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Artery and Vein Classification in Retinal Images using Graph Based Approach

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Abstract: Digital image analysis of eye fundus images has fewer benefits than current viewer-based methods. A symptom of various systemic diseases such as high blood pressure, glaucoma, diabetes and heart disease etc. affects the retinal arteries. Diseases such as diabetes indicate dysfunction and a wide range of changes in the retina. In retinal hypertension the blood vessels show dilation and dilation of the large arteries and veins. Arteriolar to Venular Diameter ratio (AVR) reveals high blood pressure levels, diabetic retinopathy and prematurity retinopathy. Among other image processing AVR measurements require vessel fragmentation, accurate vessel measurement and vein or vein segments [1]. The work is done to automatically detect retina vessels and that is why it is a challenging task.

Keywords: artery and vein classification, graph, retinal images, segmentation.

I. INTRODUCTION

Automated detection of retinopathy in eye fundus images using digital image analysis methods has huge potential benefits, allowing the examination of a large number of images in less time, with lower cost and reduced subjectivity than current observer-based techniques. Another advantage is the possibility to perform automated screening for pathological conditions, such as diabetic retinopathy, in order to reduce the workload required of trained manual graders. Retinal vessels are affected by several systemic diseases, namely diabetes, hypertension, and vascular disorders. In diabetic retinopathy, the blood vessels often show abnormalities at early stages, as well as vessel diameter alterations. Changes in retinal blood vessels, such as significant dilatation and elongation of main arteries, veins, and their branches are also frequently associated with hypertension and other cardiovascular pathologies.

II. OVERVIEW OF THE SYSTEM

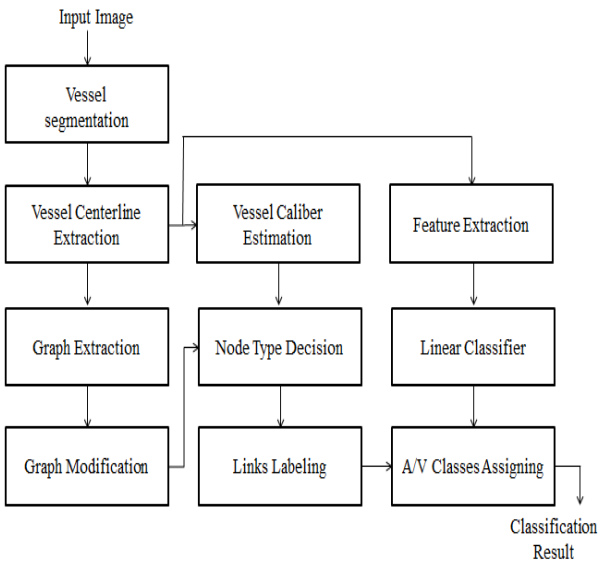

Figure 3.2 Flow chart of proposed method for A/V classification.

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Retina Artery/Vein Classification Algorithm

An automatic method for classifying retinal vessels into arteries and veins using mage features and a classifier. A set of centerline features is extracted and a soft label is assigned to each centerline, indicating the likelihood of its being a vein pixel. Then the average of the soft labels of connected centerline pixels is assigned to each centerline pixel. They tested different classifiers and found that the k-nearest neighbor (kNN) classifier provides the best overall performance. The classification method was enhanced as a step in calculating the AVR value.

This method use intensity features to discriminate between arteries and veins. Due to the acquisition process, very often the retinal images are non-uniformly illuminated and exhibit local luminosity and contrast variability, which can affect the performance of intensity-based A/V classification methods. For this reason, we propose a method which uses additional structural information extracted from a graph representation of the vascular network. The results of the proposed method show improvements in overcoming the common variations in contrast inherent to retinal images.

Graph Generation

A graph is a representation of the vascular network, where each node denotes an intersection point in the vascular tree and each link corresponds to a vessel segment between two intersection points. For generating the graph, we have used a three-step algorithm. First we use the segmented image to obtain the vessel centerlines, then the graph is generated from the centerline image, and finally some additional modifications are applied to the graph.

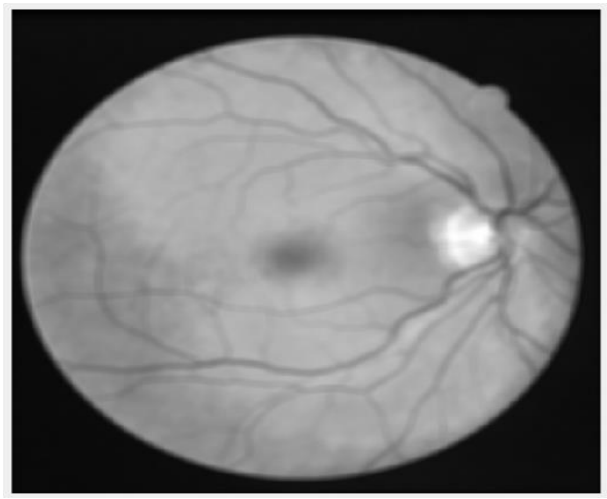

Figure 3.3 Original Image

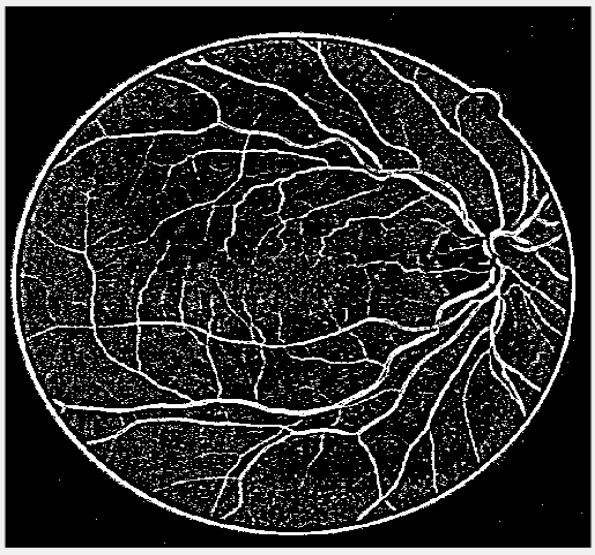

Figure 3.4 Original Image convert into binary Image

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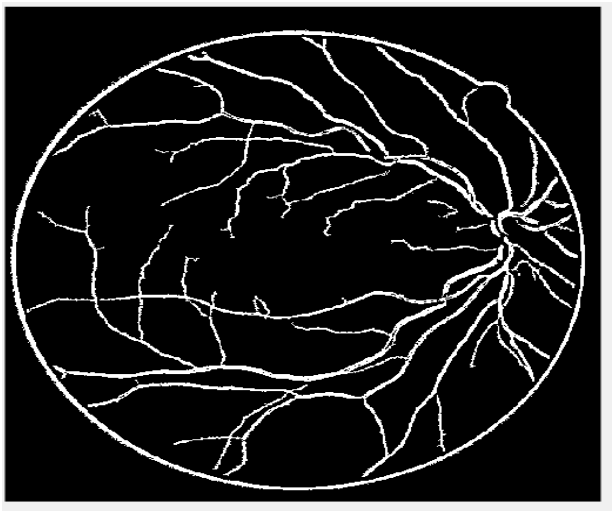

Figure 3.5 Segmented Image

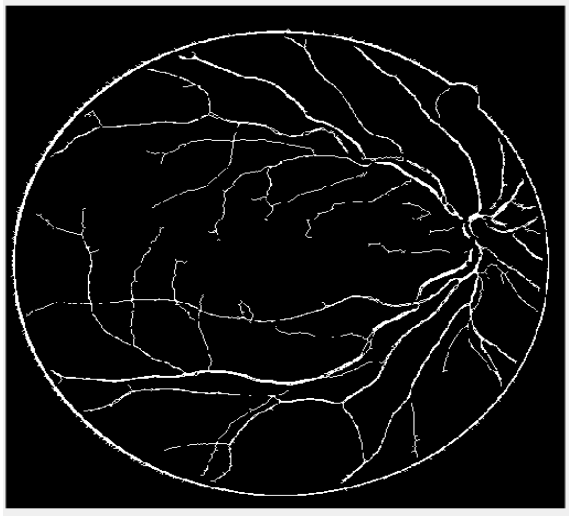

Figure 3.6 Centerline Image

III PROPOSED SYSTEM

The retina is the only location where blood vessels can be directly visualised non-invasively in vivo. Increasing technology leading to the development of digital imaging systems over the past two decades has revolutionised fundal imaging. Whilst digital imaging does not still have the resolution of conventional photography, modern digital imaging systems offer very high-resolution images that are sufficient for most clinical scenarios

IV IMPLEMENTATION RESULTS

In this project DRIVE, INSPIRE-AVR, and VICAVR. database for Artery/Vein Classification is used. This database is consist of retinal images in that 20 images of the DRIVE test set & for the40 images of the INSPIRE database also. The VICAVR database includes the caliber of the vessels measured at different radii from the optic disc also the vessel type (artery/vein) labeled based on the agreement among three experts. The per-processing RGB image segmentation and Vessel extraction and Graph extraction and Graph analysis are implemented on MATLAB, and process is implemented on Raspberry pi 3+ Model B

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Figure 6.1 Original Retinal Image

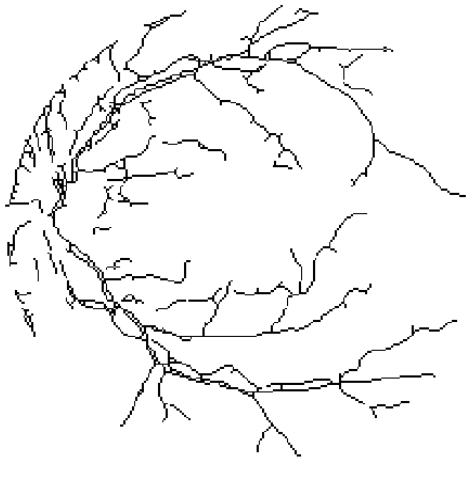

Figure 6.2 Segmented Retinal image

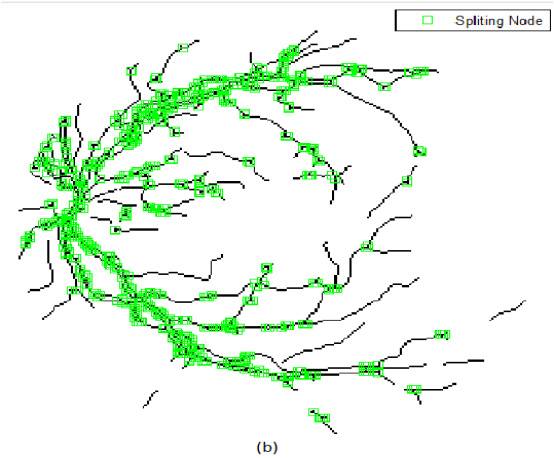

Figure 6.3 Splitting node image

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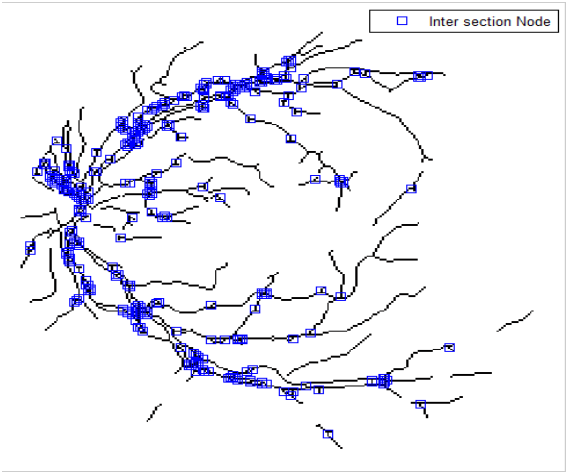

Figure 6.4 Inter-Section node image

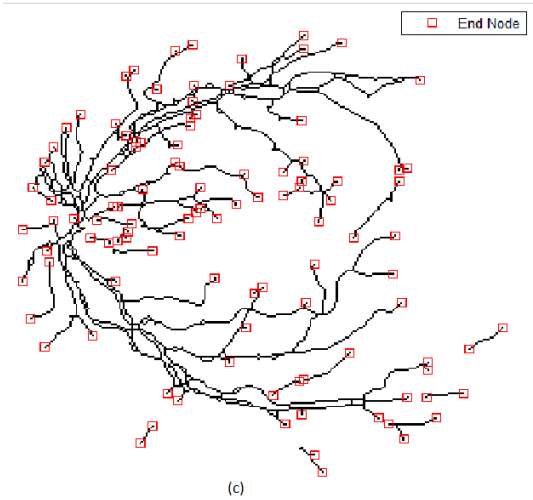

Figure 6.5 End node image

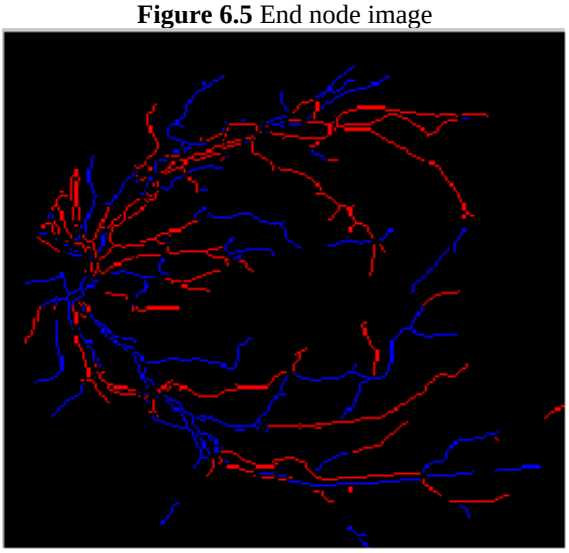

Figure 6.6 Artery/vein classification image(red is artery and blue is vein)

Finally we get the result of automatic graph based approach and we compare the results of our and base paper shown in fig 6.8.

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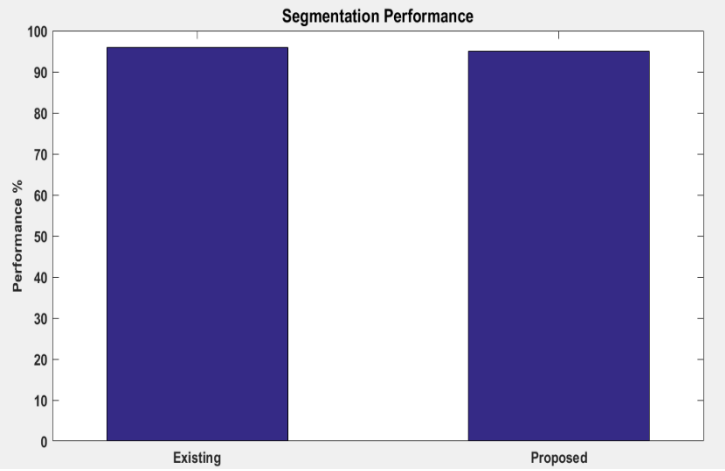

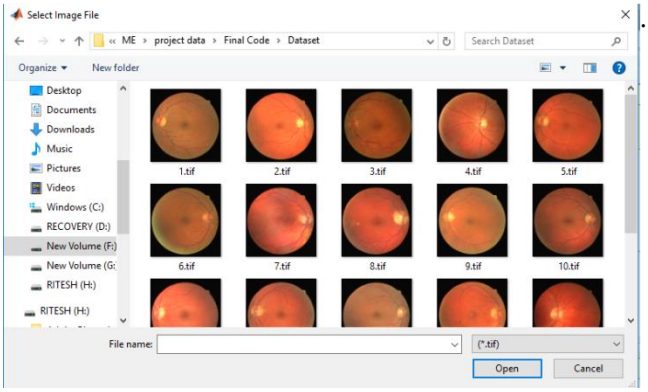

Figure 6.8 Image select from database

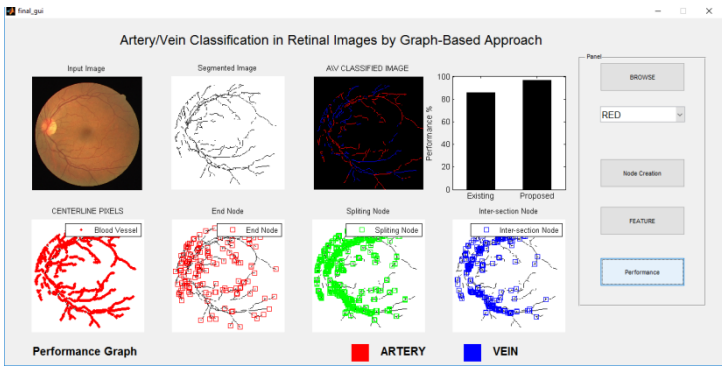

Figure 6.9 GUI of Artery/Vein classification

V CONCLUSION

It is essential to do the classification of arteries and veins in retinal images for the automated assessment of vascular changes. We have mentioned a new automatic methodology to classify retinal vessels into arteries and veins. In previous method is intensity features for discriminating between arteries and veins, in this method uses additional information taken from a graph which represents the vascular network. Proposed methods give the high accuracy achieved by our method, especially for veins, the largest arteries and confirm that this A/V classification methodology is reliable for the calculation of various characteristic signs related with vascular alterations. It is done by using by RGB segmentation that is not used in the base paper also we used ittreative thinning algorithm due to that algorithm we have accurate image of segmented.

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VI FUTURE SCOPE

In future we provide Retinal image server due to this if anyone want to classify its artery/vein in remote location. Further research is planned using the graph that represents the vessel tree and the A/V classification method for AVR calculation. In Future identifying other vascular signs, such as vascular bifurcation angles, branching patterns, and fractal-based features, which can have significant impact on the early detection and follow-up of diseases, namely diabetes, hypertension, and cardiovascular diseases.

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