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BIOMETRIC IDENTIFICATION OF SCLERA USING EYE VEIN

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Abstract - *Biometrics are used in several fields because of its security and promising results. Many biometrics include the fingerprint, iris, palm print and face recognition. As a new approach, we have tried using the sclera. The vein structure in the sclera is unique for every individual and it can be used as a biometric. A few researchers have performed sclera vein recognition and reported that it is most promising. It is very difficult to obtain the vein pattern as it moves and deforms with the movement of the eye and the surrounding tissues. In this, we have used Principal Component Analysis (PCA) algorithm to detect the vein pattern and a database is created with a set of sclera images. It is used for authentication purposes.*

Keywords- Biometric identification, pre-processing contrast enhancement, segmentation, feature extraction.

Abbreviation – PCA (Principal Component Analysis)

I. INTRODUCTION

Biometric identification technique includes the physiological and behavioral characteristics that are unique among all individuals. The behavioral biometrics include voice, gait, etc. The physiological biometrics include fingerprint, face recognition, palm print, hand geometry, iris, retina, etc. Sclera recognition is a new approach among all the physiological biometrics. Many researchers have reported the sclera recognition the most promising one.

Sclera is a white opaque region consisting of connective tissues and blood vessels. The blood vessel structure is formed randomly and is unique to each person which can be used for human identification. The unique properties of eye do not change with time and it is also possible to identify the identical twins.

Fig1.Sclera input

II. METHODOLOGY

The recognition of vein pattern of sclera includes the following steps:

Preprocessing, edge detection, segmentation and feature extraction using PCA.

III. BLOCK DIAGRAM

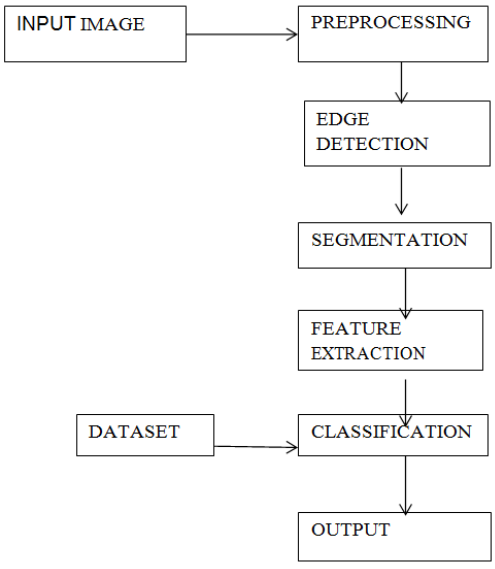

Fig 2. Block diagram of sclera recognition

IV. STEPS INVOLVED

1. PREPROCESSING

In computer science, digital image processing is the use of computer algorithms to perform image processing on digital images. Pre-processing is the size adjusting of the considered image, filtering noise with specified filter. To obtain a better visualization of the blood vessels in the sclera region, a transformation of the original image into a complemented image is proposed. For greyscale images, each pixel value is subtracted from the maximum value that can be represented by the input data type and then outputs the difference. As result, the dark areas become lighter and light areas become darker.

Fig 3. Grayscale image

2. IMAGE ENHANCEMENT

The essential target of image enhancement is to minimize noise from a digital image by keeping the specific information of the image preserved. The algorithms are especially able to improve the contrast of medical images by means of software techniques. Green channel contains fine details and valuable information. So to obtain maximum contrast between blood vessels and background green channel is extracted. To make intensity uniform and to remove non-uniform illuminations from the images, Contrast Limited Adaptive Histogram Equalization (CLAHE) is applied. It prevents the over amplification of noise by using a predefined value known as clip limit. There is no need for the adaptive selection of parameters of CLAHE parameters because image size has been fixed to the resolution of 256×256. The clip limit has been varied from 0.01-0.05. With a clip limit of 0.01, the image quality was improved, the noise level was low and blood vessels are perceivable as well.

3. EDGE DETECTION

Edge detection is a technique used to detect the boundaries of objects within the images. It detects the discontinuities in brightness. It is used for image segmentation and data extraction in areas of image processing, computer vision, machine vision, recognition tasks.

It uses the principle of template matching. It aims to find out the location and variation of the specified object in the image. With the generalized Hough transform, the problem of finding the models position is transformed to a problem of finding the transformations parameter. And then using the value, the position of model in the image can be obtained. It uses edge information to define a mapping from orientation of an edge point of the shape. In this, the binary image where the pixels are either black or white, every pixel are their corresponding reference point from orientation of an edge point to reference point of the shape. In this, the binary image where the pixels are either black or white, every pixels are their corresponding reference points.

4. IMAGE SEGMENTATION

The simplest method of image segmentation is the thresholding method. It includes selecting the thresholding value. Here, the threshold value is set to 10. We have proposed the method using Otsu threshold.

The Otsu method calculates the measure of spread of the pixel levels each side of the threshold that is to fall either on the foreground or the background.

If g(x,y) is a threshold version of f(x,y),at some threshold T, it can be defined as

$$G(x,y)=1 \quad \text{if } f(x,y)\geq T$$
$$=0 \quad \text{else}$$

5. FEATURE EXTRACTION

Feature extraction includes the dimensionality reduction which is useful when image sizes are large and is required to quickly complete the tasks in matching and retrieval of images. It processes the images without losing the important data. Feature detection, feature segmentation and matching are combined for the recognition and classification purposes. Here we used Principal Component Analysis (PCA) Technique.

Principal Component Analysis is a statistical approach that uses an orthogonal transformation to convert a set of observations of correlated variables into a set of values of linearly uncorrelated variables called principal components. PCA can be done by the Eigen value decomposition of a data covariance matrix or a single value decomposition of a data matrix after normalization step of the initial data. It is used to

emphasize variation and brings out strong pattern in a dataset. It is often used to make data easy to explore and visualize. It reduces the dimensionality of high-dimensional datasets and preserving the original structure.

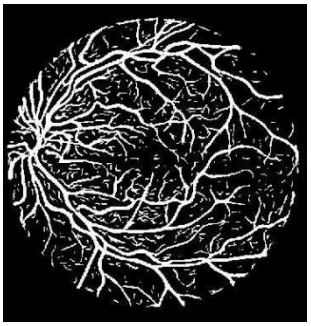

Fig4. Sclera vein pattern

IV. PROPOSED METHOD

There are several biometrics being used now-a-days. Sclera recognition using PCA technique is a new approach for the authentication purpose and can also be used in many fields in the future as it provides promising results.

V. RESULTS AND DISCUSSION

Sclera vein pattern is being obtained using the PCA algorithm. A database is being created with a set of sclera images and the details are fed into it. When a sclera image is being tested it matches with the features of images in the database and provides authentication if it matches. We have not used the real-time authentication. It can be used as the future work.

V. CONCLUSION

As discussed, the sclera recognition will be a new approach for the identification purposes and using PCA algorithm it provides results that are promising and makes quick recognition of vein pattern of the sclera.

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