SEGMENTATION OF BLOOD VESSELS IN RETINAL IMAGES

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Abstract—Retinal image analysis is a nonintrusive diagnosis method in modern ophthalmology. In this paper, a method to segment blood vessels in the fundus retinal images is presented. The morphology of the blood vessels is an important indicator for diseases like diabetic retinopathy, glaucoma, and hypertension etc. The segmentation of the retinal images allows ophthalmologist to perform mass vision screening exams for early detection of retinal diseases and treatment. The images from the public dataset DRIVE are used.

Keywords—Retinal Images, Blood Vessels Segmentation

I. INTRODUCTION

The segmentation of blood vessels in retinal images can be used as a nonintrusive diagnosis method in modern oph-thalmology. The morphology of the retinal blood vessels like length, width,branching pattern tortuosity is an important indicator for checking the presence and severity of retinal diseases such as diabetic retinopathy, hypertension, glaucoma, hemorrhages, vein occlusion etc. Manual segmentation of retinal blood vessels a has been used by ophthalmologists to assess the diameter and tortuosity of the retinal blood vessels , which is time consuming and prone to human error when the vessel structures are complicated or a large number of images are acquired.It is long and tedious task which also requires special training and skill. Therefore, there is a need of reliable automated method for retinal blood vessels segmentation in computer-aided diagnosis. Moreover, the retinal vascular tree is unique for each individual and can be used for biometric identification for the high security applications. It is commonly accepted by the medical experts that the automatic segmenta-tion of retinal vessels is the first step for the development of a computer-assisted diagnostic system for ophthalmic problems.

Image segmentation is the process of partitioning a digital image into number of segments. It is used to identify objects or the relevant information in digital images. It divides the image into different regions and extract out the interested target. The task of image segmentation is actually the partition of an image into a number of non overlapping regions, each with distinct properties.

An automated segmentation of retinal blood vessel features such as color, diameter and tortuosity and optic disk mor-phology allows ophthalmologists and eye care specialists to perform mass vision screening exams for early detection of retinal problems and for giving proper treatment. It can be useful for preventing and reducing vision impairments, age related diseases and cardiovascular diseases; it will also reduce the cost of the screening. There are several segmentation methods used for the segmentation of retinal structures such as blood vessels and optic disks and for diseases like lesions in fundus retinal images. However, the acquisition of fundus retinal images under different conditions of illumination, resolution and field of view (FOV) causes a significant degradation in the performance of automated blood vessels and optic disk segmentations in the retinal images. Thus, there is a need of a reliable technique for retinal blood vessel and optic disk segmentation. This method will be useful for medical experts to make the accurate diagnosis of the retinal disorders.[2] The anatomical structure of the retina is shown in Fig 1. It shows the blood vessels, optic disc, macula etc.

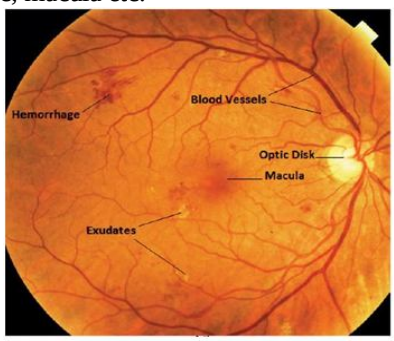

Fig. 1. Anatomical Structures in the Retina

II. BLOOD VESSEL SEGMENTATION

Blood vessels are the thin elongated structures in the retina. For segmentation of the blood vessel from the fundus retinal image, first pre-processing is done which consists of effective adaptive histogram equalization (AHE) and median filtering.

A. Pre-Processing

The acquired image may be noisy. We can enhance the image using various image enhancement and filtering tech-niques. .Then contrast enhancement process is applied to the green channel image. The

resulting image is enhanced using an adaptive histogram equalizer.

1) Green Channel Extraction: As the green channel con-sists of most of the blood vessel information ,it is extracted first.

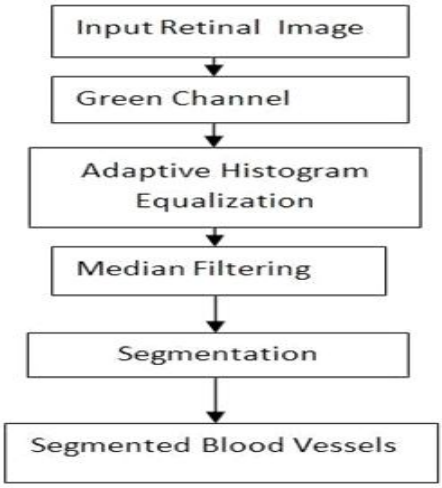

Fig. 2. Block Diagram

2) Filtering: Filtering is used to remove the unwanted noise in the fundus image. Here median filtering is used for the removal of salt and pepper noise present in the image.

3) Adaptive Histogram Equalization: Histogram equaliza-tion is performed to improve the image quality and to improve the contrast. Instead of using normal histogram equalization, adaptive histogram equalization is used since it operates on small regions in the image.

RESULTS

The vessel segmentation method is tested on public dataset DRIVE [3] .

A. Results of the Blood Vessel Segmentation on the DRIVE Dataset

The blood vessel segmentation results in MATLAB for the images in DRIVE dataset are shown in Fig.3 and Fig.4.

CONCLUSION

This approach of retinal blood vessel segmentation is useful for experts for accurate and early diagnosis of retinal problems. It is the first step in the development of computer assisted diagnostic system for opthalmic disorders.

FUTURE SCOPE

Future work consists of the the implementation of this blood vessel segmenation approach on FPGA (Field Pro-grammable Gate Array) and also based on the convergence of the blood vessels ,the segmentation of optic disc in retinal images can be performed.

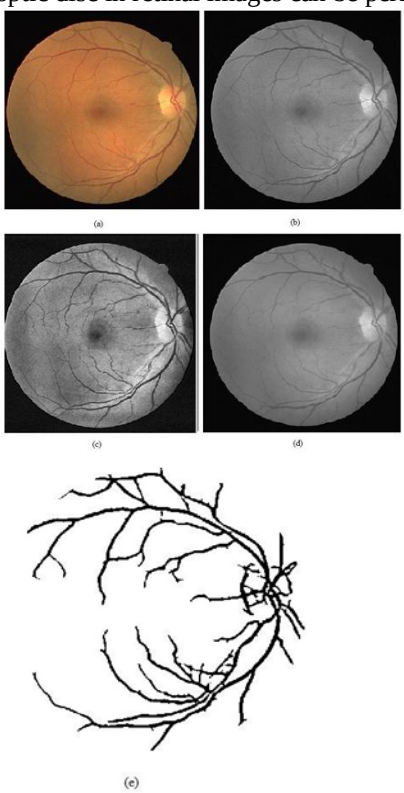

Fig. 3. Results of DRIVE dataset image1: a) Input Retinal Image, b)Green channel , c) Histogram Equalised image , d) Filtered Image ,e) Segmented image

REFERENCES

[1] M.M. Fraza, P. Remagninoa, A. Hoppea, B. Uyyanonvarab, A.R. Rud-nickac,C.G. Owenc, S.A. Barmana, ”Blood vessel segmentation method-ologies in retinal images A survey,” Elsevier journal of Computer methods and programs in biomedicine 107 (2012).

[2] Ana Salazar-Gonzalez, DjibrilKaba, Yongmin Li and Xiaohui Liu, ”Seg-mentation of Blood Vessels and Optic Disc in Retinal Images,” IEEE Journal of Biomedical and Health Informatics,2014

[3] J. Staal, M. D. Abramoff, M. Niemeijer, M. A. Viergever, and B. van Gin-neken, ”Ridge-based vessel segmentation in color images of the retina,” IEEE Trans. Med. Imag., vol. 23, no. 4, pp. 501509, Apr. 2004.

[4] Cemal Ksea, Ugur S evikb, Cevat Ikibas Hidayet Erdlc, ”Simple methods for segmentation and measurement of diabetic retinopathy lesions in retinal fundus images,”Computer methods and programs in biomedicine 107 (2012).

[5] Mai S. Mabrouk, Nahed H. Solouma and Yasser M. Kadah,” Survey of Retinal Image Segmentation and Registration,”GVIP Journal, Volume 6, Issue 2, September, 2006

[6] Nikhil amrutkar, Yogesh bandgar, Sharad chitalkar, ”Retinal Blood Vessel Segmentation Algorithm For Diabetic Retinpathy And Abnormality Detection Using Image Substraction,” International Journal Of Advanced Research In Electrical, Electronics And Instrumentation Engineering. Vol. 2, Issue 4, April 2013.

[7] S. Wilfred Franklin a, S. Edward Rajan , ”Computerized screening of diabetic retinopathy employing blood vessel segmentation in retinal images ,”biocybernetics and biomedical engineering (2014), Elsevier.

[8] Muthu Rama KrishnanMookiah, ”Computer-aided diagnosis

of diabetic retinopathy: A review ,"computers in biology and medicine (2013), Elsevier.

[9] Oakar Phyo1, Aungsoe Khaing2, "Automatic Detection Of Optic Disc And Blood Vessels From Retinal Images Using Image Processing Tech-niques," Ijret: International Journal Of Research In Engineering And Technology ,Volume: 03 Issue: 03 — Mar-2014

[10] Doaa Youssef, Nahed H. Solouma, "Accurate detection of blood vessels improves the detection of exudates in color fundus images," Computer methods and programs in biomedicine 108(2012). Elsevier.

[11] Niluthpol Chowdhury Mithun, Sourav Das, "Automated Detection of Optic Disc and Blood Vessel in Retinal Image Using Morphological, Edge Detection and Feature Extraction Technique."

[12] http://www.ces.clemson.edu/ ahoover/stare/

[13] http://www.parl.clemson.edu/stare/nerve

[14] http://www.isi.uu.nl/Research/Databases/DRIVE

[15] https://itiv.kit.edu

[16] https://www.mathworks.com/matlabcentral

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