

A Review on Iris Recognition Using Hybrid And Moments Techniques

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ABSTRACT: Iris recognition is one of the biometric recognition system. It helps to identify people using the uniqueness of each one's eye and iris patterns. In this paper the iris recognition using method of moments and hybrid technique is discussed. The recognition process is done in different steps like capturing of iris image, enhancing it and identifying it. This gives us a solution by matching different iris images in the database.

KEYWORDS: Iris Recognition, Biometric Recognition, Feature Extraction, Matching, database.

I. INTRODUCTION

Biometrics is the automated recognition of individuals based on their behavioral and biological characteristics. Recognition system has become popular in this era because it gives effective and a secured authentication to a particular person, and iris recognition is one among the most commonly used biometric recognition. Biometrics includes face, iris, fingerprints, voice, palms, hand geometry, retina, handwriting, gait etc. [6].

Iris is an ideal part of human body, It is an internal organ that is well protected against damage and wear by a highly transparent and sensitive membrane (the [cornea](#)). This distinguishes it from fingerprints, which can be difficult to recognize after years of certain types of manual labor. The iris is mostly flat, and its geometric configuration is only controlled by two complementary muscles (the sphincter pupillae and dilator pupillae) that control the diameter of the pupil. This makes the iris shape far more predictable than, for instance, that of the face.

Iris recognition is one by capturing digital image of the human iris, A biometric recognition is usually done by using the features which are unique and there is less availability of two humans having the same feature. Person identification based on iris recognition gives one of the most reliable results [8].

II. REVIEW ON IRIS RECOGNITION

2.1 Biometrics

A biometric system is based on pattern recognition system that recognizes an individual based on their physiological or behavioural characteristics. The features are stored in a database (sometimes recorded on a smart card and given to the individual) and are later extracted. Biometrics run on two modes: verification or identification. While recognition means comparing the acquired biometric information against templates of all users in the database, verification is comparison of only those templates of the claimed identity.

A biometric system consists of four basic components [5,3]:

- Sensor module which acquires the biometric data.
- Feature extraction module where the acquire data is processed to extract feature vectors.
- Matching module where attribute vectors are composed against those in template
- Decision making module in which the user's identity is established or a claimed identity is accepted or rejected.

Biometric traits have highly reliable and unique features that make it best suited for security systems over a traditional or conventional security system. [12], identified seven factors that could be used to identify a person's physical or behavioural characteristics as a biometric trait to be used in biometric security systems. They are

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 6, Special Issue 11, September 2017

- Universality (ease of availability in an individual)
- Uniqueness (distinct characteristics)
- Permanence (stability or durability)
- Measurability or collectability (ease of acquisition)
- Performance (quality of being efficient)
- Acceptability (degree of approval) and
- Circumvention (ease use of a substitute).

2.2 Iris recognition using Hybrid technique

In this paper, iris recognition is implemented via histogram equalization and wavelet techniques. The critical attributes for any biometrics are: the number of degree of variation in the chosen index across the human population, since this determines uniqueness its immutability over time and its immunity to intervention and the computational prospects for efficiently encoding and reliably recognizing the identifying pattern. In the whole human population, no two irises are alike in their mathematical detail, even among identical twins. Iris recognition is a method of biometric authentication, based on extraction features of the iris of an individual's eyes. Each individual has unique eye, the variation even exists between the left and right of the same person. [1]

The iris recognition using hybrid technique is done by various steps :

- Step 1: Preprocessing & Iris capturing: this process includes revises processing in which the image must be clear so that we can proceed to next step. And then the iris image is resized from the original size of the image.
- Step 2: Converting image into gray scale: this process deals with the converting of color image into gray scale image.
- Step 3: Histogram equalization: this process includes redistributing of pixels in order to enhance the overall image.
- Step 4: 2D DWT: this process is applied to generate the most significant features of the image in order to minimize the preprocessing time as to get minimum reduction size.
- Step 5: edge detection: this process in useful to generate the minimum feature required to identify the specific iris.
- Step 6: Storage process: this process tries to arrange the generated features into vector to be ready in testing processing.

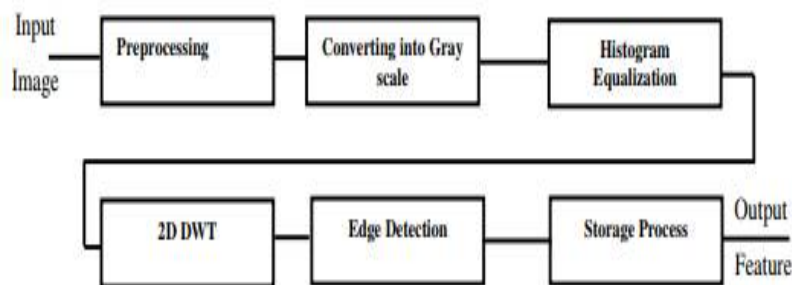


Fig 1: Iris Recognition Process [9]

2.2.1 Results using Hybrid Technique

The iris recognition by hybrid method is implemented via many steps, in this we will see the visual results of them by each steps

Step 1: Preprocessing and Iris capturing

This step is done by filtering and capturing the boundaries of iris image. Preprocessing step is performed to minimize noise as possible as well as to resizing the original image as shown in the below figure 2

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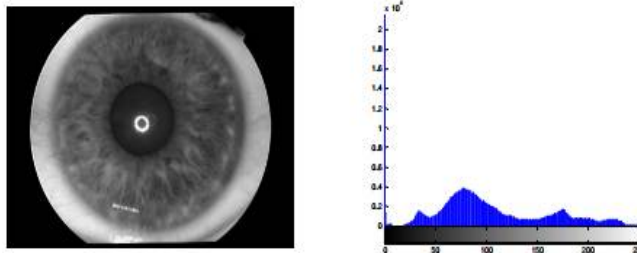
Vol. 6, Special Issue 11, September 2017



Fig 2: Capturing the original color image

Step 2: Converting Image into Gray Scale

In this step the original image is converted into gray scale image.



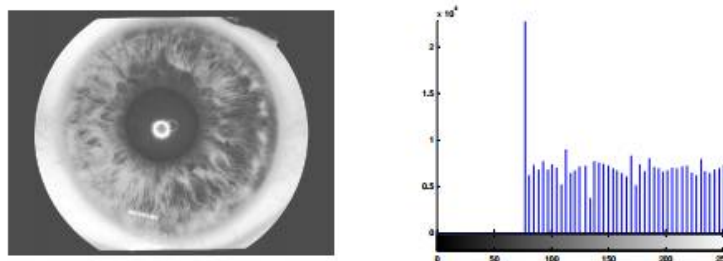
a) Gray image with noise b) Histogram of gray image

Fig 3: Converting original image into gray scale image.

Step 3 : Enhance Iris Image

Two types of enhancement is done to improve the quality of image

At first Histogram equalization is used to enhance the iris image and to improve its equalization



a) Enhanced image b) Histogram of enhanced image

Fig 4: Image enhancement using Histogram equalizing.

Step 4: Two Dimensional Discrete Wavelet Transform to generate the specific features we applied 2D DWT to the enhanced image in which the output image is compressed to minimum number of suitable pixels as shown in below figure .2D DWT is used for compression of image.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 6, Special Issue 11, September 2017

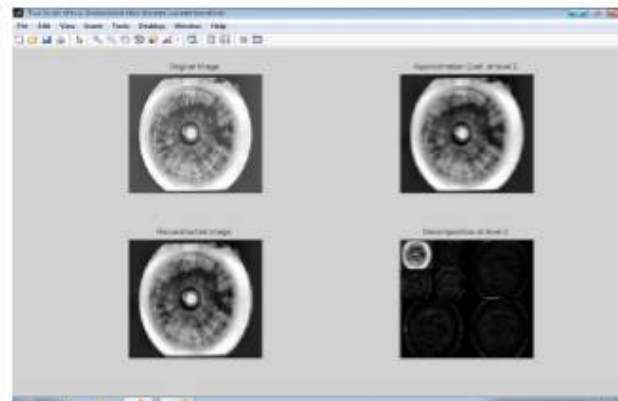


Fig 5: 2 Level DWT decomposition

Step 5: Edge detection

CANNY EDGE DETECTION METHOD

The Canny edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. It was developed by John F. Canny in 1986. Canny also produced a computational theory of edge detection explaining why the technique works.

The Process of Canny edge detection algorithm can be broken down to 5 different steps:

1. Apply Gaussian filter to smooth the image in order to remove the noise
2. Find the intensity gradients of the image
3. Apply non-maximum suppression to get rid of spurious response to edge detection
4. Apply double threshold to determine potential edges
5. Track edge by hysteresis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges.

The edge detection has different types but Canny method is used here, the edge detection is used to recognize the iris features. The below figure shows the results of Canny method.



Fig 6: edge detection using Canny method

2.3 Iris Recognition using Method of Moment

Moments are area descriptors used to characterize the shape and size of the image. In the method of moments, a sequence of numbers is computed, this sequence is called moments. These moments identify the shape of the object such as area, centroid, moment of inertia, orientation etc.[11]

Image $f(x,y)$ is taken as object and grey level of pixel is considered as the mass at a point of the object. For an $N*N$ image, the (i,j) th moment of the image $f(x,y)$ is defined as :

$$\text{Now, } m(i,j) = \sum_x \sum_y x^i y^j f(x,y)$$

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 6, Special Issue 11, September 2017

$$m(0,0) = \sum_x \sum_y x^0 y^0 f(x,y) = \sum_x \sum_y f(x,y)$$

The $m(0,0)$ is the zeroth order moment. The moment $m(0,0)$ is the mass of the object. Similarly, $m(1,0) = \sum_x \sum_y x^1 y^0 f(x,y) = \sum_x \sum_y x f(x,y)$, and $m(0,1) = \sum_x \sum_y y f(x,y)$. $m(0,1)$ and $m(1,0)$ are first order moments.

Any region-based feature requires a datum point from which further features can be derived. The centroid which is the center of area, (the center of mass) is a good parameter for specifying the location of the object.

If the coordinates of the centroid be x' and y' such that the sum of square of the distance from this point to all other boundary points within the object is minimum.

Here, $x' = m(1,0) / m(0,0)$ and $y' = m(0,1) / m(0,0)$. Moments $m(2,0)$ and $m(0,2)$ are the moments of inertia of the object:

$$m(2,0) = \sum_x \sum_y x^2 f(x,y) \quad m(0,2) = \sum_x \sum_y y^2 f(x,y)$$

These basic moments are limited in their usefulness since they vary according to their position with respect to the origin, the scale and orientation of the object under study.

The invariant moments are the central moment μ , in terms of its centroid. $\mu(i,j) = \sum_x \sum_y (x-x')^i (y-y')^j f(x,y)$. These central moments are still sensitive to rotation and scale transformation.

The normalized central moments η are given by :

$$\eta(i,j) = \mu(i,j) / (\mu(0,0))^\lambda = \mu_{ij} / \mu_{00}^\lambda$$

$$\text{Where } \lambda = (i+j)/2 + 1 \text{ and } i+j \geq 2$$

Orientation of any object is defined as the angle of the axis of the minimized moment of inertia and is given by

$$\theta = 1/2 \tan^{-1} [2 \mu(1,1) / (\mu(2,0) - \mu(0,2))]$$

Due to the above relation first-order moments are always invariant [14]

2.3.1 Results using method of moments

Below figures show the step by step output for the method of moments technique. Figure 7 indicates Gray scale conversion, figure 8 describes FFT transformation, figure 9 shows matching result.



Fig 7: Result for Gray Scale Conversion [13]

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 6, Special Issue 11, September 2017

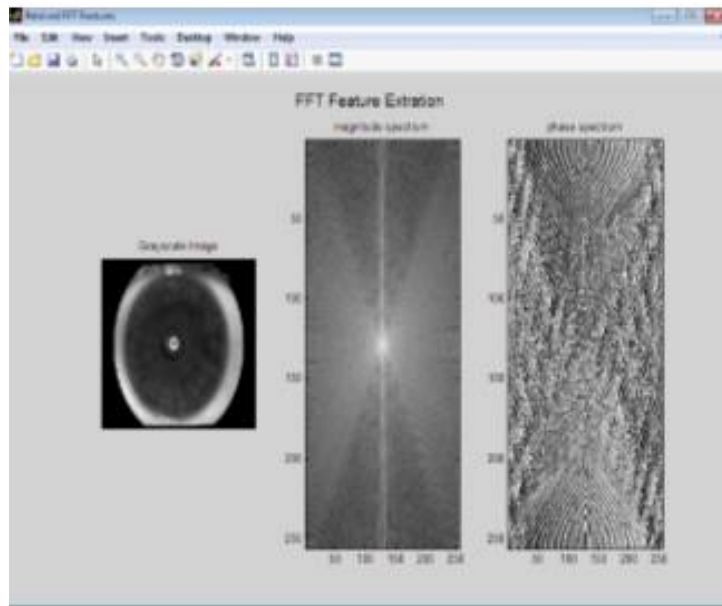


Fig 8: Result for FFT [13]

A Fast Fourier transform (FFT) algorithm computes the Discrete Fourier transform (DFT) of a sequence, or its inverse (IFFT). Fourier analysis converts a signal from its original domain (often time or space) to a representation in the frequency domain and vice versa. And later this FFT results Are compared with our results and checked for Matching patterns.



Fig 9: Result after Matching [13].

2.4 COMPARING HYBRID AND MOMENTS METHOD

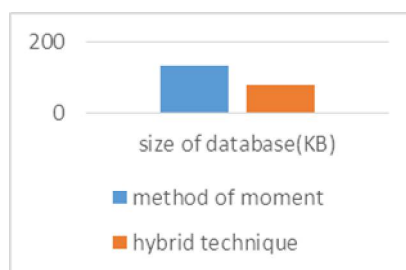
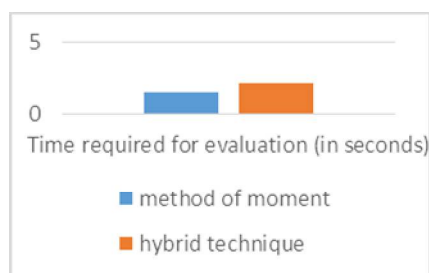
Comparing both the techniques it is observed that time taken by method of moments is comparatively less than that of hybrid technique ,but the size occupied by methods of moment in database is greater than hybrid technique size in database .below table shows the comparison of these two techniques for 100 images in database.[13]

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 6, Special Issue 11, September 2017

Parameters	Method of moment	Hybrid technique
Time required for evaluation	1.54 seconds *	2.189 seconds*
Size of database	133.79 KB	79.39 KB
Complexity	Less complex (Direct formulae are also available)	More complex (Two level decomposition using DWT)



Estimated on Intel Core,2.4 GHz processor,8GB RAM [13]

III. CONCLUSION

Iris recognition is one of the biometric techniques to recognize an individual using his/her iris pattern, as each one unique iris patterns and it makes easier to identify specific person. Nowadays biometrics are used majorly for security purposes in many organisations. Iris recognition systems have been proven to be very effective in protecting information and resources in a large area of applications. In this two techniques method of moment and hybrid is compared and it is observed that method of moment gives results at a less period of time to that of hybrid technique but requires more space in database than hybrid technique.

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