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IRIS RECOGNITION BY USING HCT, PCA, HAMMING DISTANCE

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Abstract: *In this paper, we have developed a system that can recognize human iris patterns and an analysis of the results is done. A novel mechanism has been used for implementation of the system. Feature training has been used to extract the most discriminating features of the iris and is done using HCT, HAMMING DISTANCE and PCA scheme. And finally the biometric templates are secret using CANNY edge detection which tells us whether the two iris images are same or not and on the basis of that performance metric are evaluated like FAR, FRR and Accuracy. The whole simulation is taken place in the MATLAB environment.*

Keywords: *CANNY edge detector, Hough Circular transform (HCT), Principal Component Analysis (PCA), Hamming Distance.*

1. Introduction

Biometric authentication systems verify a person claimed identify by behavioural traits (signature traits) or physiological traits (face, iris, ear) [1]. Multimodal biometric system overcomes the limitations of uni-modal biometric systems such as non-universality, noise in sensed data, spoofing, intra-class variability, inter-class variability [2] [3].

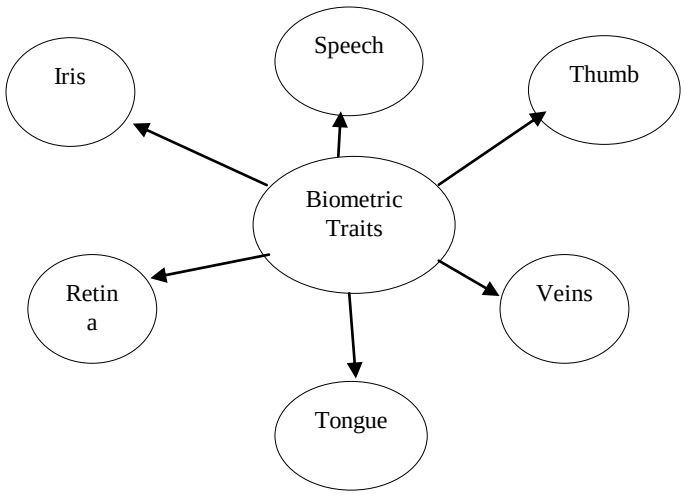

Figure 1: Biometric Traits

Iris is a standout amongst the most solid biometric feature because of its steadiness and haphazardness. Iris is changed to polar arrange by the routine acknowledgment frameworks [4]. They perform well for the agreeable databases, yet the execution disintegrate for the non-helpful irises [5]. Despite this, associating impact is presented as an after effect of changing iris to polar space. In this proposal, these issues are tended to by allowing for annular iris free from clamor because of eyelids [6]. This proposal shows a few CANNY based systems for separating exacting invariant highlights from iris that can be utilized to perform dependable coordinating between diverse perspectives of an item or scene. After limitation of the iris, PCA (Principle Component Analysis) is utilized to concentrate the neighbourhood highlights. The CANNY edge detection and HCT descriptor is a broadly utilized technique for coordinating picture highlights. At that point order of iris layouts will be done utilizing HCT [7].

2. Iris Recognition Block Model

Figure 2 below describes the working model of iris recognition using HCT, PCA and Hamming distance in MATLAB 7.10. Below are the working steps of iris

recognition system that has to be followed in order to recognize iris precisely. Therefore the block diagram of the iris recognition system is given below. Where the all steps are to described further that how the process will move and grow.

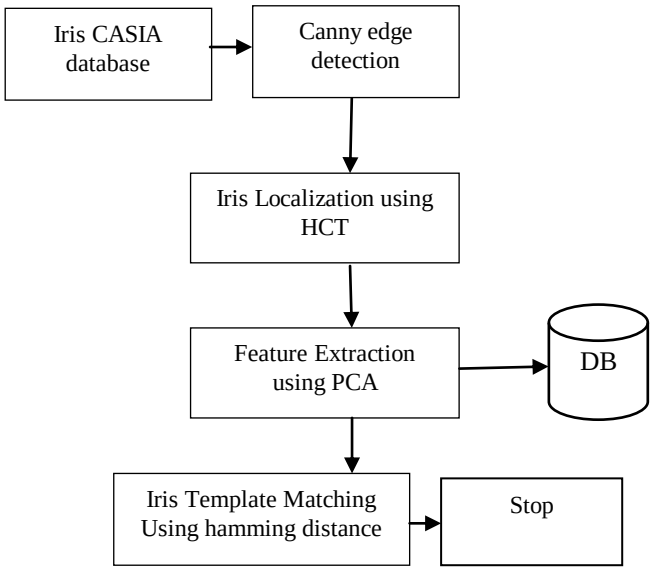

Figure 2: Proposed Model

Step1. Iris Database

The Chinese Academy of Sciences Institute of Automation (CASIA V1.0) iris database is considered to test the algorithm which consists of 756 eye images from 108 persons i.e., 7 eye images per individual. Each eye image is a grayscale image of size 280×320 [8]. The database images were collected using close-up iris camera in two sessions i.e., first three images in the first session and the next four images in the second session.

Figure 3: Iris Biometrics

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 [9].

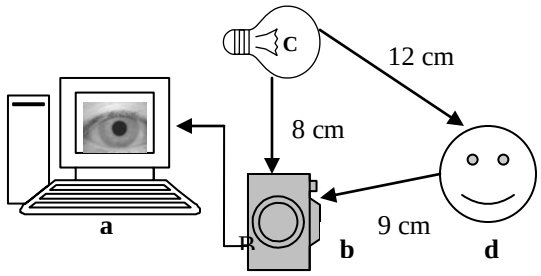

Figure 4. Image acquisition System (a) System with frame grabber (b) CCD Camera (c) Light Source (d) User

Step2. Canny edge detection

Canny edge detector is applied to get the edges of the image. The purpose of edge detection in general is to significantly reduce the amount of data in an image, while preserving the structural properties to be used for further image processing. The Canny edge detection algorithm is known to many as the most favorable edge detector. Canny edge detection scheme uses a multi-level algorithm to notice the edges. It is also known as optimal edge detector. It has chiefly three principles:

- Low error rate**:** Meaning a good detection of only existent edges.
- Good localization*:* The distance between edge pixels detect and real edge pixels have to be minimize.
- Minimal response*:* Only one detector response per edge.

Canny has the same method of finding the gradient as shown follows [10]:

$$G = |G_x| + |G_y| \quad (1.1)$$

Step3. Iris localization using HCT

The Hough transform can be applied to detect the presence of a circular shape in a given image. It is used to detect any shape or to locate the iris in the face [8]. The attribute equation of a circle of radius r and centre (a, b) is given by [11]:

$$(x-a)^2+(y-b)^2 = r^2 \quad (1.2)$$

This circle can be described by the two following equations:

$$x = a + r\cos(Q) \quad (1.3)$$

$$y = b + r\sin(Q) \quad (1.4)$$

Step4. Feature extraction using PCA

Then feature extraction will takes place. Principal Component Analysis (PCA) is a computational method to get hidden values of random variables. PCA basically designed for multivariate data. ICA is somewhat related to Principal Component Analysis (PCA) [12].

Step5. Matching Using Hamming Distance

For matching, the Hamming distance was chosen as a metric for recognition, since bit-wise comparison was necessary. The Hamming distance algorithm working also incorporates noise masking, Hamming distance are calculated between two templates by using only important bits. Now when taking the Hamming distance, only those bits in the pattern that corresponds to '0' bits in noise masks of both iris patterns will be used in the computation. The Hamming distance will be planned using only the bits generated from the correct iris region, and this modified by each template. Although, in theory, hamming distance is 0 when the result calculated on same iris templates but in put into apply this will not occur [13].

3. Results and Experiments

3.1 Parameters

Estimate parameters like FAR, FRR and accuracy. Fault acceptance rate and Fault rejection ratio is appraised. As much as the Fault acceptance rate (FAR), Fault rejection rate (FRR) is low as much as the Accuracy will increase. This adding up of FAR, FRR take the result to accurate according to their low values [14] [15].

3.2 Snapshots

Iris identification is done by using the dissimilar algorithms for the feature extraction. The algorithms such as canny edge detector is used for detect the image, as it can detect the thick descriptions also very easily. HCT algorithm is used after detecting the edges for finding out the shapes of iris circle. After applying the Hough Transform PCA is applied for feature extraction and then matching of the result of the database and planned technique result is matched by using hamming distance. Whole of the method of iris recognition is explained with snapshots below:

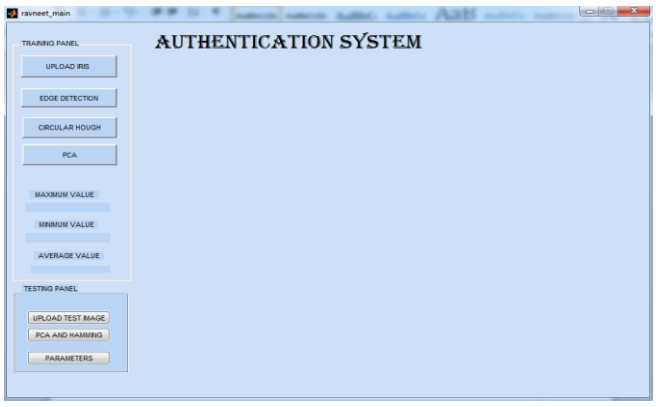

Figure 5: GUI panel

The figure 5 shows the graphical user interface panel with dissimilar user interface controls like panel, pushbuttons which are implement by click on the pushbuttons. Every pushbutton is having dissimilar functions at call back. The database panel will be obtaining after clicking on the upload button. The two folders are having iris images and the window contains training folder and testing folder. After that the panel in which iris image is uploaded and its grey scale image which is plot will be there after clicking on the upload pushbutton. It will be having static text also which contain minimum value, maximum value and average value. These are the principles which are extracting after applying principal component analysis. And according to it the next step will go on to make the system accurate.

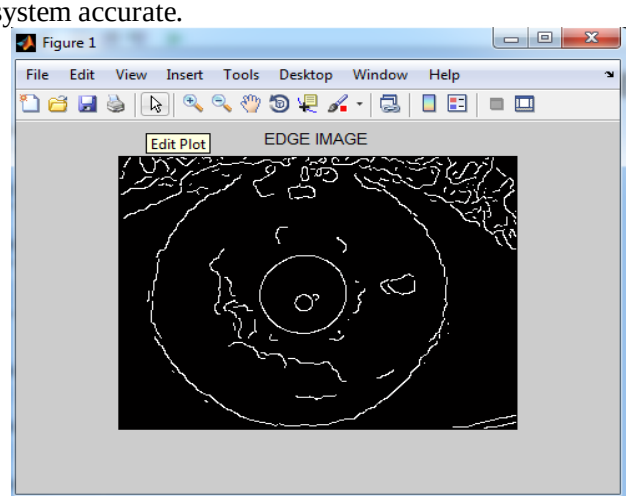

Figure 6: Edge Detection

The above figure 6 shows the edge image of the uploaded image which represents the edges on the boundary. These edges which are detected help to simplify the image and extract their features. The edge detector is of different types like canny edge detector, sobel, prewitt etc. and we have used canny edge detection because more edges are obtained after clicking on the edge detection pushbutton. Canny edge detector is being used for the edge detection as it takeout the thick edges of images very easily. The detected image is further used for applying the other algorithms on it, such as HCT, PCA. According to the whole the matching is done.

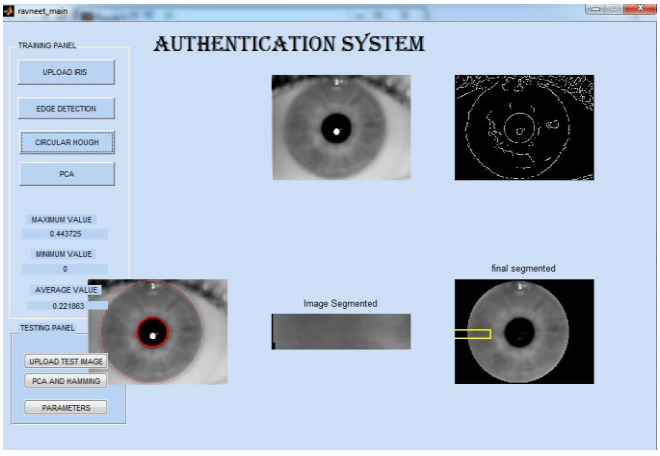

Figure 7: Applying HCT

The figure 7 shows the Circular Hough transform of the uploaded image after finding the edges of the image and get the circle frontier of the pupil using thresh function which is used to find the inner and outer circle radius and the final segmented image is obtain in which only inner and outer circles are obtain and rest part is eliminate and in the end we got the segmented image [16].

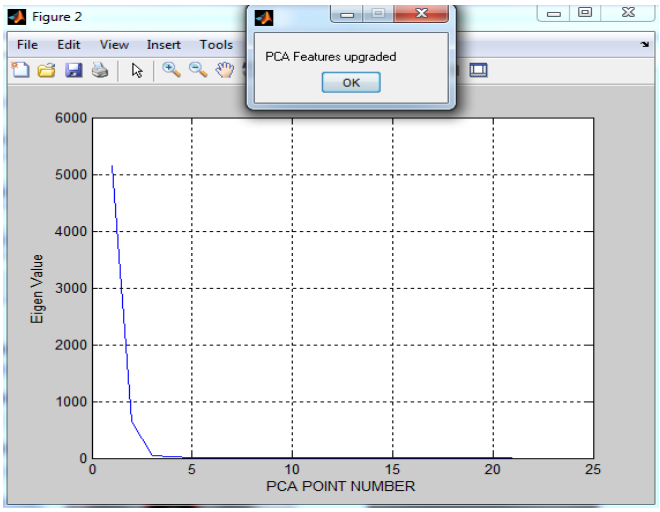

Figure 8: Result Graph after Applying PCA

The figure 8 shows the Principle component analysis(PCA) output which are used for the attribute removal after applying Hough circular transform and shows the feature extracted values based on principle component analysis and shows the message box that the features are take out. So move to the testing process. After that the testing folder is chosen in which the image is selected for the testing and then we will upload the iris sample to test to which it is trained. Here the PCA output is taken as Eigen value to take out the consequences of dissimilar iterations.

The following figure 9 shows the test image after clicking on the upload button on the testing section. That how the image is selected and then tested. This image for testing is taken by the test image of the database. The result of the image which got tested is shown as below in the figure. 9. According to it the result is formulated.

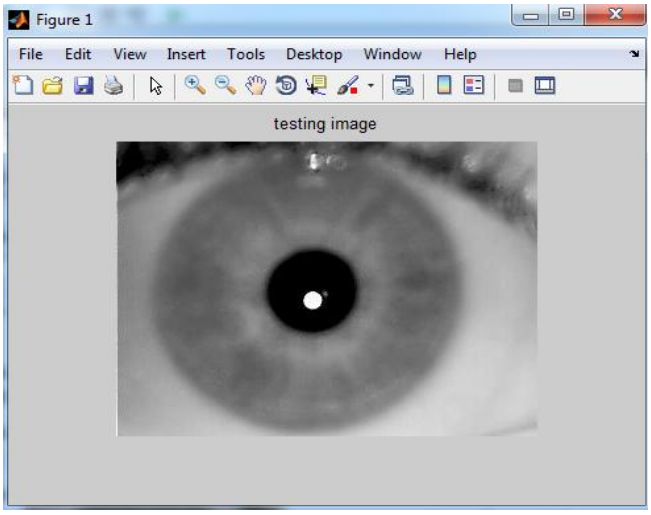

Figure 9: Image Tested

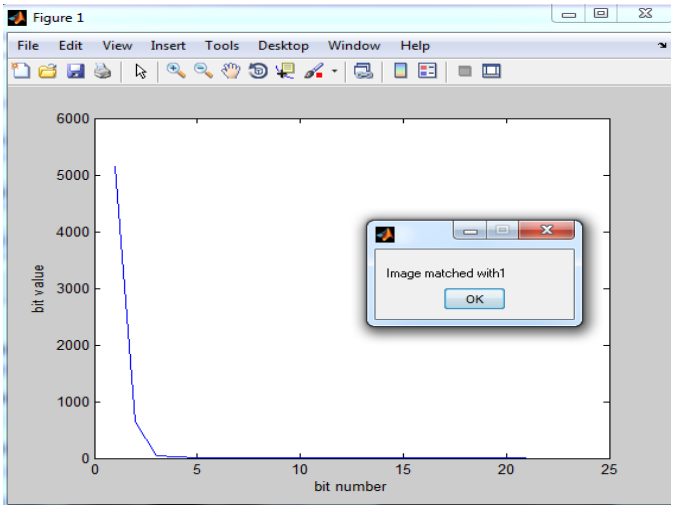

Figure 10: Image matched

The figure 10 shows the consequence of after clicking on the hamming distance and principal component analysis pushbutton and shows that the result is coordinated with the image number 1 which we upload the test image to test with the training images. As much as overcrowded match is there and iteration go on, the points will make accordingly. These are the points of image corresponding.

Figure 11: Results

The figure 11 shows the False Acceptance rate measure, False Rejection rate measure and accuracy of the verification process which shows that the FRR is 0.00032 and FAR 0.0303 and accuracy is 96.96 %. False rejection rate and false acceptance rate should be less for improved accuracy of the system.

Table 1.1: Images Parameters

IMAGE	FRR	FAR	ACCURACY
1	0.02278765	0.00037409	99.9626
3	0.00803125	0.00256470	99.7435
4	0.03407941	0.00006997	99.9301
5	0.05865235	0.00095106	99.9049
9	0.00803125	0.00162660	99.8373
TOTAL/5	0.13189061	0.00125868	99.87412

In the table 1.1the different values of the test images is represented. And the values of parameters increased or decreased are simultaneously, shown in it.

4. Comparison

Table 1.2: Comparison

APPROACHES	FRR	FAR	ACCURACY
PREVIOUS APPROACH [17]	0.22	0.193	58.7
PROPOSED APPROACH	0.13189061	0.0012586 8	99.87412

The table 1.2 shows the False Rejection rate measure, Accuracy, False Acceptance rate measure of the authentication process which shows that the FRR is 0.13189061 and FAR 0.001258684 and accuracy is 99.87412% for the proposed work. And the values of previous approach are also shown in this table. False rejection rate and false acceptance rate should be less for better accuracy of the system. As much as the FRR and FAR will be less the accuracy will increase highly.

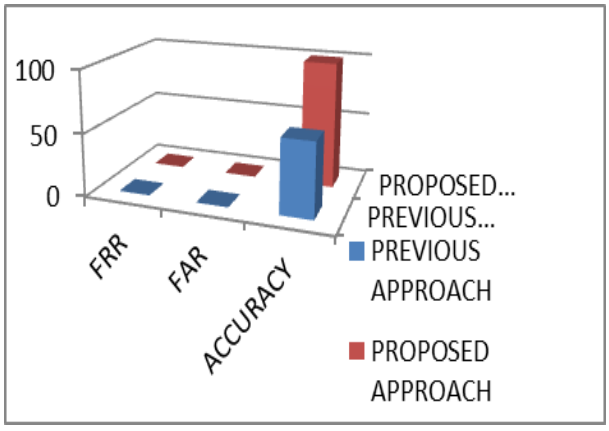

Figure 12: Comparison Graph

Therefore the figure 12 shows the comparison of previous approach and proposed approach in the graphical form. Accuracy is also measured and improvement in accuracy is there as such as FRR and FAR value will decrease, simultaneously Accuracy of the system will increase. This graph show the comparison of previous work with the proposed work. Where there accuracy has increased and FAR and FRR has decreased.

5. Conclusion and Future scope

In the proposed system a new technique is generated at feature level for feature extraction and matching of iris and ear increase the accuracy of the authentication systems. In this ICA features are extracted for iris and ear. This proposed method decreased the FAR as well as FRR, & has increases the system performance on the given data set.

Future works could go in the direction of using more robust modeling techniques against forgeries and hybrid fusion level can be used. Multimodal modalities can be used together to make forgeries more difficult. Also, the system should be tested on a larger database to validate the robustness of the model.

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