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Sclera Feature Extraction for Detection of Diabetic Disease

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Abstract: Sclera is a white and opaque outer protective covering of the eye. It is stable over the life time and unique to each person. A very few researchers have studied about the color changesoccur in sclera, but low accuracy, initial results. This is the challenging to identify the particular disease. Here segmentation is performed to separate the sclera from the image; k-means clustering is used. Enhancement is necessary to develop the accurate vessel structure for that Gabor filter is used. To detect the disease it is important to extract the feature for the identification of the particular disease. Here LBP method is used to extract the feature of the sclera. SVM is used to classify the affected and non-affected sclera regions.

Keywords: Diabetes, Segmentation, Sclera, LBP, SVM classifier.

I. INTRODUCTION

An increase in the development of automated diagnostic systems has lessened the load for health professionals. These systems are not only used for an automatic detection but also for an efficient diagnosis.

Diabetic is a condition that high sugar level and this condition causepathological change of the eyes. If not treated early can lead to other risks like vision loss, cardiovascular disease. Each human's sclera is unique, like the fingerprint, thus it is important to understand how the disease affects eachIndividual's eye during the progression of diabetes.

Fig 1 Original image

The functional impairment during diabetes causes alterations in the blood flow and in the vessel wall structure, which can in turn affect the function of the sclera. These changes are believed to start affecting the vascular geometry early, before the first stages of diabetic. In this paper mainly focused on the detection of the diabetic disease. For that segmentation, enhancement and feature extraction will be takes place. Depend upon the threshold values the disease affected area will be identified and classified as a diabetic disease.

II. PROPOSED METHODS

A. SEGMENTATION

It is the process of dividing eye image into related regions. For that here K-means clustering is used to separate into three clusters like sclera, iris and around the eye. The proposed system uses multilayered thresholding approach to increase the accuracy of vessel segmentation.

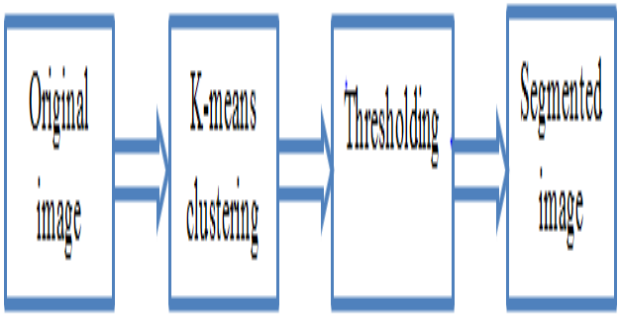

Fig 2. Segmentation process

In the segmentation process Semi-automated techniques are used to separate the sclera from the image [1, 7].

In this paper automated clustering is used to provide exact result of the segmentation [8,9]. Each pixel is represented in a Rectangle coordinate system based on their spectral RGB components in a three dimensional view. The partitioning the pixels into three categories based on K-means clustering and the sclera can be identified from the eye, as it is white in nature [2]. The K-means clustering algorithm is used separate the scleral pixels from the eye image [4].

The result of clustering is the region of interest corresponding to sclera can be identified by binary masking on the original images.

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Fig 3. Segmented sclera area

The sclera pixel cluster is used to determine the largest Euclidian distance from the origin to its centroid of the coordinate system [9]. Sclera region is marked as '1' in the mask denotes the pixels assigned to the sclera cluster. Remaining part is denoted as the '0'.

B. IMAGE ENHANCEMENT:

After performing the sclera segmentation, it is essential to enhance and extract the features from sclera [4]. Then the sclera vessel structures are not prominent and are very hard to identify the vein features. Before performing the feature extraction method it is essential to enhance the vein patterns [2].

A Gabor channel is a linear filter whose impulse reaction is characterized, Product of harmonic function into Gaussian capacity. Gabor channels have been utilized broadly via specialists for composition location, arrangement and image recovery purposes. The genuinePiece of 2D Gabor channel utilized as a part of the structure of sclera vessel division is very much characterized in the spatial space g(x,y) as takes after.

$$g(x,y) = exp\left[-\pi\left(\frac{x_p^2}{\sigma_x} + \frac{y_p^2}{\sigma_y}\right)\right]\cos\left(2\pi f x_p\right) \quad ..(1)$$

where

$xp = x \cos\theta + y \sin\theta$

$yp = -x \sin\theta + y \cos\theta$

The edge θ is orientation of the channel, for instance, a point of zero shows a channel that reacts well to the vertical elements in a picture. The parameter f gives a frequency of pass band. Next, σxand ,σy is the standard deviation of gaussian in x and y direction of the filter.

Fig 4. Gabor filter image

A Gabor filter is used here for sclera vessel enhancement. A polar coordinate-based mapping with iris center was performed for template matching.

C. FEATURE EXTRACTION:

Depending on the physiological status of a person (for example, fatigue or no fatigue), the vascular patterns could have different thicknesses at different times, because of the dilation and constriction of the vessels [4]. Therefore, vessel thickness is not a stable pattern for recognition. In addition, some very thin vascular patterns may not be visible at all times.

In this paper, local binary patter is used to perform the operations. Binary morphological operations are used to thin the detected vessel structure down to a single-pixel wide skeleton and to remove the branch points. This leaves a set of single-pixel wide lines that represents the vessel structure [6]. It is the important method to extract the feature for the further process. For that binary values are to be considered for the particular sclera region and develop the one centroid value of that particular sclera.

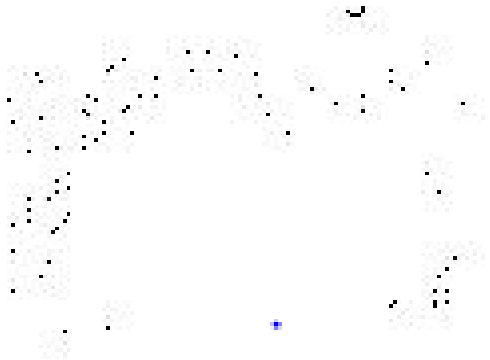

Fig 6. LBP method image

Here LBP is used extract the feature of the particular sclera. The enhanced images are considered for the extraction process. In this stage the binary value will be consider to identify the particular disease.

D. CLASSIFICATION:

Support Vector Machines (SVMs) are used for classification. SVMs are a popular supervised machine learning technique which performs an implicit mapping into a higher dimensional feature space. This is also known as kernel trick. After the mapping is completed it finds a linear separating hyper plane with a maximal margin to separate data from this higher dimensional space.

In this paper SVM classification method is used to perform the operation. It is necessary to classify the required result with comparing the extracted feature data. SVM is the one of the best classifier to separate the disease affected features and other features. Depend upon the threshold value which is given in the time of the feature extraction it will perform the classification operation.

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III.EXPERIMENTEL RESULTS

In theproposed system we used a MATLAB to perform the operation. The sclera images are stored in database. These images are acquired in the visible wavelength also. In the below image (fig 7) the original images are to be taken for the experiment. If the image is bluer or blink also the images are considered. First input image is taken to extract the sclera part by segmentation method. Here all the area will be clustered into three parts in that sclera is the one cluster.These sclera parts areenhanced and then feature extraction will be takes place.

In (fig 7) segmented part is extracted by clustering the eye image into three parts. Here depend upon the threshold values the sclera area is clustered. In that only sclera part is taken for the process. This sclera area is enhanced to remove the other parts like eyelashes and eyelids. In the next step feature extraction can be performed to extract the exact feature of that particular person. These features are used to classify the disease affected sclera part of the person and the healthy person. Considering all the methods and the threshold value which is different from the infected part and the healthy part by performing these operations the particular diabetic disease is identified. As shown in the below figure it will give the result of all the methods and diabetic disease is identified.

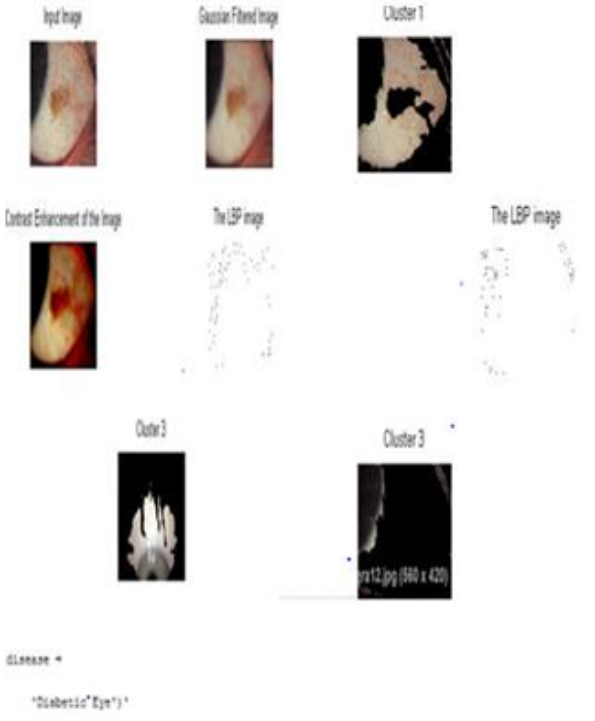

Fig 7. Shows result of the sclera segmentation, enhanced regions and the feature extraction is done for the disease identification, in the diabetic disease is identified.

IV. CONCLUSION

In this paper sclera feature extraction provide a strong solution for the identification of the disease. The Proposed system can reduce the complicated procedure in the hospitals. It can be achieved with the help of the automated technique where clustering algorithm is used to classify the image into three clusters- sclera, iris, and background of the eye image. The LBP method, which can greatly help to improve the efficiency and for the extraction of the feature. So that proposed method provides highly diabetic disease detection.

V. FUTURE SCOPE

An efficiently considering all these methods particular disease can be identify, such as hypertension. Data base can be improved for the process.

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