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User Identification Using Iris Scan

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***Abstract*— This paper delivers a iris coding method for effective recognition of an individual. An algorithm that is based on person iris independent of spatial position, orientation and center frequencies of the iris image. The fact that the iris is protected behind the eyelid, cornea and aqueous humour means that, unlike other biometrics such as fingerprints, the likelihood of damage and/or abrasion is minimal. We have worked with grey scale database with help of images available in CASIA. We have focused on striking a balance between speed and accuracy. The images have been pre-processed to get rid of the unnecessary portions of the image like sclera, eye-lashes etc. The number of variations in the iris allows one iris to be distinguished from the other..Thereafter only the iris is localized using a circular contour and it is centered onto the frame for ease of comparison with other images. The localized iris images were then worked upon by technique, namely Discrete Cosine Transform [DCT] mainly use for image compression. Once the DCT have been implemented, the images are checked for match by using the Mean Square Error formula on DCT values.**

***Index Terms*— Discrete Cosine Transform (DCT); MATLAB; Image compression; gray scale images.**

I. INTRODUCTION

In the realm of computer security, Biometrics refers to authentication techniques that rely on measurable physiological and individual characteristics that can be automatically verified. In other words, we all have unique personal attributes that can be used for distinctive identification purposes, including a fingerprint, the pattern of a retina, and voice characteristics. Although the field of biometrics is still in its infancy, it's inevitable that biometric systems will play a critical role in the future of security. Biometrics refers to the automatic identification of a person based on his or her physiological or behavioral characteristics. An important issue in designing a practical system is to determine how an individual is identified.

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Depending on the context, a biometric system can be either verification (authentication) or an identification system.

- Any human physiological and/or behavioral characteristic can be used as long as it satisfies the following requirements:
- Universality: Each person should have the characteristic.
- Distinctiveness: Any two persons should be sufficiently different in terms of the characteristic;
- Permanence: The characteristic should be sufficiently invariant (with respect to the matching criterion) over a period of time;
- Collectability: The characteristic can be measured quantitatively.

However, in a practical biometric system (i.e. a system that employs biometric for personal recognition), there are a number of other issues that should be considered, which are:

- Performance: which refers to achievable recognition accuracy and speed, the resources required to achieve the desired recognition accuracy and speed, as well as the operational and environmental factors that affect the accuracy and speed;
- Acceptability: which identifies the extent to which people are willing to accept the use of a particular biometric identifier(characteristic) in their daily lives;
- Circumvention: which reflects how easily the system can be fooled using fraudulent methods.

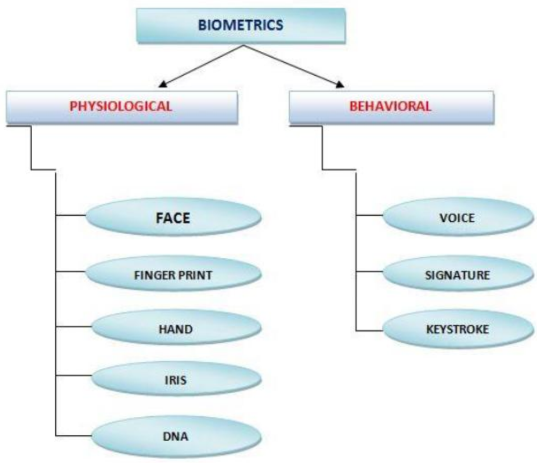

Figure 1: Types of Biometrics

II. ABOUT IRIS

It is an internal organ that is well protected against damage and wear by a highly transparent and sensitive membrane (the cornea). The iris is mostly flat and its geometric configuration is only controlled by two complementary muscles (the sphincter papillae and dilator papillae), which control the diameter of the pupil. This makes the iris shape far more predictable than, for instance, that of the face. The iris has a fine texture that – like fingerprints – is determined randomly during embryonic gestation. Even genetically identical individuals have completely independent iris textures.

An iris scan is similar to taking a photograph and can be performed from about 10 cm to a few meters away. There is no need for the person to be identified to touch any equipment that has recently been touched by a stranger.

Some argue that a focused digital photograph with an iris diameter of about 200 pixels contains much more long-term stable information than a fingerprint. While there are some medical and surgical procedures that can affect the colour and overall shape of the iris, the fine texture remains remarkably stable over many decades. Some iris identifications have succeeded over a period of about 30 years

III. EXISTING METHODS

There are several methods already present in the domain of iris recognition. None of these methods are completely foolproof. Each method has its own pros and cons, some being faster but with less accuracy. Others being extremely accurate but require heavy processing power. Some of these methods are listed below:

A. Linde, Buzo & Gray Algorithm

Here color feature extraction of iris is done using vector quantization for color images of the iris. The local iris is selected to obtain the image code vectors of this region with each code vector consisting of 3 components R, G & B. Comparison is based on the average mse obtained between all the code vectors present in the codebook of the acquired image.

B. Gabor Wavelet Method

Gabor transform and wavelet transform are typically used for analyzing the human iris patterns and extracting feature points from them. Each isolated iris pattern is then demodulated to extract its phase information using quadrature 2D Gabor wavelets. It amounts to a patch-wise phase quantization of the iris pattern, by identifying in which quadrant of the complex plane each resultant phasor lie when a given area of the iris is projected onto complex-valued 2D Gabor wavelets.

Only phase information is used for recognizing irises because amplitude information is not very discriminating, and it depends upon extraneous factors such as imaging contrast, illumination, and camera gain. The extraction of phase has the further advantage that phase angles are assigned regardless of how low the image contrast may be.

One of the difficult problems in feature-based iris recognitions that the matching performance is significantly influenced by many parameters in feature extraction process (e.g., spatial position, orientation, center frequencies and size parameters for 2D Gabor filter kernel), which may vary depending on environmental factors of iris image acquisition.

IV. PROPOSED METHOD

The block diagram for Iris recognition is as shown in following figure. Block diagram consists of various stages which are occurring in recognition process. First of all the image of iris is to be taken from the microlens camera in gray scale format. Since we are using the database so no need of camera here. In pattern Matching we are taking the help of MATLAB.

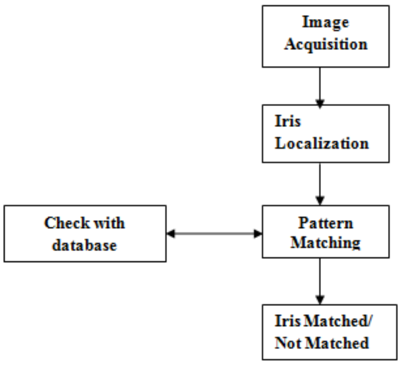

Figure 2: Block Diagram

A. Image Acquisition

For the method we need to test our algorithm on iris images. There are several databases available on the internet, the most famous one being the CASIA database. These are only gray scale images for our method.

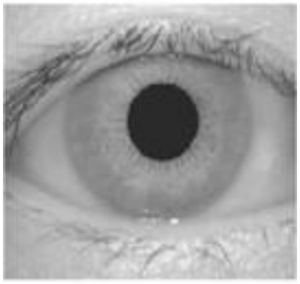

Figure 3: Iris in Gray Scale Format

The main features of the Gray database are:

- The database contains iris images of 10 persons.
- These are the images of the left eye and there are 3 images each.
- The images are: 8 bit - Gray, 320 x 320 pixels, .BMP.

B. Pre-Processing

An iris image contains some irrelevant parts (e.g., eyelid, sclera, pupil, etc.). Also, the size of an iris may vary depending on camera-to-eye distance and lighting condition. Therefore, the original image needs to be normalized and these irrelevant parts need to be segmented out.

C. Iris Localization

Image acquisition of the iris cannot be expected to yield an image containing only the iris. It will also contain data derived from the surrounding eye region.

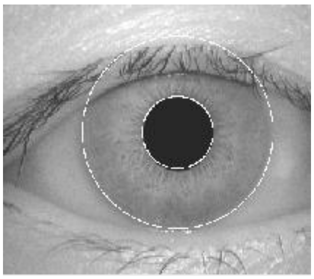

Figure 4: Segmented Iris

Therefore, prior to iris pattern matching, it is important to localize that portion of the iris derived from inside the limbus (the border between the sclera and the iris) and outside the pupil.

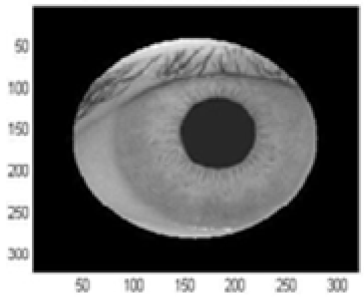

Figure 5: Formation of Circular Contour

D. *Determination of Center and Radius*

The pupil is the dark part in the centre of the iris image. By counting the rows and columns, the rows n columns that had the maximum no of zeros [Zero = Black] were taken together and a rough contour of the pupil was formed. Since the no. of rows and columns were counted we can easily find the central value of both and hence determine the centre of the pupil.

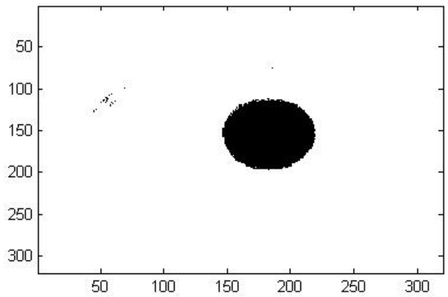

Figure 6:Isolation of pupil

E. *Moving Image to centre of frame*

The iris may not be at the centre of the frame. But for the ease of comparison with the other images and faster processing speeds the iris is centered. In the above stage the centre of the pupil was computed. That stage is superimposed with the iris image and depending on which quadrant the centre of the pupil lies in, the iris is brought to the centre of the frame.

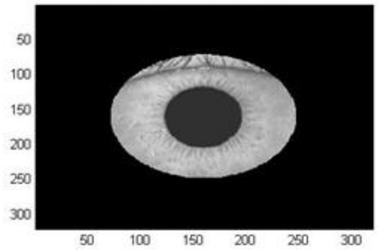

Figure 7: Iris moved at the centre of frame

V. IRIS MATCHING

A. *Determination of Center and Radius*

An important step in this stage is determining the center and radius of the pupil as well as outer iris circle. We make an assumption here that the pupil center and iris center are the same and they are concentric circles.

B. *Application of DCT*

Now the main part of our algorithm is to apply DCT to the image which is isolated. Here DCT is use for image compression that important information is concentrated on some pixels value so that there is no need to compare all the pixels of image.

The basic operation of the DCT is as follows:

- The input image is N by M;
- f(i,j) is the intensity of the pixel in row i and column j;
- F(u,v) is the DCT coefficient in row k1 and column k2 of the DCT matrix.
- For most images, much of the signal energy lies at low frequencies; these appear in the upper left corner of the DCT.
- Compression is achieved since the lower right values represent higher frequencies, and are often small - small enough to be neglected with little visible distortion.
- The DCT input is an 8 by 8 array of integers. This array contains each pixel's gray scale level; 8 bit pixels have levels from 0 to 255.

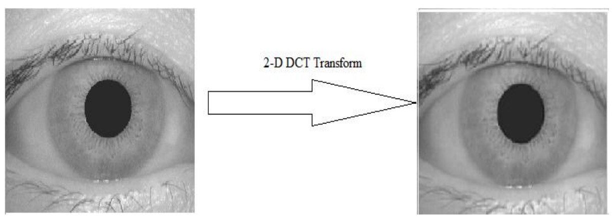

Figure 8: Computation of 2 –D DCT of left image

Although there is some loss of quality in the reconstructed image, it is clearly recognizable, even though almost 85% of the DCT coefficients were discarded.

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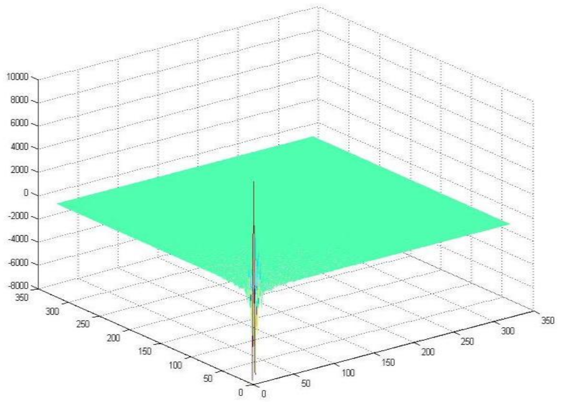

Figure9:DCT graph of an image

C. Comparison of images using Mean Square Error formula

For every Database image 'i' and a Query image 'q' the Mean Squared Error is calculated.Each pixel of the query image is subtracted from the pixel value of the database image and then squared and the summation is found. This entire formula gives us a single value; 'Z' in the case of DCT. By processing these values and finding if they are within the threshold value set, one can say if the irises match.

VI. RESULT

A. Comparison for gray iris images

The tabulated values for the DCT function for same person with his both iris i.e. left as well as right are shown in table. After analyzing the results for the entire database, we concluded that an optimum threshold value for images that match would be, i.e. iris images of the same person will give values of:

- A <= Threshold Value.
- An image matched with itself, gives a value of 0.

TABLE I. RESULT ANALYSIS

Sr. No.	Image of User1 in database	Position of iris image which is to be compared	Iris matched or not
1	 001_1_1	 001_1_3	Matched with value A<Threshold Value
2	 001_2_1	 001_2_2	Matched with value A<Threshold Value
3	 001_1_1	 001_2_2	Not Matched with value A>Threshold Value
4	 001_2_2	 001_1_3	Not matched with value A>Threshold Value

VII. CONCLUSION

Iris was found to be the perfect biometric for authentication purposes as it is highly distinctive, stable with age, is well protected and the morphogenesis of the iris occurs during gestation which leads to patterns and colors which are random and unique to each person, hence making it difficult to forge and imitate the actual person. This randomness of iris pattern is used for authentication purposes. The pattern of the iris was the feature extracted for matching and decision making for authentication.

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