Sclera Recognition System

Pallavi Yadkikar, Dishant Mehta, Mayuri Naykodi, Sheetal Pareira

Abstract— **Identification of a person based on some unique set of feature is an important task. Human identification is possible with several biometric systems and sclera recognition is the accurate and best biometrics. The sclera is the white portion of eye. The vein pattern seen in the sclera region is unique to each person. Thus, sclera vein pattern is a well-suited biometric technology for human identification. The existing methods used for sclera recognition have some drawbacks as if only frontal looking images are preferred for matching. Sclera recognition is shown to be a promising method but it has slow matching speed so we have used neural network approach to classify the images. This paper presents a concept called sclera recognition, it includes following concepts: preprocessing technique, feature extraction and then classification technique like neural network for sclera biometric. This whole process is consist of one major part called sclera segmentation which involves various steps. Finally, our observations, future scope are discussed.**

Index Terms— **Sclera Recognition, Biometric, feature extraction, Sclera Segmentation.**

I. INTRODUCTION

Biometrics is relegated to authentication of human being based on their physiological and behavioral characteristics. To detect person as accurately as possible number of techniques were proposed but it was found that no biometric method is perfect or accepted globally. To achieve higher recognition accuracy, to increase population coverage further research is required. There are various techniques in biometrics to identify an individual, among these sclera recognition is found out to be a best technique to complement previous trades because of sclera part, Because Sclera areas are highly secured part of an eye, which is impossible to stole. Identification of a human being by the vessel pattern of the sclera is possible because the vessel pattern of human beings is very different, and it is unique for every individual.

Twins also have different vessel and this makes it suitable for human identification. Secondly, the vessel pattern of the person throughout lifetime is stable. Even the vessel patterns of left and right eye of a person differ from each other. Therefore, this system is best and reliable approach human identification.

This paper organized as follows. Section II covers the background of sclera recognition, after that segmentation process is clearly specified after that that we have concluded.

Manuscript received Feb, 2016.

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II. BACKGROUND

Many Different methods are used such as fingerprint, iris, voice, face. Every method has its pros and cons. almost all biometrics uses following objectives: Accuracy, reliability, stability, identification, ID capability in distance, user cooperation and scalability to large population. For example, face detection is very natural way of identifying a person by humans, but human beings face structure changes according to his age increase and these changes affects the recognition correctness. Human being finger print structure is not change and its identification accuracy is more but it has one disadvantage we cannot used it as an ID for a certain distance. In addition, there are many reasons why people object the some methods for example culture, hygiene, religion, personal preference. Fingerprint recognition may cause hygiene and medical issues.

In real life applications, some biometrics techniques are more preferable than others in certain situations are. For example, the accuracy provided by fingerprint and iris recognition is higher than face recognition.

Overall no biometric is said to be perfect or can be accepted globally. Researchers are trying to find new biometrics, which provides more options for human ID. In this paper, we have proposed a human ID system Sclera recognition, which gives us more accuracy than other methods.

Sclera is the white part of the eye. It completely surrounds the eye and made up of for layering of tissues- the epsclera, stroma, lamina fusca, and endothelium, Structure of blood vessels are quite visible and stable over time. It is different for each person. Sclera recognition system consists of four modules – sclera segmentation, sclera vessel feature extraction, sclera vessel feature matching decision.

III. SCLERA SEGMENTATION

Sclera segmentation is the first method in the process of sclera recognition system. It has many steps involved in it.

A. Preprocessing

In image processing, as we know all the filters are applied to the grayscale image. If the input image to the system is colored image then it is converted into a grayscale image. We have incorporated one instruction in Matlab Software, which gives us exact output as grayscale image, which we want to process further in this project.

ISSN: 2278 – 7798

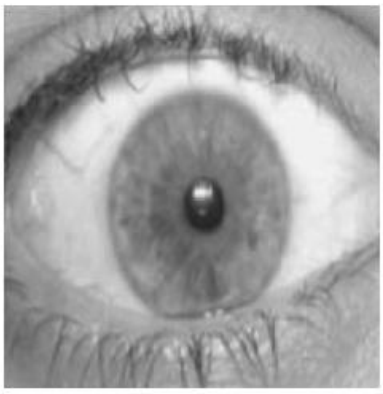

Fig.1 Preprocessed image

B. Color Plane Conversion

Any colored image has three dimensions that is, red, green and blue plane. In MATLAB a binary and gray-scale image is represented by one 2-dimensional array. A color image is represented by a 3-dimensional array (one 2-dimensional array for each of the color planes or color channels red, green and blue). The origin of the image is in the upper left and the size of the image is defined by the parameter width (number of columns of the array) and height (number of rows of the array). Note that the x- and y-coordinates are chosen such that the z-axis points to the front. If any image from the dataset has green or brown colored iris then it is necessary to get those color intensities. Hence the colored image is converted into the three planes using following formulae where 1,2,3 resembles to red, green and blue plane respectively [6].

$$R = testimg(:,:,1);$$
$$G = testimg(:,:,2);$$
$$B = testimg(:,:,3); \quad (1)$$

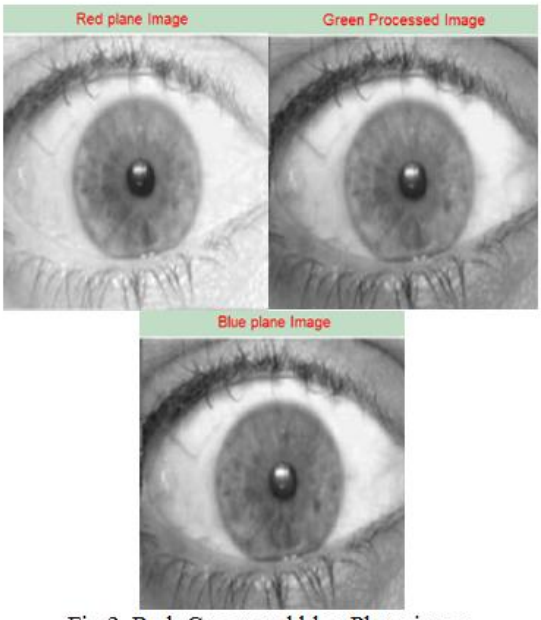

Fig 2. Red, Green and blue Plane image

C. Sclera segmentation

The glare area detection is the first step to do in the system. Glare area is a white colored bright area of an eye image. The glare area detection is carried out by brighten the part of eye except the skin and pupil part. To brighten the required area we have used contrast stretching mechanism as well as intensity enhancement technique.

Fig 3. Enhanced Intensity Image

We have given a threshold using which contrast stretching implemented as follows [4]:

$$if\ G(i,j) < 150\ then\ G(i,j) = 0; \quad (2)$$

After that to brighten the glare area, we have enhanced the intensity values of an image. After these techniques are applied, the image is converted to binary image with following logic.

$$Binaryconv\ v = imcomp(enhance\ intensity); \quad (3)$$

Where enhance intensity which is passed in the function of the complement process is the image which is given by the contrast stretching considered to be prerequisite to current function.

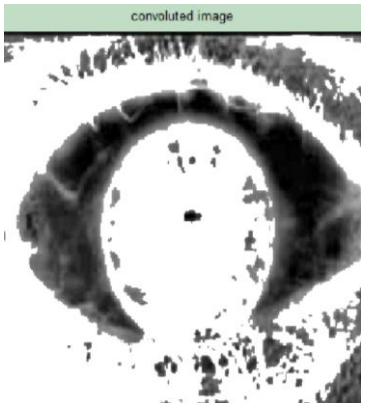

Fig 4. Convoluted Image

D. Sclera Enhancement

Sclera enhancement is a stage where sclera part of an eye is enhanced with the help of gabour filter [2]. Gabour filter helps for the feature extraction from the image. Gabour filter deals with the complex numbers to give a precise output and it helps us for the optimized results. In this stage, we have applied the filter then real and imaginary images are convoluted to form a resultant image. Gabour filter equation is given as follows, where sx is variance along x-axis and see is the variance along y-axis and repeated within the loop of variance.

ISSN: 2278 – 7798

$$G1(fix(Sx)+x+1, fix(Sy)+y+1) = \left(\frac{1}{2*\pi*Sx*Sy}\right)* \exp\left(\frac{1}{2}*\left(\frac{x}{Sx}\right)^2+\left(\frac{y}{Sy}\right)^2\right)+2*\pi*li*(U*x+V*y)); \quad (4)$$

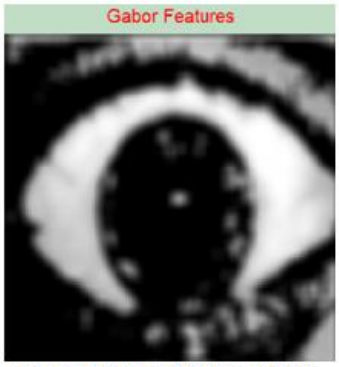

Fig 5. Output of Gabour filter.

E. Vein Segmentation

Vein segmentation extracts pattern of the veins from the features extracted by Gabour filter. These veins are then clearly seen from the previous output. For segmentations of veins, we convolute the image using a technique, which is alike Hough transform, Because it always happens that veins which are not visible to human's naked eye are also exists and to detect those veins for more accuracy in the process we convolute the image. Then regions are created and in each region, veins are segmented using a thresholding algorithm or we can say it is a process of histogram equalization in a different way as it checks frequencies of pixels and then segregate them into different regions. After that, the image is converted into a binary image so that rests of the veins are segmented accurately.


Fig 6. Output of Vein Segmentation.

IV. Conclusion

Techniques and algorithms explained in this paper are successfully implemented. Sclera segmentation part is executed and tested successfully which finally gives us the output where veins are segmented. This paper gives detailed knowledge about sclera recognition system.

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ISSN: 2278 – 7798