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PERSONAL IDENTIFICATION USING RETINAL IMAGES

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ABSTRACT

This paper focuses on vessel extracion algorithm for personal identification of retinal blood vessel. Blood vessel extraction is an important task for biometric application. Here the vessel extraction is done using morphological approaches. Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels). Segmentation refers to the operation of partitioning an image into component parts, or into separate objects. Segmentation subdivides an image into its constituent regions or objects. The level to which the subdivision is carried depends on the problem being solved. The goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyze. The objective of Segmentation is to partition an image into regions.This paper proposes biometric application for retinal images. Each induvidual has unique retinal blood vessels. Thus retinal blood vessels can be used for personal identification. input image is first preprocessed. The pre processed image contain enhanced blood vessels. After pre processing it is taken for vessel extraction followed by feature extraction. finally it is given to the classifier.

Keywords; Retina, Biometric, Image Segmentation, Personal Identification, Morphological Approaches.

I. INTRODUCTION

Eye is nearly a sphere with an average diameter of ap- proximately 22 mm. Three membranes enclose the eye: the cornea and sclera is the outer layer, the choroid, and the retina. Innermost layer is the retina. Retina lies inside of the walls posterior portion. When eye is properly focused, the light from the object outside enters into the eye. Pattern vision is afforded by the light receptors over surface of retina. Retina has two cells. They are cone and rod cells. Retina allow conscious light perception and vision including color differentiation and the perception of depth with the help of rods and cone cells. Retina has numerous blood vessels. Retinal blood vessel may get damaged due to various diseases. Retinal hemorrahage is one of the major diseases that affect retina. Diabetics, hypertension, atherosclerosis are the major condition where blood vessel diagnosis is important. retinal blood vessels have various properties such as uniqueness, certainity, potentiality, represent ability, safety, simplicity, ease of access, universality, reliability, pramanence, practicality[5-7].

First we have to produce an input[1] digital image from a paper envelope. This can be done by using either a CCD camera, or a scanner. Preprocessing is done for input image. After preprocessing we get enhanced image which will be more suitable for further processing. An image may be referred to as a two dimensional image f(x, y) where x and y are spatial co-ordinates. Amplitude of f at any pair of co-ordinates is called intensity or gray level of the image at any point. When x, y and amplitude of f are all discrete, finite quantities we call it as discrete image.

II. BLOOD VESSEL EXTRACTION

Block diagram for blood vessel extraction is shown in figure2. First the input image is taken for preprocessing.

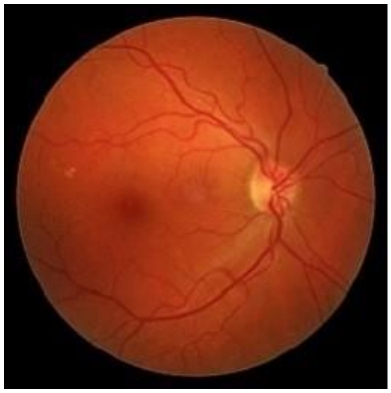

Fig. 1. Human Retina.

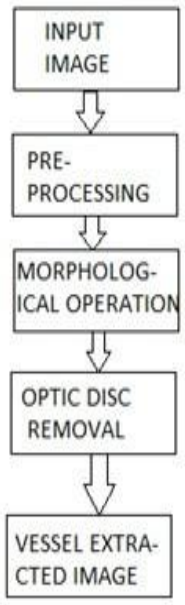

Fig. 2. Block diagram for blood vessel extraction.

2.1 Input Image

Input image is retinal image which contain retinal blood vessels. Retinal image is taken using fundus camera. Fundus camera is a complex optical photography. Fundus camera is designed to capture the inner surface of

the eye. Retina, macula, optic disc and postirior lobe constitute the interior surface of the eye. So the image of retinal blood vessel is taken using fundus camera. images taken using fundus camera is the fundus image.

2.2 Pre-Processing

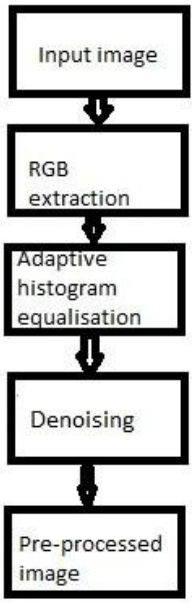

Fig. 3. Block diagram for preprocessing.

1. Extract green channel of input image.
2. Image after green channel extraction is used for histogram equalization. Instead of normal histogram equalization we use adaptive histogram equalization.
3. Median filtering is used to remove the noise.

Adaptive histogram equalization is used for image en- hancement. Adaptive histogram equalization gives better result than histogram equalization. This gives a better image. His- togram equalization automatically determines a transformation function that seeks to produce an output image that has a uniform histogram. When automatic enhancement is desired, this is good approach because the result from this technique is predictable and the method is simple to implement. Histogram equalization is an adaptive enhancement tool. Next step is noise removal. Median filter is employed for noise removal. This is a powerful denoising tool. After pre-processing we can achieve the pre-processed image. This image will be highly enhanced denoised image. Pre-processing improves image quality and after preprocess- ing we go for image segmentation. Image segmentation is a critical task through which we get the result. Segmentation operation should be better so that we get better result for biometrics[2,8,10]

Fig. 4. preprocessed image.

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2.3 optic disc removal

Optic disc removal is a major task during retinal blood ves- sel segmentation[11]. Several methods have been put forward for optic disc localization [9]. This is mandatory because the optic disc may be confused during segmentation. For optic disc removal we subtract the image after opening from adaptive histogram equalization. After optic disc removal the image is

Fig. 5. optic disc removed image.

adjusted to increase its contrast. After adjusting operation the blood vessel will be brighter than the previous image.

2.4 Binaristion

This image is then binarised. Binary image will have only two values: 0 and 1. Binarisation is one of the most important approaches to image segmentation. If background and object pixels have gray levels grouped into 2 dominant modes, they can be separated with a threshold. After binarisation the image will be converted to black and white. Only black and white pixel will be present. The gray scale image is converted into black and white image after binarisation. Lighter region is converted to white and the darker area will be transformed to black pixel.

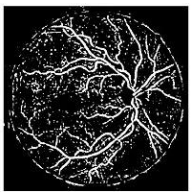

Fig. 6. Binarised image.

2.5 Vessel Extraction

In the final step we get the image with extracted blood vessels. We get the clear blood vessel after extraction. From a binary image all connected components (objects) are removed. Connected components that have fewer than P pixels which produce another binary image, BW2. This operation is known as an area opening operation. This operation is used to attain the final image. Block diagram for the proposed method is

Fig. 7. Vessel extracted image.

given below. input image is first taken for preprocessing as explained above. then it is taken for vessel extraction.

2.6 Feature Extracion

During feature extraction[5] various features of the retinal blood vessels are taken. these features contain both negative and positive features. Positive features are the required features for vessel extraction and negative features are the feature that are not required for feature exraction. Ending, bifurica- tion, crossover,lake, island, spure are the different bifurication points which can be selected during feature extraction. these features are shown in below figure 9.

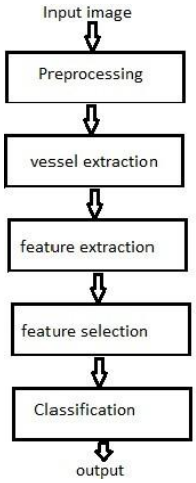

Fig. 8. block diagram for proposed method.

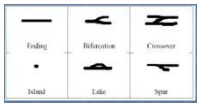

Fig. 9. features that can be extracted.

2.7 Feature Selection

Amoung various retinal landmarks bifurication[8] points are important. Bifurication point is the relevent and abundent feature. These features are given for feature selection. in feature selection required features are selected according to the given criteria and other features are removed. Bifurification point is selected during feature selection[3,4].

This is then trained and required features are selected.

2.8 Classification

Selected features are given to a classifier[8]. Its performance measure can be calculated after classification

III. CONCLUSION

Morphological image processing is a simple operation. That can be done more accurately and efficiently. It shows less complexity. Thus time consumption is less. Using this method we get result in simpler manner with less time. The segmented image is more accurate. Optic disc has to be removed during segmentation. This is

an important task because the optic disk may be misleaded as the blood vessel during segmentation[8]. Optic disk may be segmented as blood vessel during the segmentation process. Thus optic disk removal is an impor- tant task. Finding image compliment, dilation and erosion, binarisation, etc are the simple morphological operators used in this project. Pre-processing is an important criteria that is used before segmentation. Adaptive histogram equaliza- tion is used in this project which gives better result than normal histogram equalization. Median filtering is used for denoising.Segmentation[9] refers to extracting the particular features which allow us to recognize between objects. Here we will be looking for curves, holes and corners which allow us to distinguish the dierent types of digits which constitute a postcode. This means assigning labels to objects based on their descriptors from the previous step, and assigning meanings to those labels. So we identify particular digits, and we interpret a string of four digits at the end of the address as the postcode. This is an automated method which can be implemented using MATLAB commands.

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