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Automatic Identification of Retinal Vessels using Line Operator Approach

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Abstract

Due to presence of foggy wounds in a retinal image, tracking down of blood vessels become very difficult. In this paper we are going to present the segmentation of blood vessels using line operator. Changes in blood vessels tells us about some serious diseases like cardiovascular disease and stroke which can help us to detect some diseases in patients at very early stage and it can help abundantly in medical field and will give birth to a whole new era of examining diseases. DRIVE and STARE databases are used for parting of blood vessels. MATLAB has been used for detection of blood vessels in retina using line operator technique.

Keywords*: Retinal vessel segmentation, green channel histogram, line operator, median filtering, morphological directional filtering*

1. Introduction

Retinal blood vessel segmentation is the only way to detect retina vein occlusion, early diagnosis of glaucoma or some diseases like diabetic retinopathy. Mainly these techniques can be used by ophthalmologist. An ophthalmologist is a medical doctor who specializes in function, structure and diseases of human eyes. In process of examining human eye, ophthalmologist notes the findings that tells reason about the problems that patient is facing like discoloration of optic nerve or something like narrowing of blood vessels in the retina and during all this examining the common technique used is retina imaging, that is why it is a field where research needs to be done and new techniques are required so that it becomes an easy and comfortable task to do. A fundus camera is used for retinal fundus images through which we can observe things about optic disc which is the mark of outlet for ganglion cell axons escaping the eye, fovea centralis is a central pit constructed of adjacently packed cones in the eye and it is short in diameter, macula lutea or macula which is an elliptical-shaped bistered area near the center of the retina of human eye and retinal blood vessels as shown in Figure1. These images are then used to diagnose diseases of human eye. Certain approach other than line tracking are nominated in the literature to get rid of these complications along with matched filtering [2], tracking methods [3-5], multithreshold probing [6], mathematical morphology [7], or a sequence of nonlinear filtering and morphological operations [8]. For segmentation, different vessel segmentation algorithms have been proposed ranging from the primitive thresholding technique to elegant approaches such as active contour models [9-10].

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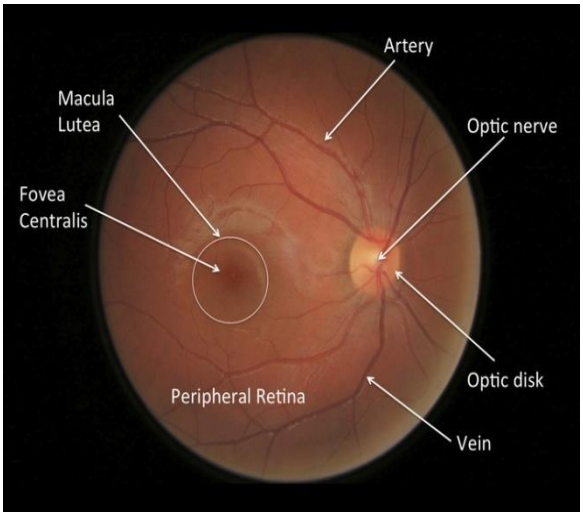


Figure 1. Retinal Fundus Images [1]

This research is concerned with a system in which the disease of human eye is automatically diagnosed. It results in automatic location of optic nerve to diagnose the disease. Input and output information of system: Input information: The input is observable information in retinal image. Output information: The above input information is formulated by ophthalmologist during a clinical examination and the ophthalmologist concludes about the health of subject including detailed information of anatomical structures and lesions visible in retinal image. Basically the approach of STARE [11] (Structured Analysis of the Retina) project breaks the problem into two components. First component is that it deals with the retinal image being automatically processed to denote the important findings. Second component is that it deals with the important findings in retinal image which are automatically reasoned to determine the diagnosis. Concluding it, the above measurements are useful for tracking disease severity and evaluation of treatment progress over time. The database of above measurements could support the clinical population and also intern training. DRIVE [12] (Digital Retinal Images for Vessel Extraction) database have been used in automatic segmentation of retinal blood vessels in 2D color images. DRIVE database is easily accessible than the STARE database because it shows the images in jpeg, png format. DRIVE database is used for automatic diagnosis of pathologies like diabetic retinopathy, hypertension retinopathy and glaucoma. In this technique we had taken 40 images whether normal or abnormal. These 40 images are divided into two sets that are training images and test set. Single manual is available for training image which consists of segmentation of blood vessels. Test set also contain 20 images, it has 2 manual segmentation. First manual segmentation is gold standard. Second manual segmentation compares human observation with computer generated segmentation. The size of images in database is 768 by 584 pixels. Each image in database is taken by Canon CR5 non-mydriatic 3CCD camera. Images in database uses 8 bit per color. The thickness and shape of blood vessels of retina are noticed carefully for experimenting on eye diseases. The images obtained in the database play an important role in experiment on retinal disease and it is easy to use for everyone.

2. Proposed Methodology

Proposed methodology is represented by the flow chart shown in Figure 2. Images for segmentation are picked from DRIVE and STARE database. Firstly reading of image is done and if the image is grayscale image then it is converted to RGB image. After that for the elimination of noise, preprocessing is applied in the fundus image. Retinal images have often poor distinction that cause to barely notice the blood vessels. This approach is

to enhance the effective range of image to develop images for later step so that these can be used to discover blood vessels in an appropriate way. In this way higher accuracy can be attained. For this purpose, the color components are considered separately and contrast improvement, green channel is used in colored retinal fundus images, because compared to red and blue channels it bears the apical contrast and it is less noisy. Therefore, green channel images which are used are inverted, where blood vessels are developed brighter than the background. After preprocessing, line operator technique is used for tracing of blood vessels in an appropriate manner. In the last step, post processing is done on the processed image which includes median filtering followed by morphological directional filtering at an angle of 00, 300, 600, 1200, and 1500. Results of segmentation are shown in Section-3.

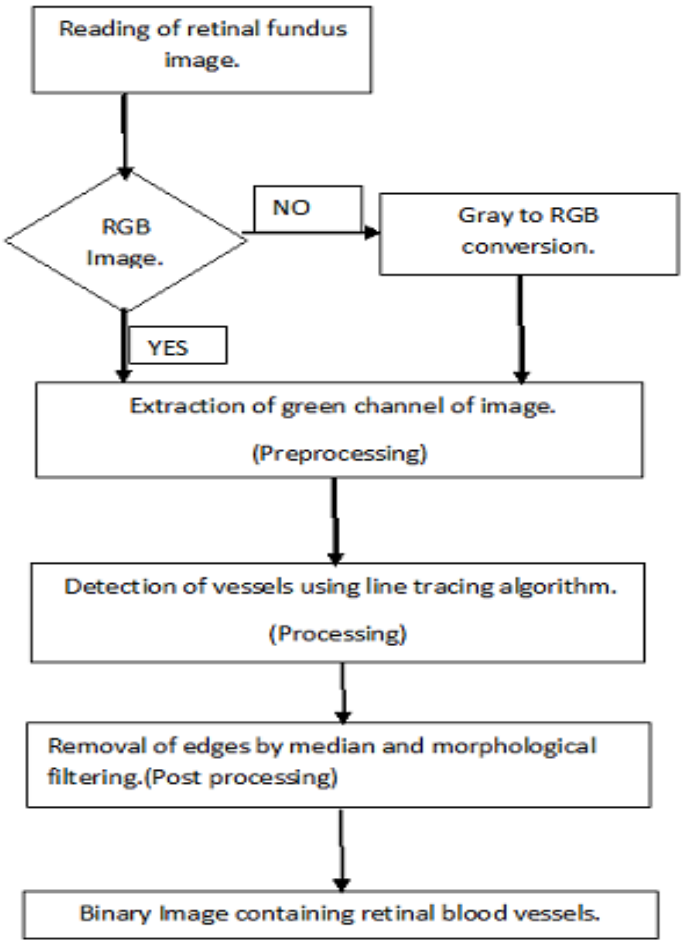
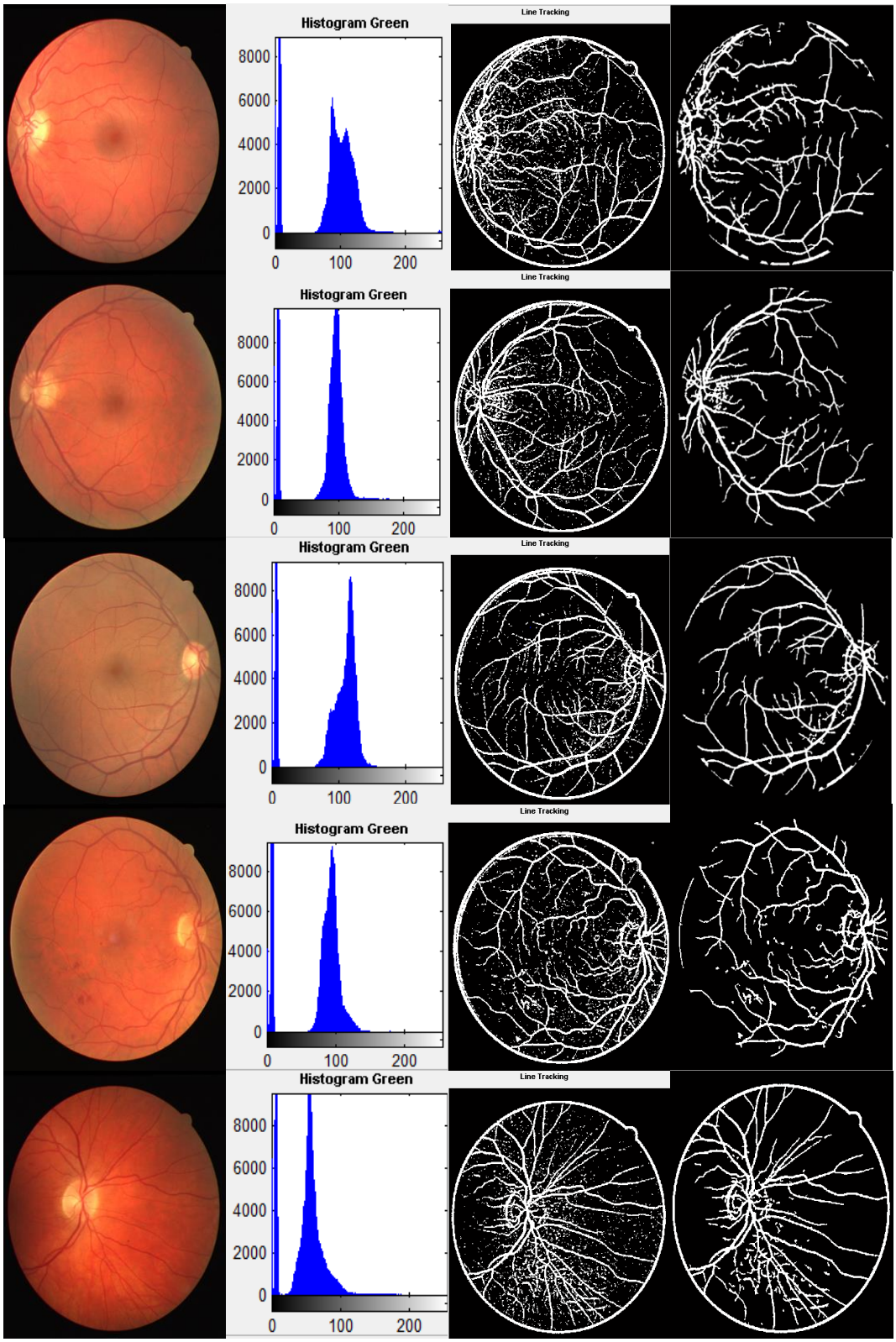


Figure 2. Proposed Algorithm for Detection of Blood Vessels

3. Results

Original Image, Histogram of Green Channel, Line Tracking, Final Segmentation



4. Conclusion

In the images, the number of vessels in retina plays a vital role in diagnosis of diabetic disease. We have taken these original images from DRIVE and STARE database.In results we can see the green channel of the histogram, retinal images obtained after line tracing algorithm and final segmented image which is further analysed for detection of abnormalities. This helps us to find diseases and information that is not so easy to find and recognized by doctors. Concluding it, the above technique is very useful for the doctors to easily recognize the eye disease.

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