ISSN: 0976-9102 (ONLINE)
DOI: 10.21917/ijivp.2016.0197

A SURVEY OF RETINA BASED DISEASE IDENTIFICATION USING BLOOD VESSEL SEGMENTATION

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Abstract

The colour retinal photography is one of the most essential features to identify the confirmation of various eye diseases. The iris is primary attribute to authenticate the human. This research work presents the survey and comparison of various blood vessel related feature identification, segmentation, extraction and enhancement methods. Additionally, this study is observed the various databases performance for storing the images and testing in minimal time. This paper is also provides the better performance techniques based on the survey.

Keywords:

Retina, Blood Vessel, Segmentation, Filter, Database, Fundus

1. INTRODUCTION

The biometric devices are used for security identification and authentication services. These biometric devices are using the automated methods for checking and recognizing the identity of a people based on either physiological or behavioral characteristics. This authentication technique includes facial images, finger prints, iris prints and voice recognition patterns. Biometric devices are utilizing in regular working premises for authentication verification such as personal signature verification systems and iris recognition systems [10].

The biometric system uses unique structural and interactive characteristics of humans to authorize a person identity by filtering, and matching patterns with characteristics and online registered patterns. The registered indexed, authorized patterns are matched within a committed tolerances and personality can be used to authenticate person's identity. The biometric applications such as finger print, hand or finger geometry, face, iris, speech, retina, signature, hand vein, etc are used for verifying computation. Every human has their own characteristics for perfect identification.

Recently, the retina identification is most popular approach in the authentication system. The retina is provided the accurate and high level of security to access control systems based on the retinal classification with the retinal vasculatures [9]. However, the traditional biometric is used in most of the offices, organization, industries, etc. Hence, there is more possibility to forge the system.

In the biometric system model, every person has a single vascular pattern that is in human retina in the rear side of the human eye. It cannot be able to forge easily and also not able to access directly. The foundation of the retinal recognition is the retinal fundus image interpreted from the fundus camera with low power microscope. It is used by eye diagnostic experts for treatment of retinal diseases. The fundus of eye represents inside surface of the eye that is opposite to the lens.

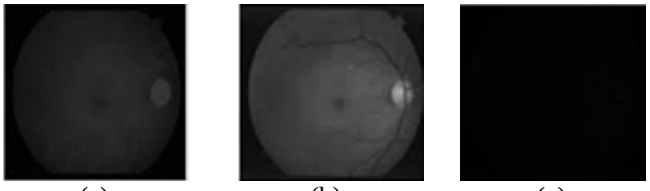
2. LITERATURE SURVEY

Adam and Michael have been presented a model based on the automation to identify the optic nerve in picture of the ocular fundus. This method is exploited a novel algorithm fuzzy convergence to represent the origination of the blood vessel network. This method is exploited to check 31 images of good and healthy retinas, and 50 images of diseased retinas. It is offered different indications such as tortuous vessels, choroid neovascularization hemorrhages and ambiguous of the actual nerve [1]. Al-Diri et al has been described a new retinal vessel technique that is demonstrated using reference dataset. This data subset consist 16 images with 193 vessel segments that are represented a various kind of pathologies and vessels. The vessel edges have noticed by three observers using a distinct drawing tool. This approach is used to process the segments to yield vessel profiles and also assessed the vessel width [2].

Chaudhuriet al has been offered the blood vessel detection, feature removal based on the optical and spatial attributes of objects that are to be predictable. The Gaussian shaped curve has been utilized the approximated gray colour contour of the cross section of a blood vessel [3]. The research work matching filter detection of signals is proposed to detect segment wise linear blood vessels in these retinal images. This method is used 12 various templates with possible constructed directions [3, 11].

Cree et al has presented the comparison of various approaches to delineate blood vessels in retinal images. The diabetic retinopathy is visible through marks of the vessel types such as narrowing of the arteriole walls, beading of venues into sausage like structures and novel vessel growing as an attempt to reperfusions ischemic regions. Computerized quantification of these scratches is very useful in diabetes research and clinical practice especially for eye-screening programmers to detect the eye-disease amongst diabetic persons [4].

The Fig.1 and Fig.2 have shown the various colours of retina images such as red, green, blue and grey level respectively.

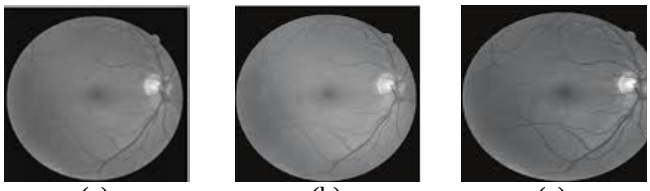


(a) (b) (c)

Fig.1. Red, Blue and Green Component Images

Chanwimaluang et al. have been suggested local entropy threshold algorithm for blood vessel detection in retinal images. They described an automatic detection and feature extraction of

blood vessels from retinal images to delineate specific vascular intersections/crossovers. This method is self-possessed by matched filtering, local entropy threshold, length filtering and vascular intersection detection. The matched feature extraction technique phase is developed the blood vessels. Entropy-based threshold is protected the spatial structure of vascular tree extraction segments. Length filtering is used to eliminate misclassified pixels. This method has been deployed on twenty ocular fundus images [5].



(a) (b) (c)

Fig.2. Gray Scale Retinal Images

Kelvin et al have been proposed an enrichment of retinal fundus image to emphasize the features to detect abnormal eyes. The proposed approach has been detected the main characteristics of fundus images such as optic disk, fovea, exudates and blood vessels. They have been applied Hough transform method that used the optic Disk and its center of the brightest part of the fundus. The candidate solution of fovea region is well-defined in the circle area. The spatial relationship with optic disk is exploited to detect the fovea. Exudates are generated the solution based on their high grey level variation and contours that are firm based on morphological reconstruction schema. The blood vessels are painted using lowest hat transmute and morphological dilation after edge detection [6].

Li and chutatapeet have been presented an automated feature extraction in colour retinal images. This prototype is presented to develop primary structures of colour retinal images. It has been utilized the principal component analysis to locate optic disk. A modified active shape model is suggested in the outline recognition of optic disk. A fundus coordinate system is recognized to offer a better description of the landscapes in the retinal images. This approach also is developed to detect exudates by the pooled region growing and edge detection [7].

3. COMPARISON OF BLOOD VESSEL SEGMENTATION TECHNIQUES AND DATABASES

The Table.1 shows the comparison of various algorithm working principles and storages [3]-[4], [6]–[7], [9]–[11].

The comparison is presented the preprocessing, extraction and feature enhancement of various approaches. This paper authors have observed that CLAHE is provided high accuracy in preprocessing, features enhancement and pixel based classification provided accurate extraction results. Comparison of various databases used to store retinal image segments is shown in Table.2 [3]-[4], [7]-[9].

The authors have observed that automatic detection method to identify the blood vessels that are affected by diabetic retinopathy.

The DRIVE database is improved the performance by avoiding unauthorized users and redistribution of images. It has been performed the operation using 40 images that conducted 20 tests and 20 training sets in twenty seconds.

4. CONCLUSION

This paper has been presented the survey and comparative study of blood vessel identification techniques that are used for identifying the diseased eyes. The blood vessels segmentation has been performed accurately using automatic detection by classifier based vessel tracking methods. The DRIVE database has been provided better performance in terms of resolution, speed, and accuracy.

This retinal identification is also can be used for authentication. The authors will extend this research work in blood vessel segmentation using DRIVE database in future.

Table.1. Comparison of various algorithm working principles and storages

Techniques	**Personal identification using retinal blood vessels**	**Multiple oriented blood vessels using automatic detection**	**Global thresholding with retinal vessel segmentation**
Algorithm	Neuro-Fuzzy Classifier	1. Blood vessel segmentation 2. Gabor filter 3. Diabetic Retinopathy	1. CLAHE global based threshold technique 2. IDM based threshold 3. Phase congruence technique
Methods	Morphogical operation	1. Filter based method 2. Vessel tracking methods 3. Classifier based methods 4. Morphological method	1. Preprocessing Technique 2. Global Threshold 3. Post processing technique
Preprocessing	This method considered red channel, blue channel, and green channel parameters of images of retina.	This approach is also processed the red, blue, green, channels of retina.	This system is proposed CLAHE that is processed gray scale and green channel of the retinal fundus image.
Advantages	Green channel retinal images only have better performance.	Green has good and darker colour retinal images.	Gray scale has good performance.

Enhancement	CLAHE enhancement	CLAHE enhancement and the algorithm	Vessel enhancement
Feature Extraction	Noise is removed in vascular pattern resulting from the segmentation process. Because the segmentation process reduces the impulsive distortion in an image and it should have the better class separability, matching and classification.	In this, Drive database and Hoover's database are used for the automatic segmentation of the retinal vessels since manual segmentation takes more time than the automatic segmentation. In automatic segmentation, it takes only 20 seconds to detect the retinal images.	Retinal vessel segmentation classification is a PIXEL based classification result. The pixel based classification has the high accuracy rates compared to other segmentation.
Databases Used	1. Stare database 2. Drive database 3. Messidor database 4. Review database 5. Varia database	1. Drive database 2. Hoover's database	1. Drive database 2. Stare database

Table.2. Comparison of various database storages for image processing

Database Type	Personal identification using retinal blood vessels	Multiple oriented blood vessels using automatic detection	Global thresholding with retinal vessel segmentation
STARE DATABASE	1. The Stare database contains 20 images for blood vessel segmentation, 10 of these contain pathology. 2. The digitized pictures are captured by a TOPCON TRV-50 fundus camera at 35 degree Field Of View (FOV). 3. It has 605 × 700 pixels and 8 bits per color channel. 4. The approximate diameter of the (FOV) is 650 × 500 pixels.	1. The database consists of 89 color fundus images of which 84 contain at least minor non proliferative emblems of the diabetic retinopathy and five are considered as normal which do not contain any symbols of the diabetic retinopathy agreeing to all the specialists participated in the evaluation. 2. Images were captured with the similar 50 grade pitch-of-view digital fundus camera with varying imaging controlled by the system.	1. This stare database involves retinal images taken with the use of TOPCON TRV-50 fundus camera with 24-bits gray scale resolution and it has the spatial resolution of 700 × 605 pixels. 2. The database provides 20 colored retinal images and 20 hand categorized pictures as the crushed truth for the reasonable enactment evaluation of different vessel segmentation algorithms.
DRIVE DATABASE	1. Digital Retinal Image for vessel extraction is publicly available database. 2. It has 40 color fundus images. 3. It has contained 7 pathology, hemorrhages, exudates and pigment epithelium changes.	1. The Drive database is provided 40 images; the images are acquired using a canon non- mydriatic 3CCD camera with a 45 degree field of view (FOV). 2. Each image is captured using 8 bits per colour plane at 768 × 584 pixels. 3. It has the circular with distance almost 540 pixels.	1. The Drive databank is made up of 40 images captured with the use of canon CR% camera with 24 jiff dark scale resolution. 2. It has the spatial resolution of 565 × 584 pixels. 3. The Drive database also offered golden average images as the earth fact for vessel separation for the comparative performance evaluation of different vessel segmentation algorithm.
MESSIDOR DATABASE	1. It is the largest database of 1200 retinal images 2. The images acquired at the 3 different ophthalmology, branches using a non- mydriatic 3CCD camera at 45 degree of Field of view (FOV) with a resolution of 1440*960, 2240 × 1488 or 2304 ×	1. This database has been familiar to abbreviate trainings on computer-supported diagnoses of diabetic retinopathy. 2. The 1200 images are packaged in 3 collections, one per ophthalmologic division. Each set is divided into 4 zipped sub sets containing each 100 images in	1. In this, 800 images were acquired with learner enlargement (one drop of Tropicamide at 0.5%) and 400 short of expansion. 2. For instance given increasing number of download requirements, handling these desires and related questions

	1536 pixels are stored in the TIF format	TIFF design and an Excel file with health diagnoses for every image.	requires approximately one hour per week
REVIEW DATABASE	1. In this database, it includes 16 mydriatic images with 193 annotated vessel segmentations that consists 5066 profile points. 2. It has high resolution image, the vascular disease image and the kick point image set.	1. It is an original retinal vessel reference dataset; containing four spitting image sets were chosen to assess the accuracy and precision of the pitcher thickness measurement. It processes in the presence of pathology and a central light reflex, and to compare the presentation of the future procedures with manual measurements with accuracy up to 0:25 of a pixel 2. This dataset includes 16 images with 193 vessel segments, representing a variety of pathologies and vessel types. 3. These image sets contain 5066 manually marked profiles.	1. This dataset includes 16 images with 193 vessel slices, representing a diversity of pathologies and pitcher types. The vessel boundaries are clear by three observers using a special drawing tool 2. This method also defines the process used these segments to produce vessel profiles, against which vessel breadth measurement algorithms can be assessed.
VARIA DATABASE	1. The VARIA database is a set of retinal images used for authentication purpose. 2. The database has 233 images from 139 different individuals. 3. The image with optic disc centered have been taught with a TOPCON non-mydriatic camera NW-100 model with a firmness of 768 × 584.	1. In this, VARIA database containing 153 (multiple) retinal images of 59 individuals. 2. The database currently contains 233 imageries, from 139 dissimilar individuals. The pictures have been developed with a TOPCON non-mydriatic camera	1. Detection and classification of feature points is validated using the VARIA database. These results provide a more dependable methodology for retinal structure analysis.
HOOVER'S DATABASE	1. In this the results, it is easy to see that even if the retinal image has a large pathological area. It extracts the vessels correctly. 2. However, this method not yet accurately segments the vessels in retinal images.	1. The Hoover's database comprises of 20 digitized slides taken by a TOPCON TRV-50 cameras at 35 Field of View (FOV) 2. The slides were digitized to 700 × 605 pixels with 8 per bits per color channel.	1. It consists of 19 images. 2. The first observer segmented far less (small) vessels than then ext viewer and there is a huge changeability between the observers.

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