

Retinal Vessel Segmentation Techniques

Dr. M. Renuka Devi¹, C.Preetha²

¹Professor and HOD, Dept of MCA

²Dept of MCA

^{1,2}Sri Krishna Arts And Science College, Kuniyamuthur, Coimbatore

Abstract- Segmentation of an image to extract the vessels to diagnose various diseases such as diabetic retinopathy, pathology related diseases is called retinal vessel Segmentation. In this paper, various retinal vessel segmentation techniques has been discussed and compared for the early detection of the diseases. Infinite perimeter in active contour model is best in case of accuracy. Structure based, hybrid information, Infinite contour, Index Terms-Rotating filter.

Keywords- Segmentation, Filter, Rotation filter, Structure based level, Infinite perimeter active contour model.

I. INTRODUCTION

Retinal vessel segmentation is used for the proper detection of diseases. Manual retinal vessel segmentation is time consuming while automatic retinal vessel segmentation is less time consuming and provides more accurate results[1]. Manual segmentation need some expert person to carry out the segmentation and where automatic vessel segmentation do not need any experts. Retinal vessel segmentation is used to identify many eye-related diseases such as diabetic retinopathy and pathology related diseases. It is required to detect the eye related disease early otherwise it may cause vision loss problem. An fast and accurate vessel segmentation technique is required for the earlier detection of eye disease. So it can be treated in earlier stage.

II. TECHNIQUES

This paper is discussed about various image processing techniques in retinal vessel block prediction.

Esra Ataer Cansizoglu, et al.[1] Introduced structure-based level set method. This method is an automatic retinal vessel segmentation method. Level set-based methods has been widely used for image segmentation [4]. Level set methods are of two types:

- i. **Edge-based methods[4-6]**
- ii. **Region-based methods[7-9].**

Level set methods are not mostly used for vessel segmentation. There are only less methods are proposed for vessel segmentation on the base of level set method[1]. Structure based level set method is applicable on both pathological and non-pathological images. This method consists of three main steps:

- i. Preprocessing
- ii. Modified phase map estimation
- iii. Structure-based level set segmentation

III. PREPROCESSING STEP

Preprocessing step is used for sharpening image and denoising image. Trace based method is used for denoising and shock filter is used to sharpen the image. After filtering the image, green channel of the image is extracted. Two different images are generated after by applying a classical median filter. on the equalized histogram image and then by applying adaptive histogram equalization on the green channel image[9]. If the input image does not have intensity inhomogeneity, then the equalized histogram image will be considered as the corrected image otherwise corrected image is generated by dividing those images that were generated in the third step.

IV. ROTATION FILTERATION METHOD:

S.Badawy, et al. proposed rotation filtration method. Rotating filtration is used to visualize minute and big vessels.[2]. Edge detection contains four filters. Each filter rotates at different angles in an image and Each filter is applied on retinal image. The four filters that are used in rotation filtration method are :

- i. High pass filter.
- ii. Laplacian filter.
- iii. Sobole filter.
- iv. Laplacian of gaussian filter

High pass filter is used to enhance the edges and it also eliminates low frequency components from the image and detects all the edges by rotating in different directions.

Laplacian filter is similar to high pass filter. Summation of all components is equal to zero. The difference between laplacian and high pass filter is , in laplacian filter component has no zero value but high pass component contain zero value.

Soble filter is used as an edge detection filter. It uses two masks ,one is to detect blood vessel and other is obtained from rotation.

Laplacian of gaussian (Log) filter is used to find the areas of high special frequencies which is blood vessel edges in or method[2]. The blood vessels is the output of first three methods. This method represents more superior smooth blood vessels. Hence rotating filtration method extracts tiny blood vessels.

V. STRUCTURED BASED LEVEL

Structure based level method is complex method which works only on green channel of the image. To estimation the image whether retinal vessel network contains slim and lengthy vessels with weak edge detection intensities, the modified phase map estimation method is used. Each and every feature of an image is extracted by the log gabor filter. To trace retinal vasculature Structure based level set method is used . The level set function can be discretized more easily as compared to other methods[5]. This segmentation method provides basis for the development of computer-based image analysis algorithms.

VI. INFINITE PERIMETER ACTIVE CONTOUR MODEL

C.Retinal vessel segmentation using infinite perimeter active contour model with hybrid region information with application to retinal images[3]. Yitian Zhao, et al.[3]has proposed infinite perimeter active contour model.For diagnosis of disease,The detection of vessels is more important . The advantage of using different types of region information, are combination of intensity information and local phase based enhancement map. The local phase based enhancement map is used for preserving vessel edges and intensity information is used for correct feature's segmentation[3]. The Local phase based enhancement map is reliable and accurate and intensity information excludes unimportant information in the image. Infinite active contour model also suitable for segmentation of other images that are used to diagnose diseases related to other organs of the body.

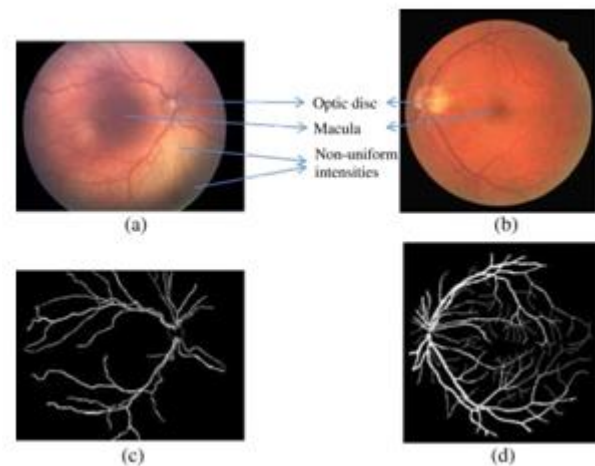


Fig. a)original image b)enhanced image c)filtered image d)segmented image

VII. CONCLUSION

The performance of all the three techniques is evaluated on the basis of Specificity, Sensitivity and Accuracy. Hybrid region information method is higher when compared to infinite perimeter active contour model because it provides accurate and reliable results. Accuracy of Structure-based level set method is low as compared to Infinite perimeter active contour model with hybrid region information as it is little complex process. Accuracy of rotating filtration is the lowest because every filter rotates at each and every angle of an image

REFERENCE

- [1] Esra Ataer-Cansizoglu et al, "automatic retinal vasculature segmentation is the method for Structure-based level set", EURASIP Journal on image and video processing, 2014.
- [2] S.Badawy, M.A.Fkirin et al, "Retinal blood vessel image segmentation using rotating filtration to help in early diagnosis and management diabetic retinopathy," 30th national radio science conference, 2013.
- [3] Yitin Zhao, Lavdie Rada et al, "Automatic vessel segmentation using infinite perimeter active contour model with hybrid region information with application to retinal images," IEEE transactions on medical imaging, 2015.
- [4] G Lathen, J Jonasson, M Borga, " Blood vessel segmentation using multi-scale quadrature filtering. Pattern Recogn, Lett", 2010.
- [5] C Li, C Xu, C Gui, MD Fox, "Distance regularized level set evolution and its application to image segmentation," IEEE Trans. Image Process, 2010.

- [6] A Belaid, D Boukerroui, Y Maingourd, J-F Lerallut, "Phase based level set segmentation of ultrasound images", IEEE Trans. Inform. Tech. Biomed, 2011.
- [7] C Li, C Kao, JC Gore, Z Ding, "Minimization of region-scalable fitting energy for image segmentation," IEEE Trans. Image Proc., 2008.
- [8] C Li, R Huang, Z Ding, C Gatenby, DN Metaxas, JC Gore, "A level set method for image segmentation in the presence of intensity inhomogeneities with application to MRI," IEEE Trans. Image Proc., 2011.
- [9] S You, E Bas, D Erdogmus, J Kalpathy-Cramer, "Principal curve based retinal vessel segmentation towards diagnosis of retinal diseases. Proc. Healthcare Inform," Imaging Sys. Biol. (HISB), 2011.