# MATLAB BASED IRIS PATTERN RECOGNITION SYSTEM

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**Abstract**—*With the need for security systems going up, Iris recognition is emerging as one of the important methods of biometrics-based identification systems. This project basically explains the Iris recognition system developed by John Daugman and attempts to implement this algorithm in Matlab, with a few modifications. Firstly, image preprocessing is performed followed by extracting the iris portion of the eye image. The extracted iris part is then normalized, and IrisCode is constructed using 1D gabor filters. Finally two Iris Codes are compared to find the Hamming Distance, which is a fractional measure of the dissimilarity. Experimental image results show that unique codes can be generated for every eye image.*

*Algorithms developed by the author for recognizing persons by their iris patterns have now been tested in many field and laboratory trial producing no false matches in several million comparison tests. The recognition principle is the failure of a test of statistical independence on iris phase structure encoded by multi-scale quadrature wavelets. The combinatorial complexity of this phase information across different persons spans about 249 degrees of freedom and generates a discrimination entropy of about 3.2 b mm2 over the iris, enabling real-time decisions about personal identity with extremely high confidence. The high confidence levels are important because they allow very large databases to be searched exhaustively (one-to-many "identification mode") without making false matches, despite so many chances. Biometrics that lack this property can only survive one-to-one ("verification") or few comparisons.*

**Index Terms**—Human Recognition, Biometrics, Integer Wavelet Transforms, Iris Image, High Security.

## 1.Introduction

Today, biometric recognition is a common and reliable way to authenticate the identity of a living person based on physiological or behavioral characteristics. A physiological characteristic is relatively stable physical characteristics, such as fingerprint, iris pattern, facial feature, hand silhouette, etc. This kind of measurement is basically unchanging and unalterable without significant duress. A behavioral characteristic is more a reflection of an individual's psychological makeup as signature, speech pattern, or how one type sat a keyboard. The degree of intra-personal variation in a physical characteristic is smaller than a behavioral characteristic. For examples, a signature is influenced by both controllable actions and less psychological factors, and speech pattern is influenced by current emotional state, whereas fingerprint template is independent. Nevertheless all physiology-based biometrics don't offer satisfactory recognition rates (false acceptance and/or false reject rates, respectively referenced as FAR and FRR). The automated personal identity authentication systems based on iris recognition are reputed to be the most reliable among all biometric methods: we consider that the probability of finding two people with identical iris pattern is almost zero That's why iris recognition technology is becoming an important biometric solution for people identification in access control as networked access to computer application.Compared to fingerprint, iris is protected from the external environment behind the cornea and the eyelid. No subject to deleterious effects of aging, the small-scale radial features of the iris remain stable and fixed from about one year of age throughout life. This paper is divided into 4 main parts. The Section 1 introduces


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what is the position of iris technology in personal authentication. In the Section 2, we sum up the state of the art in the domain of iris recognition. The more widely known iris recognition system developed by J.Daugman is taken as reference for comparison.

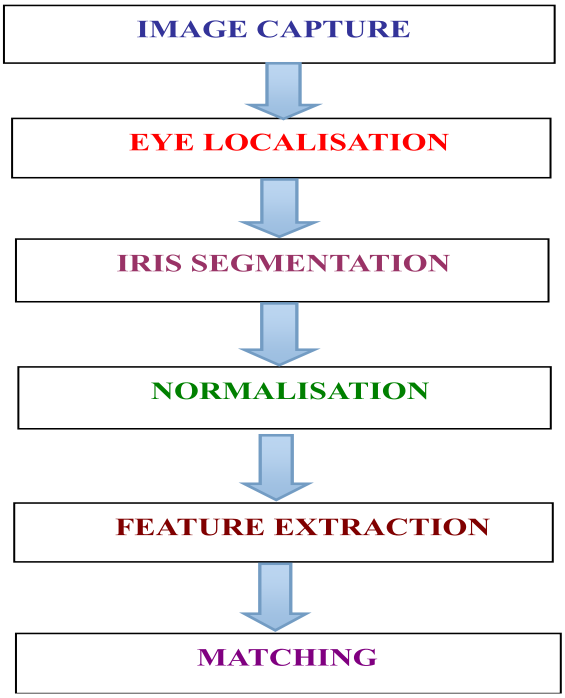
## 2. Literature Survey

Daugman's Algorithm proposed the Iris model as two circles between the Pupil and Sclera boundaries, which are not necessarily concentric. Each circle is defined by three parameters (xo,yo,r), where (xo, yo) locates the center of the circle of radius r. An Integro-Differential Operator is used to estimate the three parameter values for each circular boundary. The segmented Iris image is normalized and converted from Cartesian image coordinates to polar image coordinates. The 2D Gabor filter is used to encode the Iris image to a binary code of 256 bytes in length. Hamming Distance is used to verify the similarity of two Iris codes. The French ophthalmologist Alphonse Bertillon seems to be the first to propose the use of iris pattern(color) as a basis for personal identification. In 1981,after reading many scientific reports describing the iris great variation, Flom and San Francisco ophthalmologist Aran Safir suggested also using the iris as the basis for a biometric. In 1987, they began collaborating with computer scientist John Daugman of Cambridge University in England to develop iris identification software who published his first promising results in 1992 [4].Later on a little similar works have been investigated,such as R.Wildes' [5], W.Boles' [6] and R.Sanchez-Reillo's [7] systems, which differ both in the iris features representation (iris signature) and pattern matching algorithms.

## 3.Proposed Approach

Previous work on iris recognition, derived from the information found in the open literature, led us to suggest a few possible improvements. For justification of these new concepts we implemented in Matlab .The algorithm used is as follows:

**FLOW CHART OF PROCESS**




### 3.1 Image acquisition

One of the major challenges of automated iris recognition is to capture a high-quality image of the iris while remaining noninvasive to the human operator. Given that the iris is a relatively small (typically about 1 cm in diameter), dark object and that human operators are very sensitive about their eyes, this matter requires careful engineering. Several points are of particular concern.

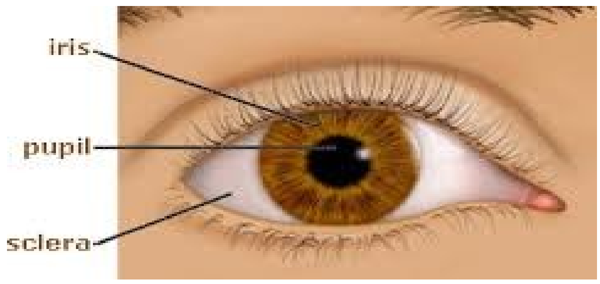



Fig1.Iris Image

### 3.2 Iris Localiztion

Without placing undue constraints on the human operator, image acquisition of the iris cannot be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expected to yield an image containing only the iris. Rather, image acquisition will capture the iris as part of a larger image that also contains data derived from the immediately surrounding eye region. Therefore, prior to performing iris pattern matching, it is important to localize that portion of the acquired image that corresponds to an iris.

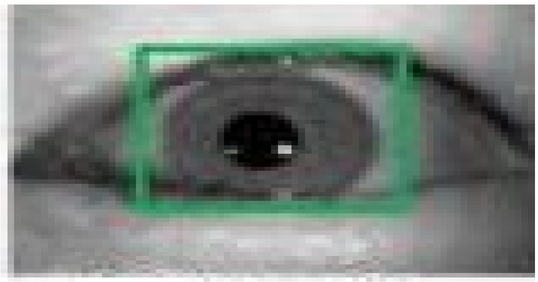

Fig 2: Localized Image

## 3.3 Iris Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as superpixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

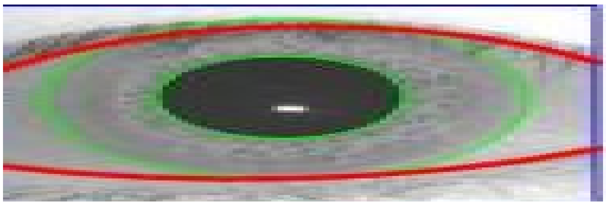

Fig 3:Segmented Image

## 3.4 Normalization

In order to obtain best features for Iris verification, polar transformed image is enhanced using contrast-limited adaptive histogram equalization [9]. The results of image before and after enhancement are shown in Figure below.

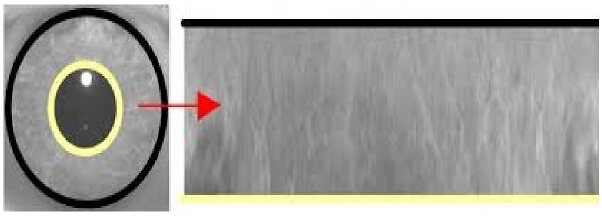

Fig 4: Normalized Image

## 3.4 Features Extraction

Feature extraction is the most important step in Iris Verification. Normalised image is used to extract the unique feature the iris image such as:

Texture analysis
Zero crossing
Overlaped patches

## 3.5 Matching

Matching between the two Iris feature vectors is done using Hamming Distance. It is a measure of how many bits are the same between two bit patterns. Using the Hamming Distance of two bit patterns, a decision is made as to whether the two patterns were generated from different Irises or from the same one.

## 5. Conclusion

Iris recognition system has been developed steadily with the help of MATLAB and some mathematical calculations, however limitations such as blur and dynamically taken images make it impossible to achieve perfect naturalness to combat this, we need to take images in ultraviolet environment. After getting image from the user the system will apply Hough transform detector technique to distinguish between pupillary and iris part of human eye, system applied various inbuilt MATLAB functions and mathematical calculations to encircle outer part of pupil that is inner part of iris and will mark the outer part of iris.

## 6. References



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## 7. Experimental Results

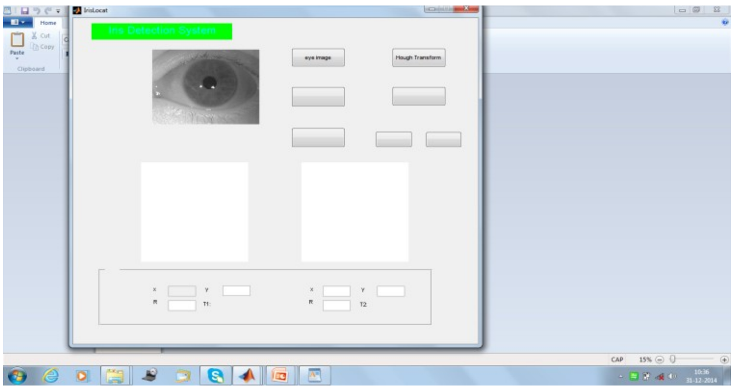

Fig 5 : Image calling interface from database

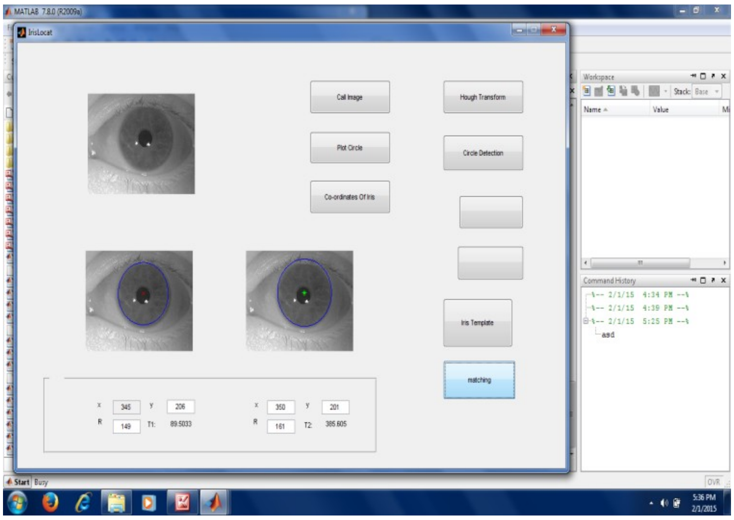

Fig 6 : Iris circle detection interface

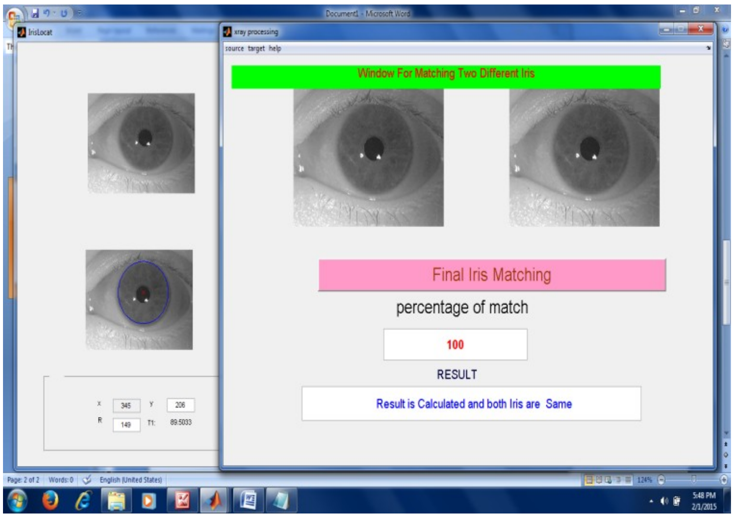


Fig 7: Iris matching interface



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