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# Detection and Localization of Iris using Digital Image Processing Techniques

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***Abstract*—**An automated method utilized for biometric identification which includes various mathematical pattern-recognition methods in it is known as the iris recognition method. The videos of the irises of various individual's eyes are studied in this technique. The complex random patterns present within this approach are single, constant moreover can as well viewed from a particular distance. In the base paper, intensity transformation is applied with edge detection. The image processing techniques are applied which will extract the contrast, energy, entropy and heterogeneity of the detected iris has been calculated. To increase the accuracy of iris detection and reduce execution time, improvement in existing algorithm, feature extraction technique is being proposed also evaluated the ROC curve for performance analysis and achieved 0.81 area under curve.

***Keywords*—**Iris, localization, Image Processing

## I. INTRODUCTION

Computer-based fraud and theft is the latest trend in computer world. People are facing the financial loss because of the personal identification number [PIN] and the password. That is why E-security is the critical need of finding accurate, secure and cost-effective alternative for PIN and password [1]. This is needed to secure data, information and money etc. Biometric solutions are useful to solve these problems as biometric data is unique and non-transferable. Biometric is the method which identifies and/ or verify a person automatically by using either physiological or behavioral characteristics [2]. Among all the biometrics such as finger print, palm print, retina, face, vein, signature, voice, gait etc., iris is the unique organ in human being. Iris recognition offers the highest accuracy in identifying individuals of any method available. This is because no two irises are alike- not between the identical twins, or even between the left and right eye of the same person. Irises are stable. Unlike other identifying characteristics that can change with age, the pattern of one's iris is fully formed by ten months of age and remains stable throughout their life-time[3]. An iris has various features such as pigment frill, collarette, crypts, concentric area etc. The figure 1 shows the different features on iris [4].

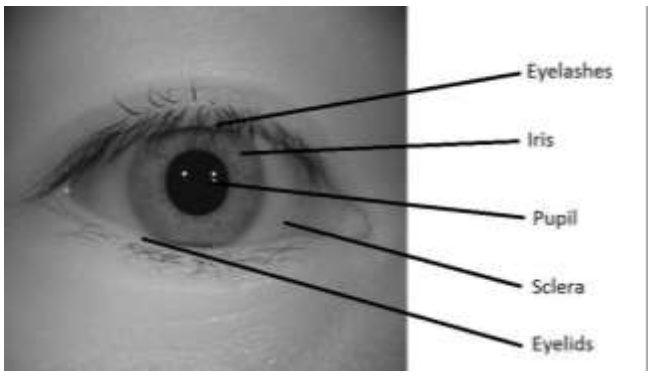



Figure 1. Structure of Iris

The acquired iris image has some irrelevant information such as eyelashes, reflections, pupil etc. To get the region of interest (ROI), the acquired iris image has to be preprocessed. The preprocessing has three basic steps :localization, normalization and enhancement. Localization finds the inner and outer boundary of the iris. Normalization unwrap the region of interest from Cartesian coordinates to equivalent polar coordinates to get the rectangular image of iris. Iris recognition comes from the unique characteristics of the human, and the permanency of the iris texture as it is stable over human life, and the environmental effects cannot easily alter its shape.

## II. RELATED WORK

Image processing is known as the enhancement of rawimages assembled from everyday lives that are gathered from any sort of sources like satellites, cameras, web, and so forth such information can be helpful either

for logical results or for the criminal examinations. As seen from daily lives, images today are being utilized for sending and accepting data. The images are received from web, satellites, cameras, and numerous other developed innovations. The images that are accessible with some data in them are thought to be as raw images. These images have in them much helpful data, which can be utilized for examination purposes. There is a ton of deception and duplicating of unique information and utilizing for individual issues furthermore to destroy others protection. The classification or structural description of the images is the prior objective of the image recognition mechanism [5]. There is feature detection with property estimation within image classification mechanism. Further, segmentation and relational structure extraction are involved within image description mechanism. However, the cost of this process is very high to minimize which; various techniques have been developed [6]. A complex issue within the image processing mechanism is automatic face detection. In order to solve the issues arising within this method, numerous methods have been presented with time. On the basis of each strategy the successful results need to be achieved which might then result in changing the degrees of results as well as the levels of complexities of these systems. The public acceptance is gained to the iris biometric. Body structure, inherent weakness, and levels of health and transition are uncovered by the iris, as it changes happen in the one's body as the way they live the life. The eyes are the window of the spirit as said in the past and they are the foremost part of our body which is very necessary of view the beauty of the nature [7]. Therefore, it is key window to one's health. Distinguish between the two iris part is difficult to distinguish as similar in the fingerprint and faces. The breaking down of the weak structures of the iris of the eye is known as Iridology that is the branch of the science. Iridology is used for the investigation of the iris for a medical purpose. Fibers and pigmentation are present in the iris that reflect our physical and psychosomatic makeup. while the condition of the organ or body system in the poor condition, the moving of the spirit operation starting that body part go in vain. Different degree of the layer of fiber are extracted when this procedure is follow as the shade of the iris of the eyes is done by this and leave behind the dark marks called as lesions [8]. Biometric Identification technique is the key objective of the iris as it is one of unique identifier of Human and provides the stability throughout the life of the person. Unique patterns are identified with the help of ocular-based biometric technique within the retinal scanning method. The patterns of retina blood vessels of each person are unique and thus can be used for studying the identity of an individual. The video camera technique is used along with unobtrusive close infrared illumination method [9]. The determination of probability of each of the possible categories, the performance of classification is impossible to be judged [10].

## III. METHODOLOGY

In this algorithm firstly, preprocessing is done by renovating the image into gray. Afterwards apply histogram equalization for image enhancement. After image enhancement, image complement operation is done for highlighting the iris. Subsequently image adjustment is done by using contrast stretching method. After applying the contrast stretching function, some noise is get added, to remove that noise median filter is used. After removing the salt and pepper noise threshold operation is done for extraction of inner iris. Following are the mathematical formulations is use for extraction and localization of inner iris.

- **Conversion of 3D to 2D:**

$$grayscale(2D) = \frac{R + G + B}{3} \quad (1)$$

Take average of the three (Red, Green and Blue) colors.

- **Intensity Transformation:**

$$G(j,k) = T\,[F(j,k)] \quad (2)$$

Where, F(j, k) is the input image G(j, k) is the output image and T is operator defined over a neighborhood.

- **Image Segmentation:**

$$\mathrm{T} = \frac{1}{2}(\mathrm{m1} + \mathrm{m2}) \quad (3)$$

Based on the intensity, the pixels in an image get divided by comparing the pixel's intensity with a threshold value.

- **Contrast Stretching Transformation:**

$$s = (r - c)\left(\frac{b - a}{d - c}\right) \quad (4)$$

Where, a and d are lower limits of the input image and b and are upper limits of the input image respectively.

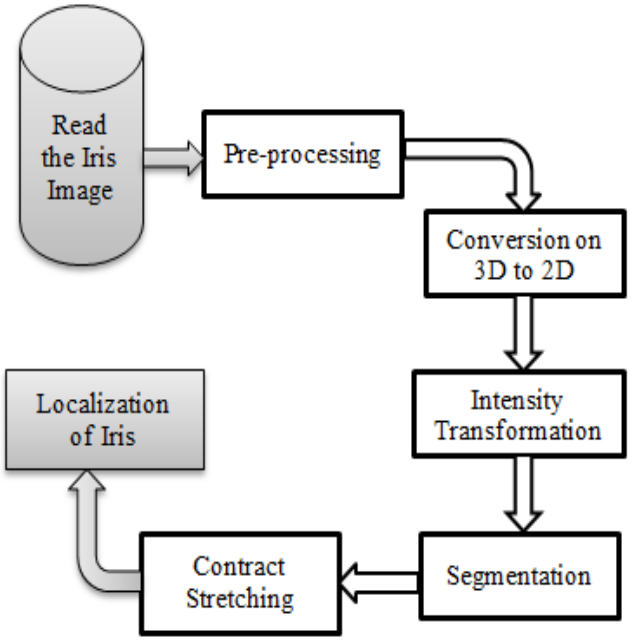
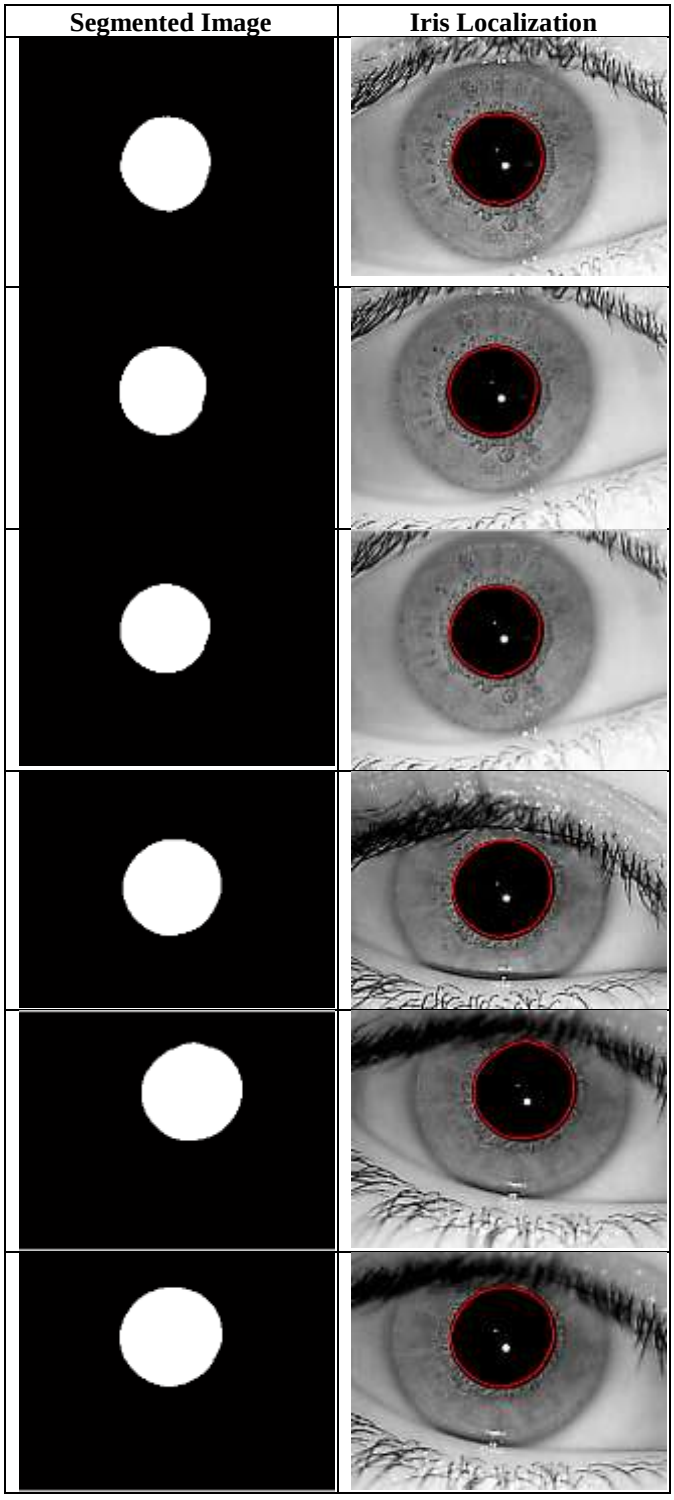



Figure 2. Workflow of Iris Localization

## IV. RESULTS AND DISCUSSION

For person identification iris detection or localization is obligatory. After image enhancement, iris localization is done. Localization of iris area is done by using boundary function. After localization of iris extract the iris by using segmentation techniques. Following figure shows the output of iris localization.



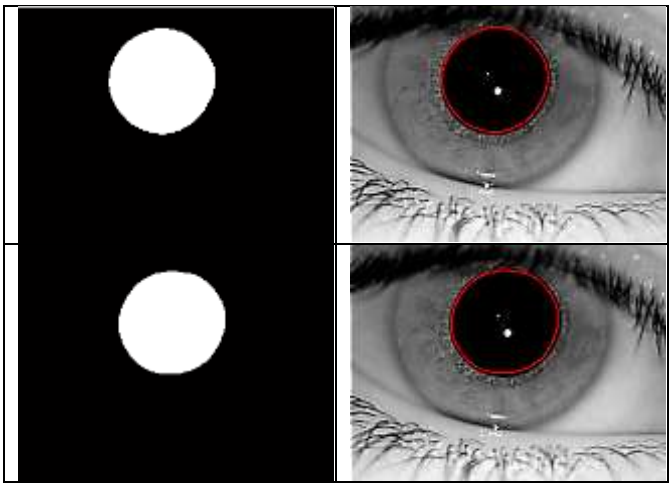



Figure 3. Image Segmentation and Iris Localization

An ROC curve (receiver operating characteristic curve) is a graph showing the performance of a classification model at all classification thresholds. This curve plots two parameters: True Positive Rate (TPR) and False Positive Rate (FPR). The proposed algorithm evaluated the ROC curve for performance analysis and achieved 0.81 AUC.

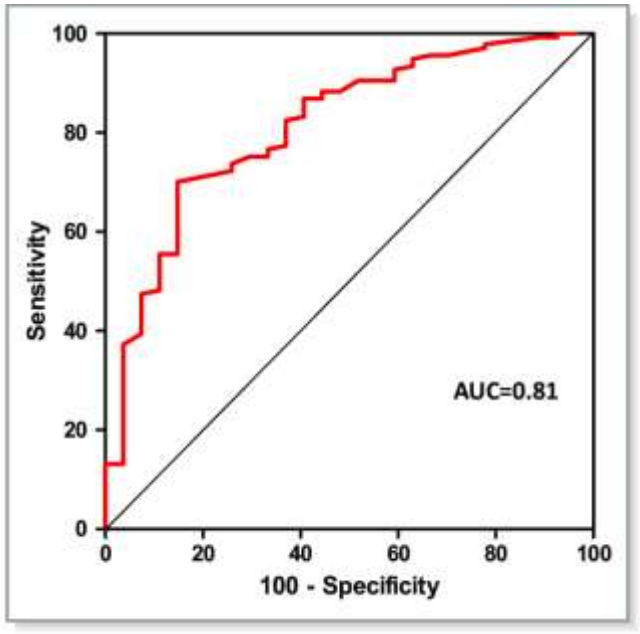



Figure 4. Performance Analaysis using ROC Curve

## V. CONCLUSION AND FUTURE SCOPE

A new system for personal identification based on inner iris localization is presented in this paper. It is collected of iris image acquisition, image preprocessing. The algorithm for iris feature extraction is based on digital image processing techniques. This algorithm is tested on IIT Delhi, UBIRIS and UPOL iris image database, which is online available. Our future work is it add more online databases and test the proposed algorithm onto it.

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