# A Study on: Iris Recognition Techniques

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*Abstract*— the randomness of the iris pattern makes it one of the most trustful biometric traits. The recognition of biometrics means to an automatic recognition of individuals based on a feature vector derived from the physiological and/ or behavioral characteristic. The iris recognition is one of the biometrics technologies based on the physiological characteristics of individual, compared with the trait recognition based on the fingerprint, palm-print etc., the certain advantages of iris are such as individuality, permanence, high detection rate, and non-infringing etc. Iris recognition is one of an automatic method for identifying persons that uses geometric model detection techniques on images of the iris in individual person’s eyes. The performance of the iris recognition systems depends on normalization and segmentation techniques. Here, it is discussing about the various technique like daugman’s algorithm technique, Multiscale edge detection, Zero-Crosssing representation method and LBP technique.

***Key words:*** Local Binary Pattern (LBP), Equal Error Rate (EER)

## I. Introduction

Development of a high end security system for both authentication and identification has always an active research world and attractive goal in almost all fields. The use of biometric technologies is increasingly encouraged by both private entities and government sectors in order to improve or replace traditional security mechanisms. The traditional security systems gives security to a product or a process with the help of "something that we know or something we have", that may be a password or a key, whereas in biometric security system, it uses "something that we have or we are", that is, a individual’s behavioral or physical traits. It is proved that Iris recognition biometric systems are efficient at personal recognition with high recognition accuracy. The term biometrics is obtained from “bio” means life and also “metric” means measurement. Biometrics means the study of automated identification, by means of behavioral traits or physical. Security is the one of the major application of biometrics.

One of the important reliable pointing technologies used for user identification is Iris Recognition Security System. The human iris has a random texture and it is always stable throughout the life span. Biometrics is an automated technique of identifying a person based on a behavioral or physiological manner. With comparing by other technologies in biometric like finger recognition and face speech, iris recognition become the thoroughly reliable form of biometric technology. Iris is seemed to be believed to give very high accuracy. Iris has certain benefits and advantages from other biometrics. Iris is a small internal organ with diameter of 1 cm but the resolution may be higher enough for recognition. The iris is a protected organ and an externally visible whose unique pattern stays stable throughout the overall life. It can serve as a kind of living passport or as a password that one need not to be remembers but can be always present. Because the randomness of iris patterns has very high dimensionality, recognition decisions are made with the high confidence levels enough to support rapid and reliable exhaustive searches through national sized databases. The data of iris is non-identical for right eyes and left eyes and for twins too.It cannot be, stolen, forgotten or borrowed.

## II. Literature Survey

Iris feature extraction has been studied from early time and plenty of advanced techniques are there for perfect iris recognition. This section of the paper discusses varied techniques planned earlier in literature for extracting feature from iris.

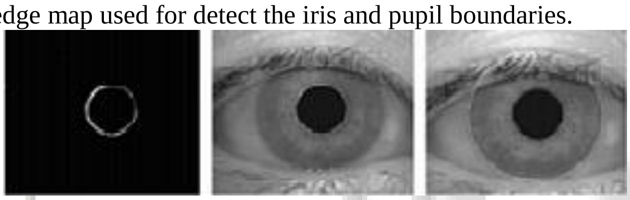
### *A. Daugmans Algorithm Method*

Daugman's algorithm [1] is mainly applying some integro differential operator to find the iris. The detection of Iris can start with identifying an iris in an image, seperating its inner and the outer boundaries at the pupil and sclera, also finding its upper and lower eyelid boundaries if they occlude, and identifying and excluding any superimposed eyelashes or reflections occurred in the cornea. This process can be called as segmentation. The algorithm is performed two times, firstly to obtain the iris contour after that to get the pupil contour. There is an illumination inside the pupil, which is a perfect circle having very high level of intensity. So that, it have a problem of sticking to the illumination as the maximum rise circle. So it is needed to set a minimum pupil radius.

The determination the pupil boundary where the maximum change should occur at the edge between the iris, which is almost darker than the bright spots due to lighting and the very dark pupil is an another problem. Therefore, it should be take care during scanning process of individual picture because high intensive bright spots may be block the operator and leads to result in a maximum gradient. This may cause the localization of pupil to be a failure. If any case occur when any pixel on the circle have greater value than threshold, then it is possible to ignore all such circles by using integro differential operator. To represent gray scale this threshold is adjusted to be 200. This encounters that only the intense spots whose values which is higher than 245 will be cancelled. The outer boundary of iris localization, two search regions is used by proposed method to detect lower and upper eyelids. The upper and lower search regions should be labeled. The iris inner, pupil centre, and outer boundaries are used as the reference to select these two search regions. These search regions will be confined within the inner and outer boundaries of the iris. The diameter of the pupil and width of the two search regions are same.

### *B. Multiscale Edge Detection*

Li.Ma et al in [2] deals with the multiscale edge detection method. Two different regions can be seperated by an edge. It can be defined an edge point is the point at where the local intensity of the image will be varies rapidly more than that of the neighbour points which are close from the edge: such a point can be characterized as a local maximum of the gradient of the image's intensity. Such a characterization is to be applied to several images, this become an main issue. Multiscale edge detection will be formalized by using a wavelet transform. The appropriate scale for edge detection is directly related to the resolution of an image. A small scale and high resolution will result in noisy and discontinuous edges; large scale and low resolution may lead to undetected edges. The significance of edges is controlled by scale. It is important to preserve edges with higher significance by using the wavelet transform across the scales. When the scale increases, it has more importance to disappering of edges with low significance. To find the edges, the multiscale edge detection method is used. This wavelet will implement the discretized gradient of the image at different scales and it is a non-sub sampled wavelet decomposition. Multiscale edge detection is firstly detect a edge map used for detect the iris and pupil boundaries.



(a) (b) (c)

Fig. 1: Iris Localized. (a) Pupil edge map (b) Pupil detected (c) Outer circle detected

Due to the chance of degrading the performance of system, it is essential to identify eyelids and eyelashes from the detected iris image because they are considering as noise. By using a linear Hough transform, it fitting a line to the upper and lower eyelid in order to isolate the eyelids. Then drawn a horizontal line which intersects the first line at the iris edge which is nearest to the pupil. There is a second horizontal line which allows the highest isolation of eyelid regions. Then it uses the multiscale edge detection to obtain the edge map and it only considers the horizontal gradient information. If the largest is the Hough freedom is lower than a set threshold, then no procession is agreed, since this implies to the eyelids. Then, the lines are restricted to place exterior to the region of pupil and interior to the iris region.

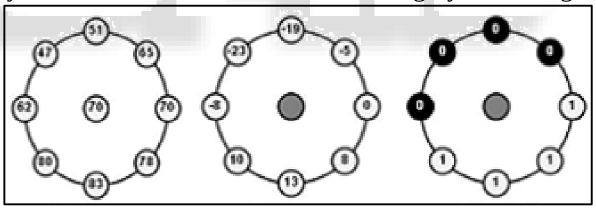
### *C. Zero Crossing Based Method*

Boles et al. in [3] represents a new method for finding the features of the iris at different resolution levels based on the wavelet transform zero-crossing. The algorithm is rotation, translation and scale invariant. To obtain a set of 1D signals and its zero crossing representation input images are processed based on its dyadic wavelet transform. To represent the features of the iris by fine-to-coarse approximations at different level of resolution based on the WT zero crossing representation. The representation can be built by; a set of sampled data is collected, and followed by constructing the zero-crossing representation based on its dyadic WT. The first derivative of the cubic spline is the wavelet function.

The edge-detected image is used for finding the centre and diameter of the iris. By using the center, the virtual circles are constructed and stored as circular buffers. The information which is extracted from any of the virtual circles is normalised to obtain same number of data points and a zero crossing representation is generated. A normalization value N, can be selected as a power-of two Integer value. The main reason for the selection of N is to enable the extraction of the whole information which is available in the iris signature by applying the dyadic wavelet transform. The representation is periodic and it is independent from the starting point on iris virtual circles. Then these are stored in the database as iris signatures. The information of iris signature can be analyzed in more detail by applying greater value of N which results in decomposing the iris signature to a large number of levels. The dissimilarity between the iris of the same eye images are lesser compared to that of the eye images of different eyes. The benefit of this function is that the amount of computation is reduced since the amount of zero crossings is smaller than the number of data points. But there have a challenge is that it requires the compared representations to have the same number of zero crossings at each and every resolution level.

### *D. Local Binary Pattern (LBP)*

Nivedita S. Sarode1[4] deals with the Local Binary Pattern for iris detection. The input image is firstly converted to binary pattern using Local Binary Pattern. Local Binary Pattern (LBP) is a simple and very efficient texture operator which labels the pixels of an image by thresholding the pixels in the neighbourhood of each pixel and stores the result as a binary number. It convert the input color image to grayscale values, because LBP works on grayscale images.




(a) (b) (c)

Fig. 2: (a) Sample (b) Difference (c) Threshold

From the figure, for each and every pixel in the grayscale image, a neighbourhood is selected around the current pixel and then determines the LBP value for the pixel using the neighbourhood. That means for each pixel in a cell, compare that pixel with each of its 8 neighbors (on its left-top, left-middle, left bottom, right-top, right middle, etc.) and follow the pixels along a circle, that is clockwise or counter- lock wise. If the current pixel value is larger or equal to the neighbouring pixel value, then the corresponding bit in the binary array will be set to 1 else if the current pixel value is smaller than the neighbouring pixel value, then the corresponding bit in the binary array will be set to 0. From these pixels, it generated the selected components based on some thresholding values known as Feature detection. The most important property of the LBP operator in real- world applications is its robustness to monotonic gray-scale change caused due to some illumination variations.

LBP provides fast texture classification and feature extraction. Due to its discriminative power and simplicity in computations, LBP texture operator has become a popular approach in various applications.

## III. Comparative Analysis

It have used several algorithm for iris feature extraction. The analysis can be based on false acception rate, false rejection rate etc. In the daugman method, the data was divided into subsets with small pupils, medium pupils and large pupils. This subset of data with large pupils showed the worst performance with Equal Error Rate (EER) at an order of magnitude which is greater compared to that of small pupil data set. If iris recognition were to be implemented on such a large scale, the comparison between two images would have to be very fast. But one of the challenge is the visibility in the iris area is reduced and greater part of iris is occluded by eyelids which provide less information for iris code generation. A multiscale approach can provide stable and complete description of signals because it is based on a wavelet formalization multiscale approach. It provide useful information about the sharp variations in terms of horizontal and vertical decomposition. It can capable to detect pupil and outer boundary circles in the case of poor quality iris images too because of the efficient edge map detection. The motivation for the zero crossing technique is that zero-crossings representation corresponds to significant features with the iris region. The representation is periodic and independent from the starting point on iris virtual circles. The advantage of this function is that the amount of computation is reduced since the amount of zero crossings is less than the number of data points. The problems of scaling, illumination, rotation in vision drawbacks had to be solved were the reflections of the eye to the light source and it use the concept of wavelet, which gives more efficiency to the recognition system. The LBP can solve iris feature extraction according the inherent intensity-related texture problem, which is robust to some illumination and interference, and it has the potential for pattern recognitions. LBP is a grayscale invariant local texture operator with powerful discrimination and low computational complexity. LBP representation may be less sensitive to changes in illumination.

## IV. Conclusion

This paper presents a survey on various techniques used in iris recognition. The physiological characteristics like iris, fingerprint etc. is relatively unique to an individual. An approach to reliable visual recognition of humans can achieve by iris patterns. The other approaches are based on the discrete cosine transforms, spot recognition etc. Sometime it is more difficult to identify a person directly because of noise present in iris images. Iris is located behind the cornea. The iris images or the templates may be disturbed by noise factors that result of degraded image capturing processes. During feature extraction methods, the uniqueness and discriminative level of the characteristics will be determining the reliability of the recognition system. Therefore, unwanted information must be discarded. The future work in real world applications may be utilization to support the invention of compact iris codes for mobile phones and PDAs. The survey of these techniques provides a great support for the development of the novel techniques in this field as future work.

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