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A REVIEW ON ARTERY VEIN CLASSIFICATION OF RETINAL IMAGES TO IDENTIFY DIABETES USING GRAPH BASED APPROACH

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Abstract: It is found that the blood vessels in retina are related to many eye diseases. Therefore extraction of retinal vessel is an important phase for automating the detection of vascular changes in retinal images. The retinal vessels are of two types viz. Arteries and Veins. The diabetes is detected on the basis of arteriolar-to-veinular ratio for that classification of vessels is necessary. Here in this paper we do a survey of different methods of blood vessels classification and identification of diseases. These methods are studied to classify blood vessels due to which we can easily diagnose and do treatment of diseases.

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INTRODUCTION

The retinal images are widely used by the ophthalmologists who play an important role in the detection and diagnosis of many eye diseases. In this automatic detection of blood vessels and its characteristics of retinal image has most important role in medical diagnoses [1]. The vascular changes occur in retinal blood vessels of retinal image is important for diagnosis or evaluation of diseases such as diabetic retinopathy [2], glaucoma and other cardiovascular conditions. It is time consuming detection of blood vessels manual and furthermore, accuracy of segmentation is depends on the experience of user. Automated detection of retinopathy in eye fundus images using digital image analysis methods has more benefits which allow the examination of a large number of images in less time, with lower cost. So it will be very helpful to ophthalmologist to diagnosis the patient suffering from eyes. The structures of retinal vessels are very messy. Changes in retinal blood vessels, such as significant dilatation and elongation of main arteries, veins, and their branches [3], [4], are also frequently associated with several diseases. The manual detection of blood vessels is very difficult since the blood vessels in a retinal image are complicated in structure and with low contrast.

One of most serious and most frequent diseases in the world is Diabetes which leads to diabetic retinopathy, causing blindness in adults. By using retinal image technologies such as extraction, segmentation, feature extraction, classification of blood vessels from retinal image is required that may help in diagnosis and treatment. There are many methods to accurately classify such as machine trained classifier, on the basis of features, semiautomatic method. But for classification using individual method does not exist due to unique properties of the acquisition techniques.

RELATED WORK

Mr. Rahul Ramchandran et.al [5] proposed a system for detecting A/V classification and diseases like glaucoma and hypertension. First, it recognizes the detection of vascular changes in retinal vessels. Then it classifies the types of graph nodes and assigns graph links to one of two levels. Finally, for the classification of artery/vein (A/V), graph based labeling results with a set of intensity features are performed. To measure the distance between nodes, a biometric graph matching algorithm (BGM) is used. In this disease like glaucoma, hypertension is detected by using a feed forward neural network (FFN). A gray level co-occurrence matrix (GLCM) is used for feature extraction.

S. Devisaranya, J. Suganya [6] proposed a system which is used for identifying Microaneurysms, which can be automatically detected by analyzing the retinal image. Initially the blood vessels

are extracted from the fundus image and classification of blood vessels such as arteries and veins should be made for determining the vessel parameters. The Graph traces algorithm is used for the classification of retinal blood vessels. It also calculates parameters of the vessels such as length, caliber measurement and diameters of the vessel. Diseases can be detected by comparing these parameters with the normal value. If there is any deviation it will indicate the presence of certain diseases.

S. V. Anandhi [7] discuss about various existing methodologies for classification of retinal image into an artery and vein, which are helpful for the detection of various diseases in retinal fundus image. This process is analyzed for the AVR calculation, i.e. for the calculation of average diameter of arteries to veins. Most of the diseases cause abnormally wide veins and this leads to a low ratio of AVR. Thus the classification of blood vessels into arteries and veins is more important.

G. Delucta Mary [8] presented a novel technique to identify true vessels from retinal images. The accurate identification of vessels is key to obtaining reliable vascular morphology measurements for clinical studies. The proposed method is a post processing step to vessel segmentation. The problem is modeled as finding the optimal vessel forest from a graph with constraints on the vessel trees. All vessel trees are taken into account when finding the optimal forest; therefore, this global approach is acutely aware of the miss linking of vessels. Experiment results on a large real world population study show that the proposed approach leads to accurate identification of vessels and is scalable.

Jihene Malek et.al [9] presents an approach to separate arteries and veins based on a segmentation and neural classification method. Blood vessels are segmented using two-dimensional matched filters, which derived from Gaussian functions. The obtained features will be introduced as the input vector of a Multi-Layer Perceptron (MLP); to classify the vessel into arteries and veins ones. Good rate of classification of the blood vessel into arterial and vein vessel in the database has been obtained at the end of this process.

Manjiri B.Patwari et.al [10] proposed an algorithm for the detection and measurement of blood vessels of the retina and finding the bifurcation points of blood vessels is general enough that it can be applied to high resolution fundus photographs.

E. Annie Edel Quinn et.al [11] proposed novel method for the retinal vessel segmentation is presented. To improve the quality of retinal image, contrast adjustment is done by using curvelet transform coefficient. Morphology is used for detecting blood vessels in retinal images. CCA is usedto remove false edges more accurately.

Andrea Zamperini [12] performed several tests aimed to understand which groups of features are useful to discriminate veins and arteries in digital fundus images. Results are quite interesting and could be useful to improve the performances of Existent systems for the estimation of related biomarkers such as the AVR.

Grisan et al. [13] developed a tracking A/V classification technique that classifies the vessels only in a well-defined concentric zone around the optic disc. Then, by using the vessel structure reconstructed by tracking, the classification is propagated outside this zone, where little or no information is available to discriminate arteries from veins. This algorithm is not designed to consider the vessels in the zone all together, but rather partitions the zone is divided into four quadrants, and works separately and locally on each of them.

Vazquez et al. [14] described a method which combines a color-based clustering algorithm with a vessel tracking method. First the clustering approach divides the retinal image into four quadrants, then it classifies separately the vessels detected in each quadrant, and finally it combines the results. Then, a tracking strategy based on a minimal path approach is applied to join the vessel segments located at different radii in order to support the classification by voting.

Claudia Kondermann et.al [15] proposed two methods for feature extraction i.e. one is based on vessel profile other on ROI around the vessel pixel on the centre line and similarly two methods for classification i.e. SVM and Neural Network. Then each feature extraction is combined with classification and finally it is observed that ROI and Neural Network give the best result.

Meindert Niemeije et.al[16] presents an automated method to estimate the AVR in retinal color images by detecting the location of the optic disc, determining an appropriate region of interest (ROI), classifying vessels as arteries or veins, estimating vessel widths, and calculating the AVR.

Behdad Dashtbozorg et.al [19] proposed an automatic graph-based approach for artery-vein classification. The graph based method with LDA outperforms the accuracy of the LDA classifier using intensity features.

DISCUSSION

The existing retinal blood vessel classification methodologies are described in the last section. These methodologies were evaluated using publicly available databases. The step pre-processing is initiate by extracting green channel image in [6]-[10] from colour retinal image. To enhance the contrast of green channel retinal image contrast limited adaptive histogram

equalization used in [6]. The various classification methods are described using bifurcation points [10], classifier SVM [6][15],minimal path[14],features[9][5][17]. And various diseases are identified like Glaucoma and Hypertension [5], Micro aneurysms[6],Hypertensive Retinopathy [18]. The Arteriolar-to-Veinular Width ratio is calculated.

CONCLUSION

This paper mainly focuses on different existing methods for detection, classication of blood vessels in retinal images, which will help to diagnose and give treatment of the disorder. We discussed various techniques used in these methodologies for the classification of blood vessels in retinal image and compare performance result of the methods.

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