

Retinal Vessels Segmentation Using Supervised Classifiers for Identification of Cardio Vascular Diseases

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Abstract: The risk of cardio vascular diseases can be identified by measuring the retinal blood vessel. The identification of wrong blood vessel may result in wrong clinical diagnosis. This proposed system addresses the problem of identifying the true vessel by vascular structure segmentation. In this proposed model the segmented vascular structure is modelled as a vessel segment graph and the true vessels are identified by using supervised classifier approach. This paper proposes a post processing step in diagnose cardiovascular diseases which can be identified by tracking a true vessel from the optimal forest in the graph given a set on constraints.

Keywords: Cardiovascular, Graph tracer, Morphology, Optimal forest, Retinal vessel.

I. Introduction

A Retinal image provides a good diagnostic approach of what is happening inside a human body. By analyzing a retinal image one can identify cardio vascular condition of the body. The risk of cardio vascular diseases such as stroke, hypertension, etc., can be found by detailed quantification of a retinal vascular structure and its properties. In existing system the identification of true vessel becomes difficult due to Bifurcations and Crossovers. The identification of wrong vessel will lead to wrong clinical diagnose [1]-[3].

Fig .1 shows an example of retinal image with several crossovers and bifurcations.



Fig .1(Retinal Image with Crossovers and Bifurcations)

Fig .2 shows an example of extracted blood vessels from Fig .1



Fig.2 (Extracted blood vessel from retinal image with Bifurcations and Crossovers)

This paper proposes a novel technique that collects information about all blood vessels that present in a retinal image and formulates to identify the true vessel in a retinal image which diagnose the cardio vascular disease [1].

The proposed system models the segmented vessels as a vessel segment graph and the true vessels are identified by using supervised classifier approach.

II. Design Methodology

II.1 Overview

The retinal blood vessel extraction is required as a pre-processing step in diagnose cardio vascular disease. The proposed method is designed for retinal blood vessel segmentation for cardio vascular disease. Input to the system is the color fundus image of a human retina obtained by a fundus camera and the output is a binary image of segmented blood vessels that are marked square at the defected nodes.

Fig.3 shows the block diagram of a proposed method.

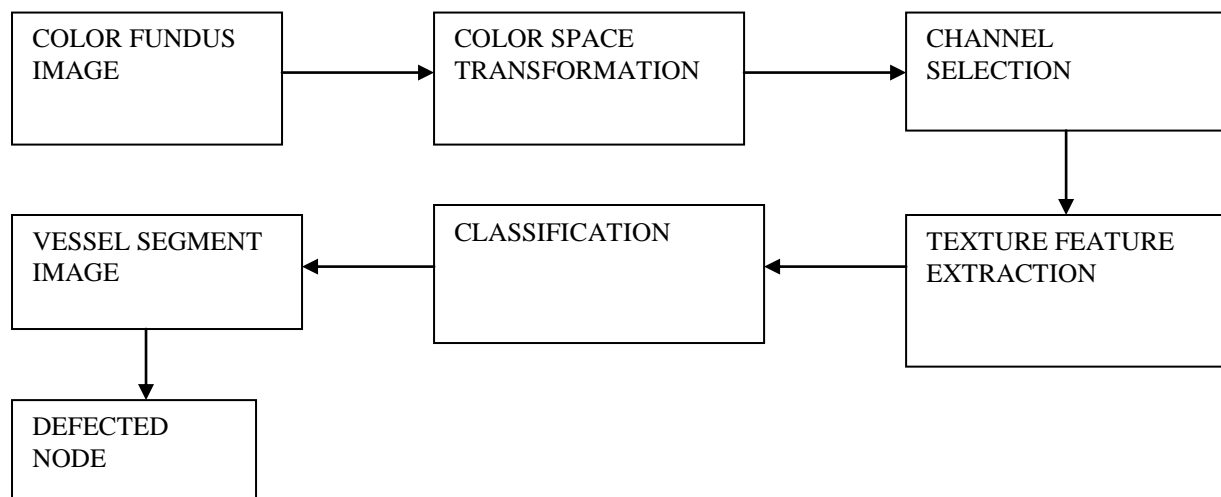


Fig .3 Proposed Diagram

II.2 Color Space Transformation

The input of the color fundus image takes more computation time. So the color fundus image is first converted in to gray scale image in order to facilitate the blood vessel segmentation and also to decrease the computational time. Gray scale image produce better luminance information from the color image after eliminating hue and saturation [5].

II.3 Channel Selection

The center point of the retinal image is calculated so that it will be easy to trace the blood vessel and to identify the defected one. This is done by channel selection. The iris of the retina is in the form of circle, so simple mathematical equations will find the center of circle by dividing the circle in to co-ordinates [5].

II.4 Texture Feature Extraction

Texture is a repeated pattern that is found in a retinal image. In this proposed design texture will be the blood vessel which is a repeated pattern.

II .5 Classification

The blood vessels are classified using a classification approach which results in a true vessel. The classification is based on threshold limit that is given in a dataset.

II .6 Vessel Segmented Image

The segmented image can be obtained by using morphological operations such as dilation and erosion. Dilation is the process of thickening the object in the binary image. Erosion is the process of thinning the object in a binary image. Both dilation and erosion can be used to analyze shapes within a image.

II .7 Defected node

The defected blood vessels are marked with square at each node. This can be done by using graph tracer algorithm and Support Vector Machines approach.

Fig .4 shows the retinal segmented image with defected nodes.

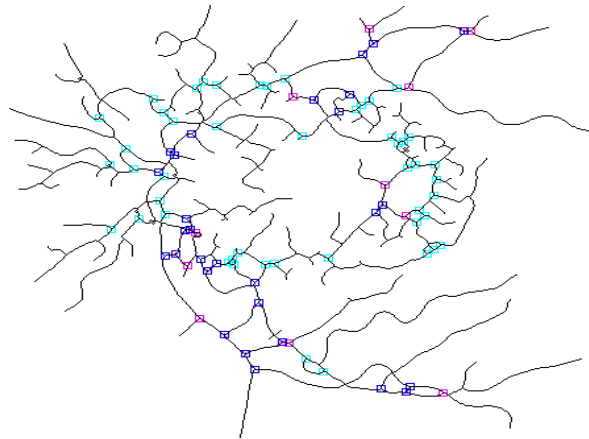


Fig .4 Retinal vessels marked at each node

III. Methods

There are various methods which are used in analyzing the retinal blood vessels. This proposed model uses three methods that are easy to implement and the are comparatively scalable.

III .1 Morphological Operations

Morphological operations are a group of operations that analyzes a shape with in an image. The output of each binary image is compared with the previous pixel and is used to analyze the structure of image. The two basic operations that are used in this method is Dilation and Erosion [4].

Dilation (Max Filter) is a process of thickening or growing an object in an image. Dilation is defined in terms of set operations as

$$A \oplus B = A1(x, y) = \max(A(x - l, y - j) + B(l, j) | l, j \in B) \quad (1)$$

Erosion (Min Filter) is a process of thinning or shrinking an object in an image. Erosion is defined in terms of set operations as

$$A \ominus B = A2(x, y) = \min(A(x - l, y - j) + B(l, j) | l, j \in B1) \quad (2)$$

III.2 Graph Trace Algorithm

This algorithm is implemented to identify the Crossovers and also to search for a true vessel in group of optimal forest.

The Crossover vessels are differentiated by coloring the true vessel based on graph tracer algorithm. Fig .5 shows the colored segmented blood vessels.

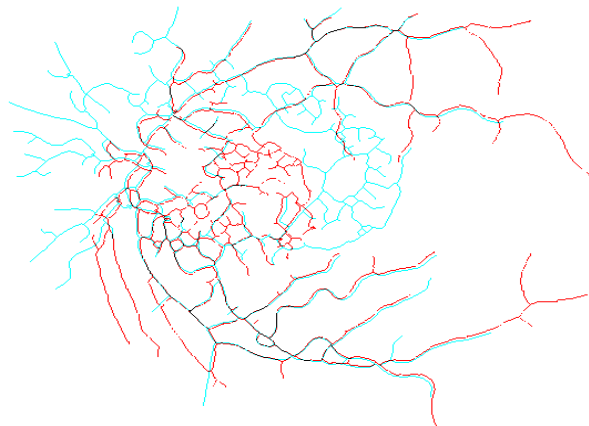


Fig .5 Colored segmented blood vessels

III.3 Support Vector Machine Classifiers

The SVMs algorithm separates the classes of input patterns with the maximal margin hyperplane. This hyperplane is constructed as:

$$f(x) = \langle w, x \rangle + b$$

Where x is the feature vector, w is the vector that is perpendicular to the hyperplane, and b specifies the offset from the beginning of the coordinate system.

IV. Conclusion

This paper proposes a novel technique to identify the correct vessels from retinal image. The proposed method act as a post processing step to determine the cardio vascular nerve from the retinal image. This global approach is actually aware of identifying true vessels taking into account of all other vessels from the optimal forest. This proposed method shows the accurate identification of vessels and is scalable to any other.

References

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