International Journal of Computer Architecture and Mobility
(ISSN 2319-9229) Volume 3 -Issue 3, May 2015

A REVIEW OVER IRIS BIOMETRIC RECOGNITION SYSTEM USING CANNY EDGE DETECTION

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Abstract: Accurate iris segmentation is a key stage of iris recognition. The iris image may hold irrelevant parts (like, eyelid, eyelashes, boundary of pupil) beside to iris. Authentication is required when there is a need to know about a person who they claim to be. It is a procedure which involves a person making a claim about their identity and then providing evidence to prove it. In this paper, iris biometric identification system has been presented that uses modified Canny Edge Detection algorithm for segmentation, binarization and cropping. Feature extraction is done by normalization and feature encoding process followed by matching process based on manhattans distance. Experimental simulation results are analyzed on the basis of False Acceptance Rate (FAR) and False Rejection Rate (FRR) and found better. Modified Canny Edge Detection algorithm provides accuracy up to 99.08% on the basis of FAR and FRR.

Keywords: **Canny Edge Detection Algorithm, Segmentation, Iris Pattern, Biometric Identification System.**

I. INTRODUCTION

Iris recognition is the process of recognizing a person by analyzing the random pattern of the iris (Figure 1). The automated method of iris recognition is relatively young, existing in patent only since 1994.The iris is a muscle within the eye that regulates the size of the pupil, controlling the amount of light that enters the eye. It is the colored portion of the eye with coloring based on the amount of melatonin pigment within the muscle.

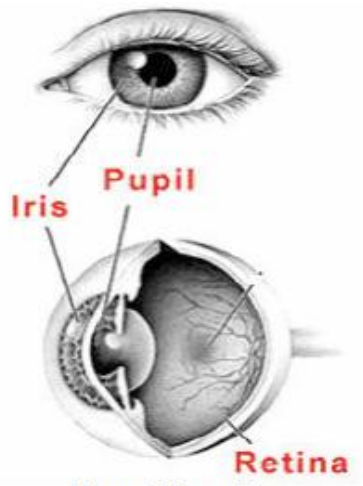


Figure.1 Human Eye

II .THE IRIS AS A BIOMETRICS

The iris is an overt body that is available for remote assessment with the aid of a machine vision system to do automated iris recognition.

A. Iris reorganization technology combines compute vision, pattern reorganization, statistical inference and optics.
B. The spatial patterns that are apparent in the human iris are highly distinctive to an individual.

- Clinical observation
- Developmental biology

Although the coloration and structure of the iris is genetically linked, the details of the pattern are not. The iris develops during prenatal growth through a process of tight forming and folding of the tissue membrane. Prior to birth, degeneration occurs, resulting in the pupil opening and the random, unique patterns of the iris. Although genetically identical, an individual's irises are unique and structurally distinct, which allows for it to be used for recognition purposes.

III. METHODOLOGY

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

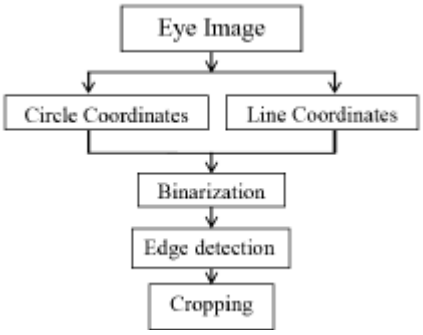
- Image acquisition-capturing eye image
- segmentation - locating the iris region in an eye image
- normalization - creating a dimensionally consistent representation of the iris region
- feature encoding - creating a template containing only the most discriminating features of the iris.

The input to the system will be an eye image, and the output will be an iris template, which will provide a mathematical representation of the iris region.

IV. SEGMENTATION

The first stage of iris recognition is to isolate the actual iris region in a digital eye image. The iris region, shown in the above figure, can be approximated by two circles, one for the iris/sclera boundary and another, interior to the first, for the iris/pupil boundary.

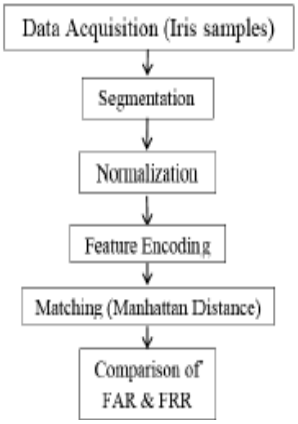
The success of segmentation depends on the imaging quality of eye images. The center of pupil can be used to detect the outer radius of iris patterns. The iris inner and outer boundaries are located by finding the edge image using the Canny edge detector.



V. IMAGE ACQUISITION

The iris image should be rich in iris texture as the feature extraction stage depends upon the image quality. Thus, the image is acquired by 3CCD camera placed at a distance of approximately 9 cm from the user eye. The approximate distance between the user and the source of light is about 12 cm. The image acquisition setup is given in Figure 1. The following attentions have been taken care at the time of grabbing the image

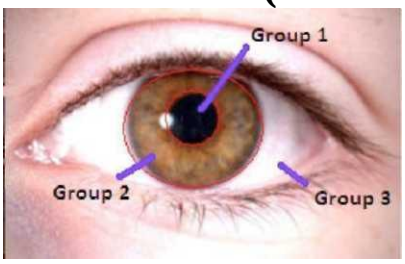
- High resolution and good sharpness: It is necessary for the accurate detection of outer and inner circle boundaries
- Good lighting condition: The system of diffused light is used to prevent spotlight effect.



VI. MODIFIED CANNY EDGE DETECTOR

- The algorithm runs in 5 separate steps:
- 1. Smoothing: Filtering and blurring of the image to remove noise, such that pixels creating indifferent spots can be reduced.

- Figure4. Blurred and filtered image
- 2. Finding gradients: At the points/pixels where color pattern falls in the similar threshold region are grouped together.



Grouping of various regions of eye on the basis of color differences.

The edges should be marked where the gradients of the image has large magnitudes.

3. Non-maximum suppression: The image portion to be processed is non linear and circular or convex hence, boundary region matching the closets shape is taken out for only local maxima and then should be marked as edges.

4. Double thresholding: Potential edges are determined by thresholding.

5. Edge tracking by hysteresis: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

VII. IMAGE NORMALIZATION

Once the iris region is segmented, the next stage is to normalize this part, to enable generation of the iris code and their comparisons. Since variations in the eye, like optical size of the iris, position of pupil in the iris, and the iris orientation change person to person, it is required to normalize the iris image, so that the representation is common to all, with similar dimensions.

Normalization process involves unwrapping the iris and converting it into its polar equivalent. It is done using Daugman's Rubber sheet model. The centre of the pupil is considered as the reference point and a Remapping formula is used to convert the points on the Cartesian scale to the polar scale.

(a) Normalization

The Iris of different people normally captured in different sizes and size also varies for the same person due to various factors such as illumination. The normalization process produce iris regions which have the same constant dimensions so that two photographs of the same iris under different conditions have characteristic features at the same spatial location.

(b)Feature Extraction

Significant features of the iris are required to be extracted so as to compare their templates images. Most iris recognition systems make use of a band pass decomposition of the iris image to create a biometric template. Iris provides texture information in the form feature vector is ordered sequence of features extracted from the iris images.

(c) Localization and Image Matching

The Manhattan distance function computes the distance that would be traveled to get from one data point to the other if a grid-like path is followed. The Manhattan distance between two items is the sum of the differences of their corresponding components.

VIII. PROPOSED METHOD

Pattern recognition algorithms generally provide reasonable answers for all possible inputs and to perform matching of the inputs, taking into account their statistical variation. This is opposite to pattern matching algorithm that provides the interclass and intra class variability. Iris recognition technique is based on biometric information of the subject and used to authenticate the access control. Iris is located between the cornea and lens of eye. It provides personal identification of an individual based on a unique features possessed by human iris. Iris recognition systems involve image acquisition localization and pattern Matching. Image acquisition is the process which deals with the capturing of a high quality image of the iris with the help of a digital camera. Iris localizations is the process which delimits the iris from rest of acquired image. Whereas in pattern matching involves segmentation and feature extraction and determination and manhattan distance from the previously stored information in the database. In this work, we use improved edge detections and compared with that of Canny Edge Detector performing the segmentation. This is a new technique in iris recognition field that helped novel approach applied recognition performance. We use MATLAB® tool to implement our work with samples of iris image collected samples from 5 people are used for training and testing purposes .

Basic Design of Work : The efficiency of the recognition system depends on four sub systems extraction which includes feature segmentation,

normalization and feature encoding and matching. Segmentation is done in this work by using both Improved Canny edge Detection and Canny so as to compare their performance in the form of flow graph and explained in brief as follows. The basic design of our proposed work .

Data Acquisition: This involves the acquisition of eye images from a group of live person, in this paper. In the work a database is created by collecting left eye image and saved as .jpg files.

Segmentation: This step involves determination of circle coordinates and line coordinates followed by Binarization, edge detection and cropping as shown in Fig. 3 The process of edge detection is experimented using Improved Canny edge detection algorithm.

Feature Extraction: This step performs feature extraction process by using normalization encoding and then save all the features in the database. It is also known to as a training phase
In binarization each pixel is converted into one bit. Assign 1 or 0 depending upon the mean value of all the pixels. If the value is greater then mean value then its 1 otherwise 0. The binarization is done by sigma and scaling center co-ordinates of each image

Algorithm 2 improved canny edge detection

Step l: Select the input (i)

I:-input iris image sample

Step 2: Apply the segmentation on **(i)** and find the Circles **(c^).**

Step 3: Apply binarization **on c_n.**

Step 4: For **all** the row & columns **in** matrix **(i)**

Convert into corresponding bit pattern **(0 &1)**

Apply Normalization on **K.**

Step 5: Apply gradient formula on **K.**

Which will give **[g^g_y].**

Step 6: **gu gy** are taken into Gaussian formula.

Step 7: if result is apply conversion to fast Fourier Transform.

Else

Normal canny "will be executed.

Step 8: FFT create the waves of sine & cosine.

Step 9: Apply Manhathen distance by converting the Waves into grid of s ***& y.***

Step 10: if d = 0 image matched
d 4- 0 image not matched.
Stop.

Binarization: In current techniques the binarization is usually performed either globally or locally. Some hybrid methods have also been proposed. The global methods use one calculated threshold value to divide image pixels into object or background classes. Whereas the local schemes can use many different adapted values selected according to the local area information. Hybrid methods use both global and local information to decide the pixel label.

Algorithm 1 Feature Extraction

Start
Add images after segmentation to
Extract Features.
For (int $i = 0$; $i <$ image; count+−)
Prop [k] =image [i].features [i]
Recall Normalization & encoding
Save to DB
Stop

Improved canny edge detection: Improved canny's edge detection algorithm is well known as the optimal edge detection method. It works on three main principles, low error rate well localization of edge point and one response to a single edge. To enhance the older edge detection methods. Canny proposed two new techniques in his algorithm. Non maximum suppression and double threshold to select the edge points. However these two thresholds use the gradient image are set experimentally. Improved canny edge detection is shown in algorithm2 that is following.

IX. RESULTS DISCUSSION

The results of the proposed system can be analyzed by implementing the whole methodology using simulation tool MATLAB®. This proposed system involves two main phases that are training and testing phase.

Performance of the biometric systems is measured by their accuracy in identification, which is calculated using false rejection rate and false acceptance rate. As shown in the Table 1, the FAR and FRR are calculated. Tests are run on the data set of 5 users. Features are generated by using modified Canny Edge Detection Algorithm. Results are reported in

the form of FAR and FRR which are obtained for the different values of threshold is calculated. Accuracy is calculated for new proposed technique, which is compared with the accuracy of previous implemented technique canny at segmentation level.

Table 1: Accuracy for Canny Vs modified Canny edge detection

Parameters	*Canny Based Iris Recognition*	*Canny Iris Recognition*
FAR	0.96%	0.92%
FRR	0.72%	0%
Accuracy	98.32%	99.08%

X. CONCLUSION

In the proposed system a new technique is used at level of segmentation. Matching of the system is on the basis of Manhattan Distance. In this the first step of recognition system is segmentation. Which can be performed by both canny and Improved canny to measure compare the performance. The second step is feature extraction and then preparing a template which can be used for matching at testing phase. Performance of Improved canny based iris recognition system is better than the Canny based iris recognition system which can be calculated by calculating accuracy. The accuracy of the proposed system is 99.08%. Future work could go in the direction of using more than one modality to increase the level of security.

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