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# An Iris Recognition System: A good Idea for Security

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## ABSTRACT

***In this paper we discuss an iris recognition system. There has been significant progress in improving the performance of computer-based iris recognition system over the last decade. This paper discusses a generic framework for the iris recognition system, and the variants that are frequently encountered by the iris recognizer. In today's word to maintain the security of information or physical property is becoming both increasingly important and increasingly difficult. It is most secure recognition system as iris doesn't change throughout adult life.***

**Keywords:**Iris Recognition**,** Acquisition, Localization, Normalization, Feature extraction and matching.

## 1. INTRODUCTION

The iris is an externally visible, yet protected organ whose unique epigenetic pattern remains stable throughout adult life. These characteristics make it very attractive for use as a biometric for identifying individuals. Image processing techniques can be employed to extract the unique iris pattern from a digitized image of the eye, and encode it into a biometric template, which can be stored in a database. This biometric template contains an objective mathematical representation of the unique information stored in the iris, and allows comparisons to be made between templates. When a subject wishes to be identified by iris recognition system, their eye is first photographed, and then a template created for their iris region. This template is then compared with the other templates stored in a database until either a matching template is found and the subject is identified, or no match is found and the subject remains unidentified. Although prototype systems had been proposed earlier, it was not until the early nineties that Cambridge researcher, John Daugman, implemented a working automated iris recognition system [1][2]. Compared with other biometric technologies, such as face, speech and finger recognition, iris recognition can easily be considered as the most reliable form of biometric technology [1][3].

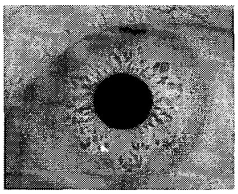


Figure 1. Iris image

**Figure 1** Iris Image

## 2. IMPORTANCE OF IRIS RECOGNITION

There is a need to maintain the security of information or physical property is becoming both increasingly important and increasingly difficult. From time to time we hear about the crimes like credit card frauds, network intrusions, or security breaches. The criminals are taking advantage of a fundamental flaw in the conventional access control systems. The systems do not grant access by "who we are", but by "What we have", such as ID cards, keys, passwords etc. None of these means actually define us. Rather, they merely are means to authenticate us. It goes without saying that if someone steals duplicates or acquires these identity means, he or she will be able to access our data or our personal property anytime and anywhere. **Iris** is an organ whose structure does not change throughout life. Thus it serves as a very good biometric for establishing identity of an individual.

## 3. GENERIC FRAMEWORK

Generic framework for iris recognition system consists of different modules.

1. Acquisition
2. Pre-processing
3. Feature extraction and matching

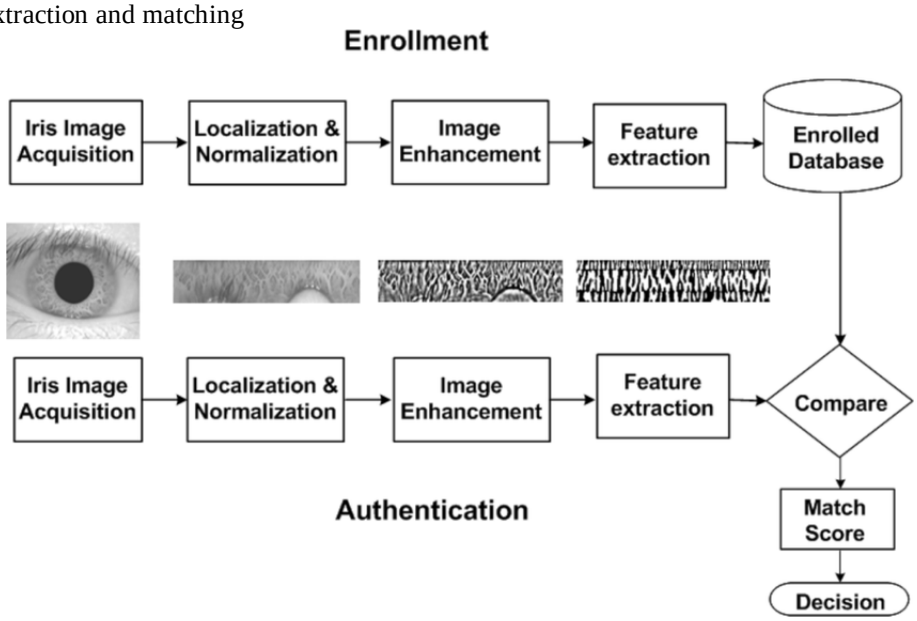



**Figure 2**Generic framework for iris recognition system

### 3.1. Acquisition

It is a difficult and important step of an iris recognition system. Since iris is small in size and dark in color it is very difficult to acquire good image of iris. . The images acquired in specified conditions having proper illumination, specified distance and other parameters, best quality pictures will be obtained. The pixels set covering the iris is transformed into a bit pattern that preserves the information which is essential for generate a statistically meaningful comparison between two iris images. To improve resolution, reduce noise, and obtain uniform contrast image preprocessing is needed.

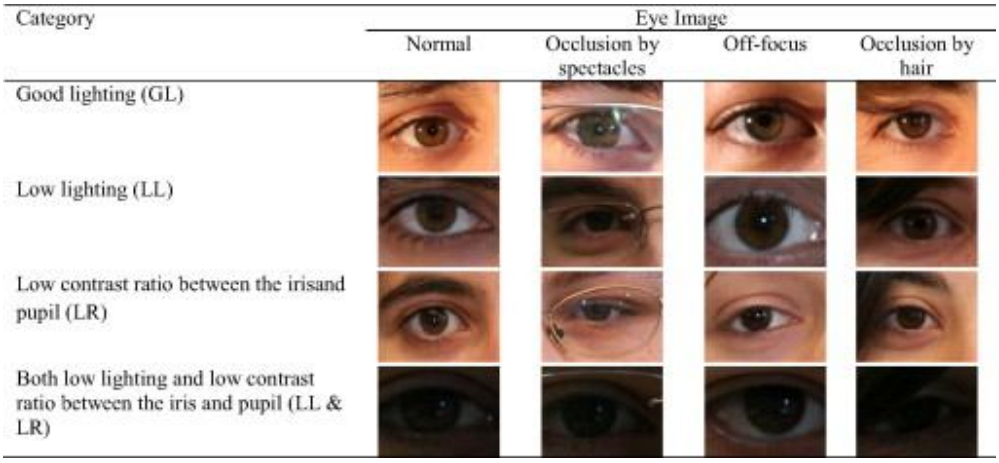



**Figure 3** Database eye Images

### 3.2. Pre-processing

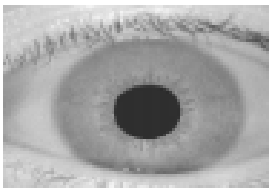
An iris preprocessing first has to identify the concentric circular outer boundaries of the iris and the pupil in a photo of an eye. The basic operations involved in iris preprocessing while extractions of features are iris localization, iris normalization and enhancement.

**3.2.1. Iris localization:** Localization of iris involves two basic operations; first one is to detect eye lids and boundary detection. The upper and lower parts of the iris are occluded by eyelids and eyelashes and hence these regions must be segmented. The next step is to recognize the internal and external boundaries of the iris.
**3.2.2. IrisNormalization:** The dimensions of eye images that are extracted from different databases are different due to stretching of iris for various levels of intensities of illumination. The inconsistency arising due to different viewing distances, rotation of camera, rotation of eye, etc. will change the iris resolution and actual distance between the pupil and limbic boundary. Therefore it is necessary to produce iris images with constant dimensions, so that two iris images under different conditions must have the same characteristic at the same spatial reference. Moreover the radius of the iris region is not a constant as it is a doughnut shaped structure. To overcome these problems normalization is performed.
**3.2.3. Image Enhancement:** The images in the database may have low contrast because of non-uniform illumination caused by the position of light sources. To achieve uniform illumination with high contrast, image characteristics must be enhanced. The normalized image may show low contrast and may have non uniform brightness because of the position of light sources. All this may affect the subsequent processing in feature extraction and classification of iris images.

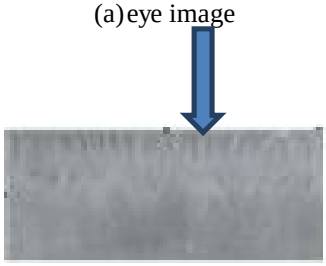
**3.3. Feature Extraction and Matching:** In order to provide accurate recognition of individuals, most matching iris pattern is extracted. Only the significant features of the iris must be extracted and encoded so that comparisons between templates can be made easily. Most iris recognition systems make use of a band pass decomposition of the iris image to create a biometric template. The template that is generation is depends on a corresponding matching metric, which gives a measure of similarity between two iris templates. When comparing templates generated, metric should give one range of values from the same eyeand another range of values when comparing templates created from different irises. From these separate values it is very easy to make a decision that, whether two templates are from the same iris, or from two different irises.

## 4. FAST FOURIER TRANSFORM

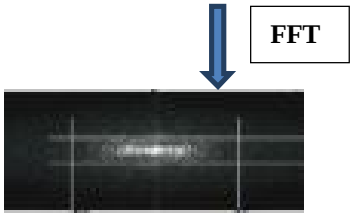
Fourier Transform decomposes an image into its real and imaginary components which is a representation of the image in the frequency domain[4]. If the input signal is an image then the number of frequencies in the frequency domain is equal to the number of pixels in the image or spatial domain. Fourier transform provides a powerful alternative to linear spatial filtering. For a large filter it would be more efficient to use fourier transform. Fourier transform allow to isolate and process particular image frequencies and thus to perform low-pass filtering with a great degree of precision. The working of fourier transform can be studied as analogous to working of a prism. White light is passed through a prism, the prism splits white light into separate colours (wavelengths).What the prism does to light, the fourier transform does to signals. So fourier transform is all about splitting signals into its component signals, so that analysis, different operations and comparisons can be done. Fourier transform states that any function that periodically repeats itself can be expressed as the sum of sine and cosine of different frequencies and different amplitudes.
Y = fft(X)
inMatlab returns the discrete Fourier transform (DFT) of vector X , computed with a fast Fourier transform (FFT) algorithm. Fast Fourier Transform is applied to convert an image from the image (spatial) domain to the frequency domain. The advantage of representing an image in the frequency space is that performing many operations on the frequencies is much more efficient than doing the same in the spatial image. Many of the convolutions are just multiplications in the frequency domain. FFT have the advantage of high speed over DFT. Also the complexity of DFT is O(N2 ) while complexity of FFT is only O(NlogN ). FFT works recursively by dividing the original vector into two halves, computing the FFT of each half, and putting the result together. FFT is most efficient when the vector length is a power of two. [8]



(a) eye image



(b) Part of iris in eye image in spatial domain FFT




(c) The above image in frequency domain after taking FFT

## 5. STEPS FOR IRIS RECOGNITION ALGORITHM

The database of eye images is taken from database. For showing result images are taken from the huge database. The algorithm is implemented as follows.

(1) First step is to input the image.
(2) In next step the code changes the image to grayscale.
(3) Then code computes the FFT point sequences for the image.
(4) Next step calculates the all the possible sets of normalized moment of FFT point sequence.
(5) Input other images for making Database.
(6) Input an image for matching.
(7) The match is found by Euclidean Distance Formula giving lowest distance.
(8) Repeat step 6.

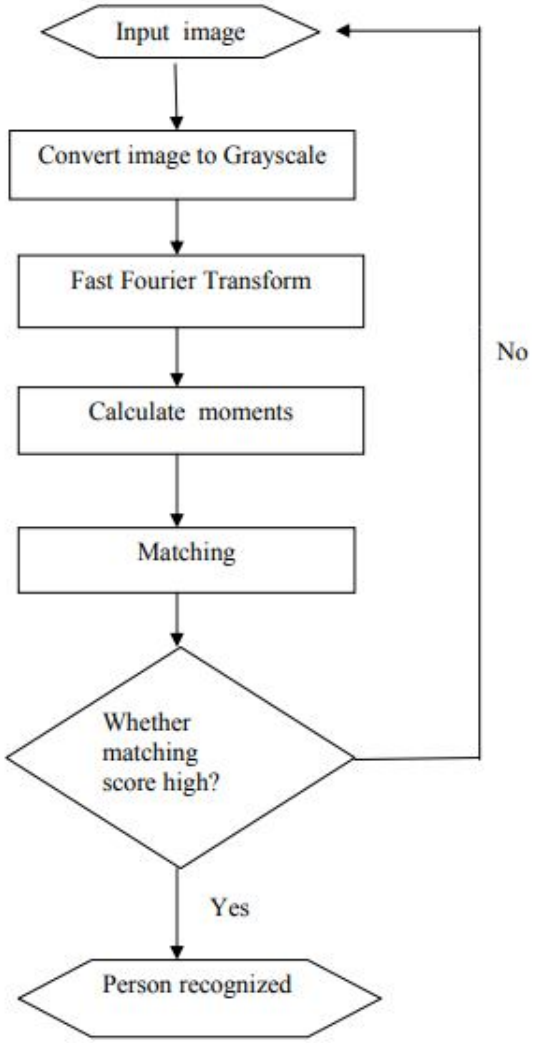



**Figure 4** Algorithmic steps for Iris Recognition System

## 6. CONCLUSION

In this paper, we discuss importance of iris recognition; generic framework, algorithmic steps of iris recognition system. Generic framework gives a brief idea about iris recognition and detection. Iris recognition system gives evidence that the methods prove, at best, 90% accurate. From these we conclude that, iris recognition and detection provides a security and its accuracy is quite remarkable. So, it is mostly used recognition system among other system.

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