exact contours in one shot. The technique presented in this paper will be very useful in the development of computer based automatic screening systems for the early diagnosis of eye diseases such as diabetic retinopathy and glaucoma. This algorithm helps to treat 20 patients in place of 5 patients, thus I can conclude simpler the algorithm, faster the process.

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