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Analysis of Disease using Retinal Blood Vessels Detection

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Abstract: The significant health issues among the senior and old individuals are eye ailments. One of the most important internal components in eye is called retina. Retinal images play vital role in several applications such as disease diagnosis and human recognition. They also play a major role in early detection of diabetics by comparing the states of the retinal blood vessels. Retinal Image Analysis is a key element in detecting retinopathies in patients. Diabetic Retinopathy is one of the most common diabetic eye conditions which cause blindness induced by alterations in the blood vessels of the retina. In this work we detect the blood vessels effectively for the diagnosis of disease such as diabetes, glaucoma, and hemorrhage.

Keywords: Blood vessels, Retinal image, Segmentation, Diagnosis.

I.INTRODUCTION

Human eye is an important organ that reacts to light and has several purposes. The eye has a number of components which include but are not limited to the cornea, iris, pupil, lens, retina, macula, optic nerve, choroid and vitreous.

The eye is not shaped like a perfect sphere; rather it is a fused two-piece unit. The smaller frontal unit, transparent and more curved, called the cornea is linked to the larger white unit called the sclera. The eye is made up of three coats:

1) Outermost layer- The outermost layer, known as the fibrous tunic, is composed of the cornea and sclera.
2) Middle layer- The middle layer, known as the vascular tunic or uvea, consists of the choroid, ciliary body, andiris.
3) Innermost layer - The innermost is the retina, which gets its circulation from the vessels of

the choroid as well as the retinal vessels, which can be seen in an ophthalmoscope.

The retina is internal part of the eye. In the center of retina there is the optic disk, a circular to oval shape. From the center of optical nerve radiates the major blood vessels of the retina. The blood vessels network is an important anatomical structure in human retina, which is use to recognise different types of disease. However, manual detection of blood vessels is not simple because the vessels in retina image are complex and have low contrast. For retinal anatomy ophthalmologist uses an ophthalmoscope. The retinal fundus image is widely used in the diagnosis and treatment of various types diseases such as diabeticretinopathy and glaucoma. There are different types of eye diseases, such as Cataract, Iridocyclitis, Corneal Haze, Glaucoma and Diabetic retinopathy.

Here we see the three types of disease description

Diabetes: Diabetes is a long-term condition that causes high blood sugar levels. Diabetes is a serious complex condition which can affect the entire body. When someone has diabetes, their body can't maintain healthy levels of glucose in the blood. Glucose is a form of sugar which is the main source of energy for our bodies.

Glaucoma: Glaucoma is a group of eye diseases which in most cases produce increased pressure within the eye- if left untreated the patient may lose vision and even become blind.This elevated pressure is caused by a backup of fluid in the eye.

Hemorrhage: Is a disorder of the eye in which bleeding occur in the light sensitive tissue on the back wall of the eye.A retinal hemorrhage can be caused by hypertension, retinal vein occlusion (a blockage of a retinal vein), or diabetes mellitus (which causes small fragile blood vessels to form, which are easily damaged).

Checking the obtained changes in retinal images in an especial period can help the physician to diagnose the disease. Applications of retinal images are diagnosing the progress of some cardiovascular diseases, diagnosing the region with no blood vessels (Macula).Retinal image analysis is a complicated task particularly because of the variability of the

images in terms of the color, the morphology of the retinal anatomical pathological structure and the existence of particular features in different patients, which may lead to an erroneous interpretation.

A.Motivation

Detection of retinal blood vessels for disease diagnosis has provided more information about retinal blood vessels and disease. Compared with the other more traditional technology, detection of retinal blood vessels for disease diagnosis has the benefits of high anti-counterfeiting strength, small imaging devices, low cost, easy collection of images with contactless operation universality and liveness. Furthermore, since the

blood vessels are located internally within the living body, the disease identification system is less affected by the outer skin surroundings (skin disease, humidity, dirtiness, etc.). Hence retinal blood vessels for disease identification is considered as one of the most promising solution for disease diagnosis in the future.

II. LITERATURE REVIEW

[1]Archna Sharma and Hempriya have proposed a method for Detection of Blood Vessels and Diseases in Human Retinal Images. In this the detection of blood vessels is important task in diagnosis the diseases of eye. The present study is aimed at developing an automated system for the extraction of normal and abnormal features in retinal images. The blood vessel network is an important anatomical structure in human retina. Several diseases such as Diabetic retinopathy, glaucoma, hemmorhages, the performance of automatic detection methods may be improved if regions containing vessels can be excluded from the analysis

[2]K.Jeyasri has proposed method on the detection of the retinal images and disease diagnosis. In this paper Retinal images play vital role in several applications such as disease diagnosis and human recognition. In this work a new algorithm to detect the blood vessels effectively has been proposed. Initially enhancement of the image is carried out using curvelet transform and modification of the curvelet coefficients.

[3] D. J. Cornforth and H. J. Jelinek have proposed Development of retinal blood vessel segmentation methodology using wavelet transforms for assessment of diabetic retinopathy. Automated image processing has the potential to assist in the early detection of diabetes, by detecting changes in blood vessel diameter and patterns in the retina. This paper describes the development of segmentation methodology in the processing of retinal blood vessel images obtained using non-mydriatic colour photography. The methods used include wavelet analysis; they show highly accurate identification of blood vessels for the purpose of studying

changes in the vessel network that can be utilized for detecting blood vessel diameter changes associated with the pathophysiology of diabetes.

[4] VijayaR.Patil proposed Detection of Optic Disc in Retina Using Digital Image Processing. The retinal fundus image is widely used in the diagnosis and treatment of various eye diseases such as diabetic retinopathy and glaucoma. He propose a method to automatically detect the optic disc in fundus images of the retina. The method includes edge detection using the canny operators and detection of circles using the Hough transform method.

[5] Yong Yang and NiniRao published paper on "An automatic hybrid method for retinal blood vessel extraction". In this paper a novel hybrid automatic approach for the extraction of retinal image vessels. The method consist in the application of mathematical morphology. In the mathematical morphology the retinal image is smoothed and strengthened so that the blood vessels are enhance and backgroumd information is suppressed.

[6] Mohammadreza Yadollahi published paper on "Image segmentation for object detection" in this paper there is brief introduction of segmentation method. It is used in many scientific fields including medical imaging, objectand face recognition, engineering and technology.

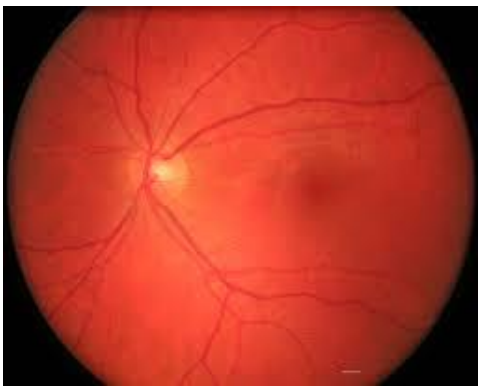
[7] Reyhaneh Sadeghzadeh and Michael Berks have proposed Detection of Retinal Blood Vessels Using Complex Wavelet Transforms and Random Forest Classification. In this paper a new method for detecting vessels in retinograms. The Dual-tree Complex Wavelet Transform (DT-CWT) is used to provide a rich, multi-scale description of local structure, and a random forest classifier is used to classify pixels as vessel/non-vessel on the basis of their DT-CWT coefficients. The method is tested on retinograms obtained from a publicly available database and our results are compared with previously reported results for the same database.

III. PROPOSED METHODOLOGY

Image acquisition

Vessels patterns, invisible to the naked eye, can be viewed through an image sensor sensitive to infrared light. Infrared light passes through the tissues of the human body and is blocked by pigments such as haemoglobin or melanin. As haemoglobin exists densely in blood vessels, infrared light shining through causes the vessels to appear as dark shadow lines in the captured image. In image acquisition module there are two cameras used one is CCD camera and the other is web camera.

Following figure shows the captured retinal blood vessels image.



Sample retinal blood vessels image

Image segmentation

Image segmentation is the authorized process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in digital images. Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify or change the

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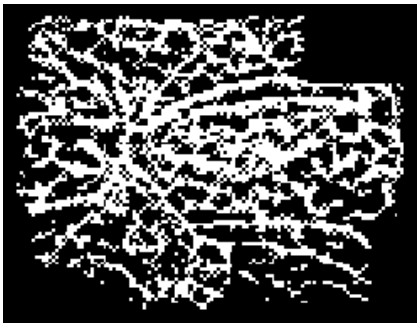
representation of an image into something that is more meaningful and easier to analyze.

Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. The result of image segmentation is a set of segments that collectively cover the entire image or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. The original image is captured with the black unwanted background. Including the background reduced the accuracy of the original image, because the position of retinal blood vessels usually varies across different retinal blood vessels images, it is necessary to image segmentation in region of interest (ROI) before feature extraction and matching with database.



Segmented image

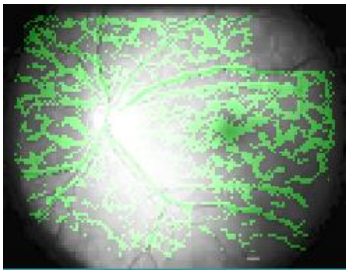
Image enhancement

The segmented retinal blood vessels image is then enhanced to improve its contrast as shown in Figure. The image is resized to 1/4 of the original size, and enlarged back to its original size. Next, the image is resized to into the original size for recognition as shown in fig.3.2.3. Bicubic interpolation is used in this resizing procedure. Finally, histogram equalization is used for enhancing the gray level contrast of the image.

Enhancement of image

Feature extraction

Feature extraction is most important step in retinal blood vessels recognition algorithm.. It is a special form of dimensionality reduction. It is a transformation of input data into the set of features. In the feature extraction process the canny edge detection method is used for feature extraction process. Extraction of features such as edges and curves from an image is useful for final authentication. Edges are important features in an image, they represents significant local intensity changes as shown in the following fig.



Filter image of blood vessels

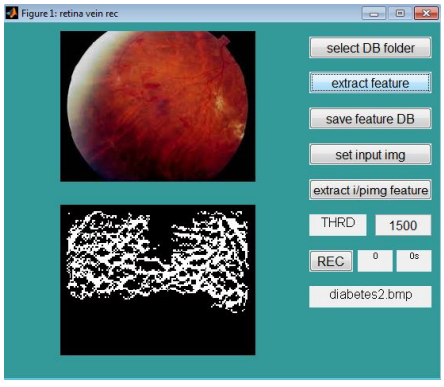
Matching with database

The retinal blood vessels matching module is use in MATLAB; the MATLAB is used to execute the retinal blood vessels recognition algorithm. In the working of real time proposed retinal blood vessels recognition algorithm contains two stages.

- The enrolment stage and
- The verification stage

IV. RESULTS

Following is the result that we get after applying proposed methodology to different images, and get the disease name. First we see the segmentation and histogram of the database images.



Segmentation of image

After that we set an input image for the recognition of the disease and extract the feature as follows, then it matches with the database images and find the disease.

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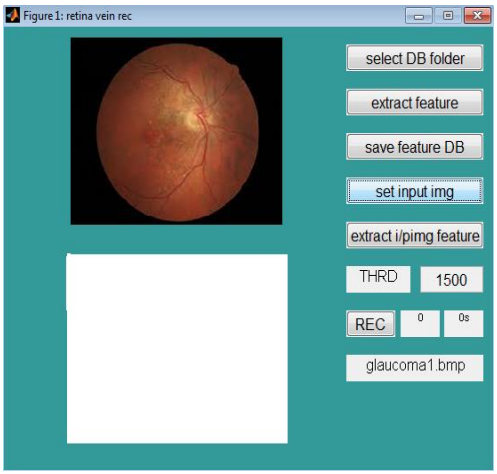

Input image for recognition of disease

The input is matches with the databases. Then the disease is diagnosis.

Detection of glaucoma disease

V. CONCLUSION

This paper provides analysis of disease using retinal blood vessels detection. Where we find out the disease such as diabetes, glaucoma, and hemorrhage on the basis of their segmentation. We use segmentation technique for retinal blood vessels detection for database images and input image then we find out the disease.

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