# Iris Segmentation using feature extraction with Hough Transform

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**Abstract: Iris segmentation is a critical stage in the whole iris recognition process. In this paper, a procedure of iris segmentation is presented which was designed on the basis of the natural properties of the iris. In the suggested work,Using Hough Transform and Daugman and purpose of the technique is to identify imperfect instances of objects through a voting procedure within a certain class of shapes. The proposal of image processing using Daugman algorithm detects the iris boundaries with high accuracy in high-quality images. Additional preprocessing of images has improved the performance of the algorithm on the lower-quality images.**

***Keywords:* *Hough Transform,Image Processing,Iris Segmentation,Daugman Algorithm,PCA***

## I. INTRODUCTION

- Iris is called a donut with colored tissue ring around the eye and has a very rich pattern of furrows, ridges, crypts, corona, freckles and spots of pigment. It is assumed that these minute aspects of the iris structure are determined during the initial development of the pupil. For different persons and even for the same person's two eyes, they are different. Iris is found to be a biometric that is well protected and has an invariant age. Like any other biometric system, the system of iris recognition mostly takes five major steps:
- Image acquisition with the help of cameraunder NIR(near infrared illumination) or visible light,
- Segmentation to lo-calize the iris,
- Normalization in which the annular iris region is “unwrapped from Cartesian to polar coordinates,
- Feature extraction from iris texture andfinally
- Matching the iris features robustly.

## II.PCA Algorithm

PCA Algorithm Following are steps involve;

**Step 1**: Column or row vector of size N2 represents the set of M images (B1, B2, B3…BM) with size N*N

**Step 2:** The training set image average (µ) is described as M n 1 1 µ Bn m = = ∑ (1)

**Step 3:** the average image by vector (W) is different for each trainee image Wi = Bi - µ (2)

**Step 4:** Total Scatter Matrix or Covariance Matrix is calculated from Φ as shown below:

$C=\sum_{n=1}^{M} wnwnt = AAT$

**Advantage and disadvantage of PCA:**

- Lack of redundancy of data given the orthogonal components [5].
- Reduced complexity in images’ grouping with the use of PCA .
- Smaller database representation since only the trainee images are stored in the form of their projections on a reduced basis
- Reduction of noise since the maximum variation basis is chosen and so the small variations in the background are ignored automatically.

**Two key disadvantages of PCA are[6]:**

- The covariance matrix is difficult to be evaluated in an accurate manner
- Even the simplest invariance could not be captured by the PCA unless the training data explicitly provides this information .

This paper is organised as follows: Section III describes the background concepts and the proposed iris segmentation algorithm. Section IV illustrates the experimental results obtained by using the proposed approach on Iris. It also describes the segmentation error categorization. Finally,the paper concludes with Section V.

## III. LITERATURE REVIEW

**Minaee et al.,(2017)** Investigated the implementation of the VGG-Net-derived deep iris recognition traits. Checked on two well-known iris databases, the proposed scheme showed promising results with the highest accuracy rate of 99.4 percent, which outperforms the previous best score. The algorithm is evaluated on two well-known datasets and yields promising results that outperform one of the databases with the previous best performance. We would like to note that most of the previous iris recognition algorithms involve a lot of pre-processing and parameter tuning, but there is no pre-processing and optimisation of the architecture in our program [1].

**Vishwakarma et al.,(2017)** Introduce a new optimized iris detection and recognition approach using a two-fold process to deduce better results in comparison with existing methods. The technique primarily uses the Finite Impulse

Response(FIR) and the transformation of the Gabor wavelet as for the fundamentals of computation. The proposed algorithm focuses on the comprehensive use of all available human iris data, specifically the red, green and blue segments, i.e. RGB unlike conventional iris-based recognition wiz.computation on grayscale inputs, thus on the contrary, the methodology presented in this paper employs suitable color coding pattern using FIR(Finite Impulse Response) in addition to the Gabor filter texture classification technique[2].

**Andersen et al.,(2018)** investigate the potential of a multi-algorithm fusion employing iris texture information extracted from VW iris images. Features extracted by four types of algorithms, i.e. conventional methods, key point-based methods, generic texture descriptors, and colour-based methods, are combined to improve the recognition accuracy. By performing a weighted score-level fusion of comparison scores obtained by four different types of feature extractors, improvements in biometric performance of 15% and 27% are achieved on subsets of the publicly available UBIRISv2 and MobBIO iris database, respectively[3].

**Mazdak et al.,(2017)** The primary component analysis (PCA) is a sort of biometric algorithm. It is a mathematical statistics and orthogonal transformation used to turn a sequence of observations of potentially correlated variables into a set of values of linearly uncorrelated variables. PCA is also a tool for reducing multidimensional data to smaller dimensions while maintaining most of the data. This contains standard deviations, covariances and ownvectors [4].

**Patil et al.,(2017)** The research work that I supported under the direction of my chief / guide was meant to create modern biomedical biometric picture planning calculations for the identifiable proof of individuals through the human eye portion of IRIS. The time consumption of the system is equally low, i.e. it has an assurance of fast handling of the result, as it can discern an IRIS within 4 seconds on the off chance of it being put away in the database. Exhibited the definite measurement use protocol alongside the recalculation occurs. The proposed system alongside the implemented reproduction demonstrates the appropriateness of the technique we have developed [7].

**Barrientos et al.,(2019)** Experiments designed to determine the importance of competing sociotheoretical systems as they apply to discussions on IT cloudsourcing. Contributions include a systematic analysis of concepts arising from the theory of social exchange, equity theory, learning theory, and negotiation win–win theories. We find strong support for social exchange theory's relevance to IT cloudsourcing negotiations, as well as moderate support for negotiation win - win theories. Their results offer clear directions for expanding their study to the field of negotiation support systems, and we rely on our findings to conjecture that IT cloud sourcing is a specific background for socio-theoretical negotiation research due to the intrinsic importance of IT to the organizational effectiveness of organizations [8].

**Bhurchandi et al.,(2018)** provides a distinct approach to the identification of iris by edge elimination using a fuzzy logic approach followed by iris position using Circular Hough Transform (CHT).It also increases localisation because of CHT's ability to detect only partially visible iris. Using the simpler iris extraction function and the matching prototype, computational speed is also increased. The proposed solution was tested on biometric databases for MMU1, IITD, and UTIRIS iris. Results show that iris localisation at lower computational time is achieved with greater accuracy [9].

**Naidu et al.,(2018)** Present a faster GPU (Graphical Processing Unit) approach to iris detection that applies Hough Transform (HT) search location. Together with Search Localization (SL), we used GPU's parallel computing capabilities to accelerate iris detection using Circular Hough Transform and compared performance on CPU (Central Process Unit) and GPU. SL reduces the area over which Circular Hough Transform is performed and thus improves efficiency [10].

**Tasdogen et al.,(2016)** Enhance iris recognition systems output through the use of hyperspectral iris images. The commercial iris recognition systems that already exist often use iris information in the infrared band and these systems ' output more often depends on the segmentation process.

Uses the dataset that contains 17 people's iris images in 16 different wavelengths. The circular transformation to Hough is used to detect the iris field. K-nearest neighbors (K-NN) algorithm is chosen to use the information from hyperspectral data in different bands. Such strategies result in a segmentation with a success rate of 84 per cent [11].

**Asharani et al.,(2018)** Iris images are read from the database and pre-processing is carried out to enhance image quality. The iris and pupil borders are further measured using circular Hough transform and normalization is done using rubber sheet model from Dougman. The fusion is achieved at patch point. The image is transformed for mask image and modified rubber sheet pattern in 3x3 patches to achieve fusion. Patch conversion is achieved using window sliding technique. So it's local Information can be extracted for individual pixels. Block empirical mode decomposition extracts the desired features as a low pass filter to analyze the iris images. Using the Euclidean Distance Classifier, the matching between the data base image and the test image is finally done. The experimental results indicate 100 percent accuracy compared to other state-of - the-art methods on CASIA V1.0 database [13].

**Pacut et al.,(2019)** Present an Iris Recognition System performance analysis for healthy and diabetes-affected irises, separately for female and male users. The database consists of 546 images from 162 healthy irises (62% female users, 38% male users) and 772 iris images from 181 diabetic eyes with a clearly visible iris pattern (80% female users, 20% male users), Adaptive weighted Hough ellipsopolar transformation technique was used for iris segmentation, and then three common iris encoding algorithms were implemented [14].

## III. PROPOSED METHODOLGY

The Hough transform is a method used in image analysis, computer vision, and digital image processing to remove features. The purpose of the technique is to identify imperfect instances of objects through a voting procedure within a certain class of shapes. The Daugman algorithm detects the iris boundaries with high accuracy in high-quality images. Additional preprocessing of images has improved the performance of the algorithm on the lower-quality images.

The system of iris recognition further consists of a number of sub-systems, which correspond to each stage of iris recognition. These stages are:

- **Image acquisition**-capturing image of eye.
- **Segmentation** – locating the iris region in an eye image.
- **normalization** – creating a dimensionally Consistent representation of the iris region.
- **Encoding** – creating a template containing only the most discriminating features of the iris.
- **Matching**- The matching module determines how closely the produced code matches the encoded features stored in the database.

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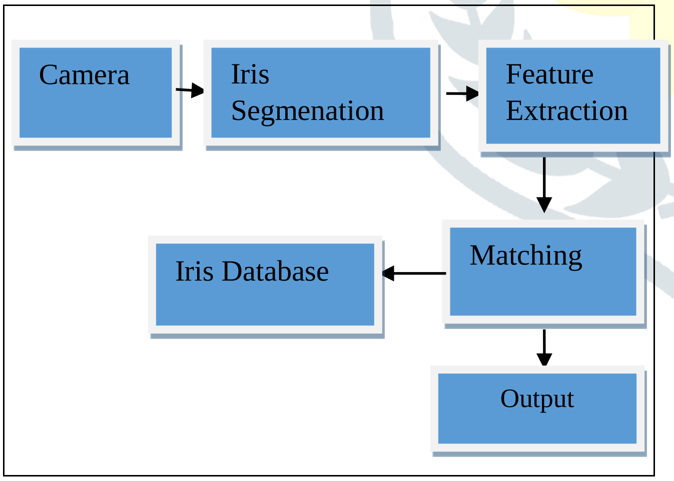


**Figure 1. Flow chart of the proposed work**

## IV. RESULTS AND DISCUSSION

MATLAB is a marketing kit called "Matrix Laboratory." MATLAB is a high-level language that gives you an interactive environment to solve several numerical problems.Often, MATLAB can be used for data analysis and visualisation. MATLAB offers all the features, including arithmetic operators, flow control, data structures, data types, object-oriented programming, and debugging.

The Hough transform is a standardized and simple algorithm based on a computer which can be used to determine the parameters of simple geometric objects, such as lines and circles. The circular Hough transformation can be used to deduce the pupil and iris regions ' radius and center coordinates. An automated Circular segmentation algorithm. First, an edge map is created by calculating the first intensity values derivatives in an image of the eye, and then thresholding the results. From the edge map, votes are casted to determine the parameters of circles which pass through each edge point in Hough space.

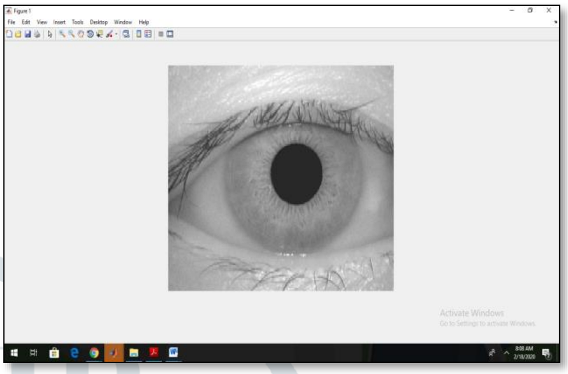

**Figure 2:Input Image**

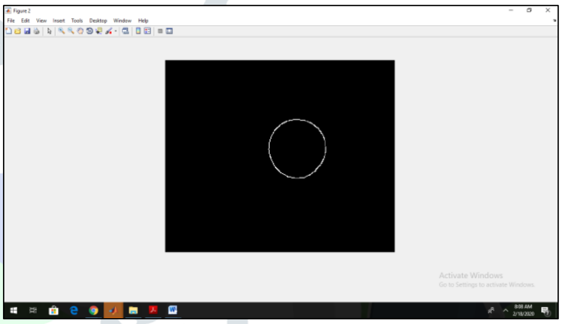

**Figure 3:Detect Iris in Image**

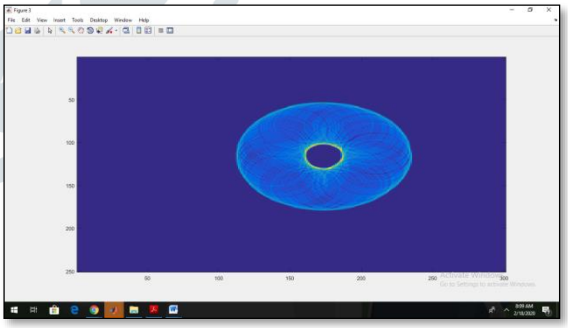

**Figure 4:Apply Hough Transform**

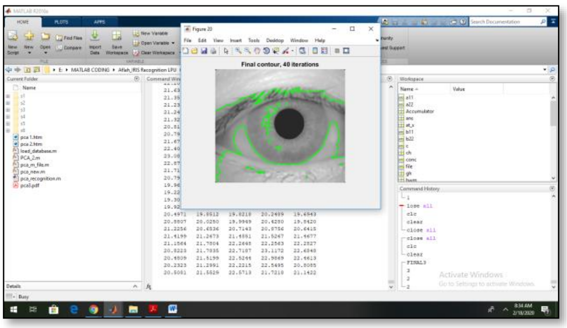

**Figure 5:Level Set Results**

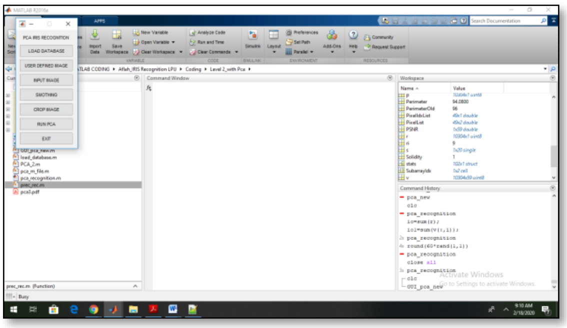

**Figure 6:Level 2 with PCA**

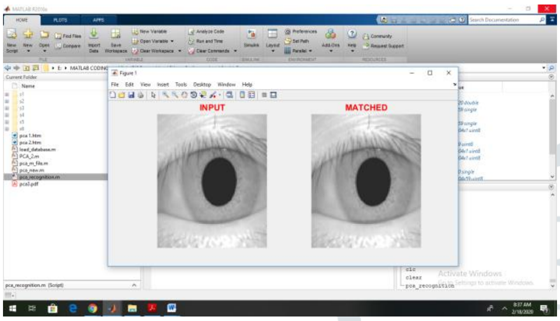


**Figure 5:Input image & Matched Image**

## V. CONCLUSION AND FUTURE SCOPE

Recognition of identity in today's society is a very important issue which everyone has to face. Fingerprint recognition and facial recognition technologies are coming to maturity. The accuracy of the fingerprint recognition and face recognition has been questioned, and iris recognition must be mentioned. The existing work consists of the iris edge detection, Hough algorithm and Daugman algorithm. Extraction of the edge is accomplished by sharpening the convolution of the template and the image.

Hough transform is a method used to remove features in image analysis, computer vision, and digital image processing. The purpose of the technique is to identify imperfect instances of objects within a certain class of shapes, through a voting procedure. In high-quality images the Daugman algorithm detects the iris boundaries with high precision. Additional image preprocessing has enhanced the algorithm's efficiency on the lower-quality images.

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