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An Automated Feature Extraction and Classification from Retinal Fundus Images

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Abstract- The first and fundamental step is the automatic classification method, which is still a complex problem. There are several reasons make the accurate classification in retinal image difficult. Firstly, the image is always very noisy and the partial volume effect causes the retinal boundary ambiguous. Secondly, the overlaps result in gaps and cavities. Thirdly, there are large variations in retinal geometric properties like retinal size and shape between patients, this can be worse if the patient retinal operations,The graph based method is a well known algorithm that has been successfully applied to a wide variety of problems. However, its application has usually been restricted to small datasets. The graph extracted from the segmented retinal vasculature is analysed to decide on the type of intersection points and later one of the two labels are assigned to each vessel segment.This paper presents some results of on going research.

Keyword- Arteries/veins classification,center line, graph based classification, AVR value, graph modification,optic disc.

INTRODUCTION

The various Process Implementation Systems play important role for obtaining the accuracy in the performance and time-complexity based processes. Various Technical Systemic processes, approaches, methodologies, techniques are used in various related to retinal images published recently. The Mathematical Morphology technique based processes used in the construction of a synthetic adaptive contrast function from regional maxima and minima and by considering the connected components of the set and the semi-automatic method to measure and quantify the geometrical and topological properties of retinal blood vessels. It enables fast tracking of retinal structures and ensures proper administration of the treatment in case of eye movement.

The initial step of vessel centerline detection combines local information, used for early pixel selection, with structural features, as the vessel length. An effective retinal vessel segmentation technique based on supervised classification using an ensemble classifier of boosted and bagged decision trees with 9-D feature vector which consists of the vessel map obtained from the orientation analysis of the gradient vector field, Morphological transformation; line strength measures and the Gabor filter response which encodes information to successfully handle both normal and pathological retinas.

The overview of this project deals with the classification of retinal vessels into artery/vein (A/V) is an important phase for automating the detection of vascular changes, and for the calculation of characteristic signs associated with several systemic diseases such as diabetes, hypertension, and other cardiovascular conditions.An automatic approach for A/V classification based on the analysis of a graph extracted from the retinal vasculature. The proposed method classifies the entire vascular tree deciding on the type of each intersection point (graph nodes) and assigning one of two labels to each vessel segment (graph links). Final classification of a vessel segment as A/V is performed through the combination of the graph-based labeling results with a set of intensity features.

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A/V CLASSIFICATION

There are certain features that enable the differentiation between arteries and veins.where the arteries are bright red in color while the veins are darker.Mostly artery calibers are smaller than vein calibers.mostly vessel calibers can be easily affected by certain diseases such as diabetes,hypertension and several cardio pathological disorders.

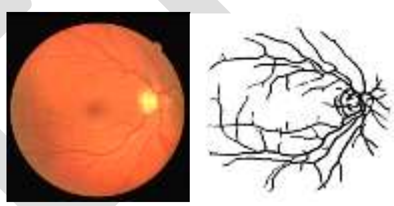
Mostly the Arteries are having the thicker walls,Which it reflects the light as a shiny central reflex strip [1].The main characteristic of the retinal vessel tree is that in the region near the optic disc (OD), veins not oftenly cross veins and arteries not oftenly cross arteries, but both types can bifurcate to narrower vessels, and veins and arteries can cross each other. For this particular reason, tracking of arteries and veins in the vascular tree is easily possible, and has been used in some methods to analyze the vessel tree and classify the vessels as arteries and veins

Tracking A/V classification technique that classifies the vessels only in a defined concentric zone that is the region around the optic disc. vessel structure gets reconstructed by tracking, later the classification is propagated outside this zone, where there s no data to differentiate arteries from veins.This type of algorithm is not designed to consider the all vessels in the zone together,it partitions the one zone into four quadrants, and works separately.

An automatic method used for classifying retinal vessels into arteries and veins .A set of centerline features gets extracted and a soft label is assigned to each centerline, indicating the vein pixel. Then the average of the soft labels of connected centerline pixels is assigned to each centerline pixel method was enhanced as a step in calculating the AVR value.

GRAPH-BASED A/V CLASSIFICATION

In the region near the optic disc, veins rarely cross veins and arteries rarely cross arteries.Different types of intersection points: bifurcation, crossing, meeting, and connecting points. A bifurcation point is an intersection point where a vessel bifurcates to narrower parts. In a crossing point a vein and an artery cross each other. In a meeting point the two types of vessels meet each other without crossing, while a connecting point connects different parts of the same vessel. Fig. 1 depicts the block diagram of the extraction and classification from retinal fundus images The important phases are: 1) graph generation; 2) graph analysis; and 3) vessel classification



Graph generation a)Original image b)vessel segmentation

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

1) Vessel Segmentation: The vessel segmentation is used for extracting the graph and also for estimating vessel calibers. This method follows a pixel processing-based approach with three phases. The first one is the pre-processing phase, where the intensity is normalized by subtracting an estimation of the image background, obtained by filtering with a large arithmetic mean kernel. In the next phase, centerline candidates are detected using information provided from a set of four directional Difference of Offset Gaussian filters, then connected into segments by a region growing process, and finally these segments are validated based on their intensity and length characteristics.The third phase is vessel segmentation, where multiscale morphological vessel enhancement and reconstruction approaches are followed to generate binary maps of the vessels at four scales. The final image with the segmented vessels is obtained by iteratively combining the centerline image with the set of images that resulted from the vessel reconstruction.

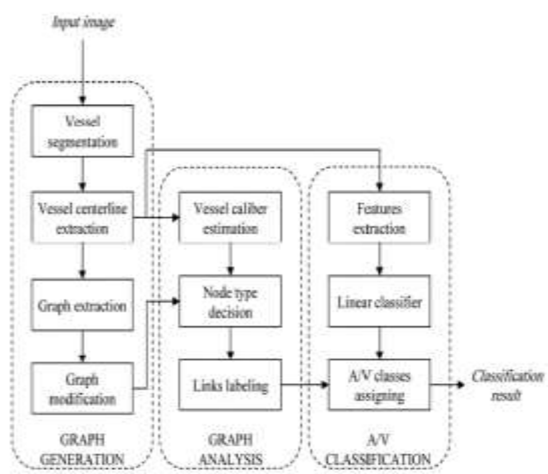
2) Vessel Centerline Extraction: The centerline image is obtained by applying an iterative thinning algorithm described in [7] to the vessel segmentation result. This algorithm removes border pixels *3) Graph Extraction:* The graph nodes are

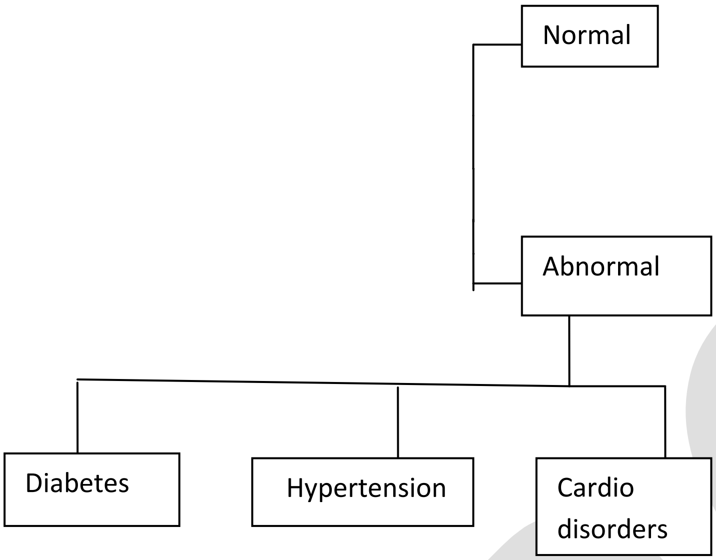
extracted from the centerline image by finding the intersection points (pixels with more than two neighbors) and the endpoints or terminal points (pixels with just one neighbor). In order to find the links between nodes (vessel segments), all the intersection points and their neighbors are removed from the centerline image and as result we get an image with separate components which are the vessel segments.

4) Graph Modification: The extracted graph may include some misrepresentation of the vascular structure as a result of the segmentation and centerline extraction processes. As a result [3], the typical errors are (1) the splitting of one

node into two nodes; (2) missing a link on one side of a node;(3) false link. The extracted graph should be modified when one of these errors is identified

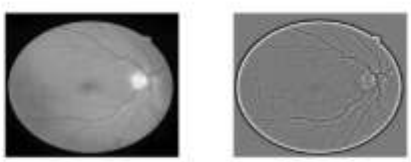
Fig 1.Block diagram for Extraction and classification from retinal fundus images

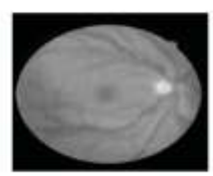




RESULTS

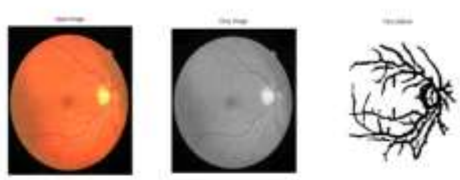
DIFFERENCE OF GUASSIAN MODEL



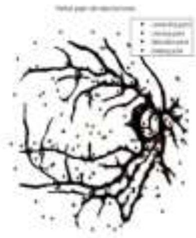


ENHANCEMENT OF VESSELS

EXTRACTION OF VESSELS



RETINAL GRAPH WITH NODES



A/V CLASSIFICATION

CONCLUSION

The classification of arteries and veins in retinal images is important for the automated assessment of vascular changes.It is the fact that our method is able to classify the whole vascular tree and does not restrict the classification to particular regions of interest, normally around the optic disc.The graph-based method with LDA outperforms the accuracy of the LDA classifier using intensity features,by which it shows the relevance of using structural information for A/V classification. Further research is planned using the graph that represents the vessel tree and the A/V classification method for AVR calculation, as well as 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 followup of diseases, namely diabetes, hypertension, and cardiovascular diseases.

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