Effective Iris Recognition For Security Enhancement

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Abstract:
Iris Recognition is considered as one of the best Biometric methods used for human identification and verification, because of its unique feature that differ from one person to another, and its importance in the security field. We proposed an algorithm using a system based on Local Binary Pattern and histogram approaches for feature extraction, and Linear Vector Quantization classifier for classification for this iris recognition. This model is designed to distinguish clients from unauthorized users so that only valid users can have access to the security systems. All iris recognition process is done with the NI Vision Assistant and LabVIEW. Here we create a LabVIEW database for storing the information of the users including Iris of the respective person. In our proposed system we give a high recognition rate on different iris databases compared with other methods.

Keywords: Linear Binary Pattern (LBP), Learning Vector Quantization (LVQ), Laboratory Virtual Instrumentation Engineering Workbench (LABVIEW).

`I. Introduction:

Iris recognition is the process of automatically differentiating people on the basis of individuality information from their iris images. The technique can be used to verify the identity of a person when accessing a system. Due to its reliability and high precision, it is beneficial for biometric authentication system.

The first is iris image is captured, and the second step is preprocessing includes localization, segmentation, feature extraction and Identification. The Iris Recognition System is considered as one of the important ways for security in airports, government buildings, and research laboratories [1]. Iris image contains not only useful parts i.e. iris but also some irrelevant parts i.e. noise like eyelid, pupil, eyelashes, specular highlight. The iris is the annular part between black pupil and white sclera is the most part that researches are focused to determine its details. In general, there are many properties that make an iris ideal biometric method, the first is the uniqueness features "no two iris are the same" even between the left and right eye for the same person [2]. Iris recognition system is generally includes a series of steps : (i) image acquisition, (ii) iris preprocessing includes localization, segmentation, and normalization (iii) feature extraction, and (iv) matching and classification, as shown in figure 1. Image acquisition is to get the feature vector and iris signature used for matching and classification to obtain the recognition rate. In this paper both texture analysis and matching of texture representation will be used with the aid of combined classifier learning vector quantization (LVQ) and a comparative evaluation with other methods using different iris datasets will be presented. This paper has been organized as follows (2) Iris Preprocessing, (3) Proposed algorithm, (4) Experimental Results and (5) Conclusion and Future work.

The general Block diagram of iris recognition system:

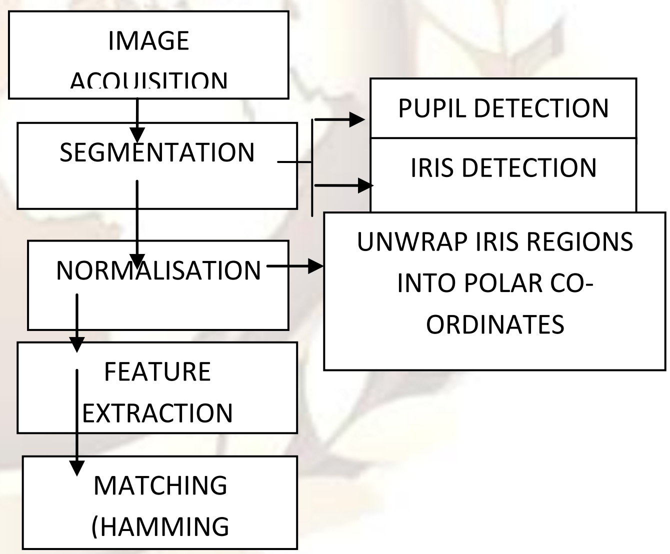

FIGURE 1.block diagram of iris recognition system.

Ii. Iris Preprocessing:

2.1 Localisation

The first step in the localization process is pupil segmentation based on analysis of the histogram. It is assumed, like in [4] that a pupil is the darkest area in the image and standard deviation of luminance in this area is relatively low. It has to be emphasized that unwanted elements (reflections, eyelashes, etc) may appear in the threshold image. Nevertheless pupil can be segmented by relatively simple method, based on image thresholding using the histogram analysis. It is possible, because in general, histogram function of all NIR eye

$$threshold = 0.52\left[\frac{1}{size_{image}}\sum Intensity_{pixels}\right] \qquad (1-a)$$

images have a local maximum placed in the area of small luminance values(pupil).

` **FIGURE 1**.Localisation of iris.

2.2 Segmentation

Segmentation is one of the important steps in preprocessing since it separates the input iris image into several components making it feasible to extract features easily. The technique we used in this step is canny edge detection, using image management tool in LABVIEW and vision assistant we perform this canny edge detection.

Steps in segmentation:

- Getting the input eye image in Vision Assistant.
- Locating the circular edge in the region of interest.
- Direction, polarity, looks for first or best edge is selected.

The Segmentation process is defined as separating the input iris image into several

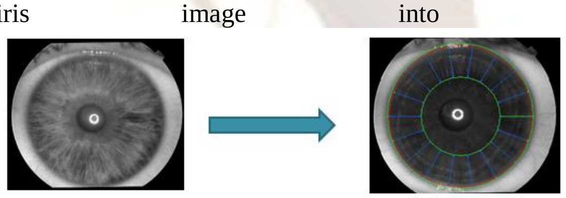

FIGURE 2.Detecting the edge in NI Vision Assistant

Components, so it is very important step in preprocessing because it describes and recognize the input image. One of the best ways to separate the pupil from the whole eye is using circular Hough transformation in order to find the circle of the pupil. The pupil is the largest black area in the intensity image; its edge can be easily detected from the binary image by using a suitable threshold of the intensity image.

2.3 Normalisation

The final step of preprocessing is normalization which transforms the iris region so that it has fixed dimensions in order to allow comparisons. Daugman's Rubber Sheet Model is used for iris normalization as shown in figure. The rubber sheet model ramps each point within the iris region to a pair of polar coordinates (r, _) where r is on the interval [0, 1] and _ is angle [0, 2_]. The remapping of the iris region from (x, y) Cartesian coordinates to the normalized non-concentric polar representation is modeled as:

$$I(x(r,\theta), y(r,\theta)) \rightarrow I(r,\theta)$$

with

$$x(r,\theta) = (1-r)\,x_p(\theta) + rx_1(\theta) \qquad (6)$$

$$y(r,\theta) = (1-r)\,y_p(\theta) + ry_1(\theta)$$

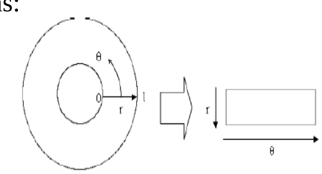

Fig. 7: Daugman rubber sheet model.

Where I (x , y) is the iris region image, (x , y) are the original Cartesian coordinates, (r , θ) are the corresponding normalized polar coordinates, and are the coordinates of the pupil and iris boundaries along the θ direction.

Iii.Proposed Algorithm:

In this paper a new algorithm is proposed using LBP and histogram properties as a
Statistical approach for feature extraction and the use of combined LVQ classifiers as a neural network approach for classification. Once the features are extracted using both LBP and Histogram properties, an iris image is transformed into a feature vector applied to combined classifier.

The steps involved in proposed algorithm:

Step1: Upload input iris images.

Step2: The preprocessing Stages:

a. Using Both Canny Edge Detection and HCT for Localization and Segmentation.
b. Normalization Of Iris Using Daugman Rubber Sheet Model

Step3: Extract The Normalized Iris Features using LBP To Obtain Feature Vector

Step4: The feature vector obtained is uploaded to LVQ classifier.

a. Set NC:number of classifiers=3
b. Determine The Minimum Acceptable Classifier Performance.

Step5: The Training and Testing By Each LVQ Classifier By:

a. Selecting Suitable Learning Rate..
b. Selecting Suitable Number Of Hidden Neuron(NH)
c. Selecting suitable training epoch number.
d. Repeat For Each Lvq Classifier(Nc=3)

Step6: The Output Is Based On Majority Voting Among Several Classifiers

a. For m=1 to number of image for test.
b. For n=1 to number of classes.
c. For c=1 to number of chosen classifiers.
d. K=Recognition Result

Winner Class=Maximum Counter.

` **3.1 Feature Extraction:**

LBP is ideally suited for applications requiring fast feature extraction and texture classification. Due to its discriminative power and computational simplicity, the LBP texture operator has become a popular approach in various applications, including visual inspection, image retrieval, remote sensing, biomedical image analysis, motion analysis, environmental modeling, and outdoor scene analysis to extract the entire iris template features; they used hamming distance for matching. In this paper LBP is introduced in order to extract the iris features from the normalized iris image. The output of LBP is the feature vectors with n-dimension used as an input to combined LVQclassifier.The edge detected image is shown in FIGURE(4).

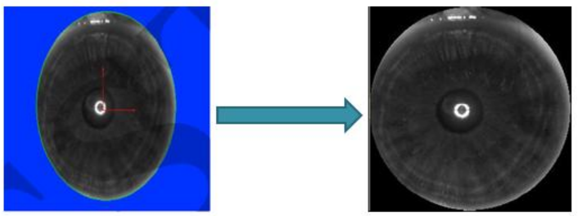

Figure 4.The Edge detected image is extracted using image mask function.

3.2 Learning Vector Quantisation:

LVQ is a pattern classification method; each output node is represented as a class. The weight vector of an output node is called a reference or codebook vector (CV). The LVQ attempts to adjust the weights to approximate a theoretical Bayes classifier. Input vectors are classified by assigning them as a class label of the weight vector closest to the input vector. The result obtained depends on the majority voting among several weak classifiers. The LVQ consisting of two layers; the first layer is the input layer which contains the input neurons, while the second layer is the output layer that contains output neurons.

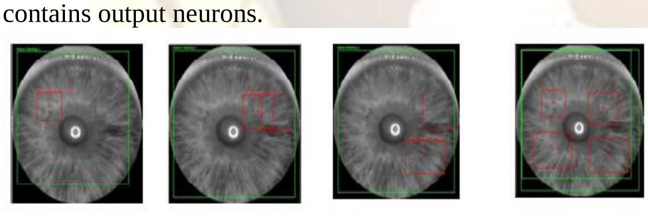

FIGURE 5. Pattern Matching Process.

The final step is the pattern matching of the Iris image with the stored templates from the database. The FIGURE (5) shows Pattern Matching process. These patterns are used to create templates for Iris recognition. It will work fine for less number of users, but it is not recommended for large number of users since it requires large storage memory. We created four templates for each Iris image rather than storing complete image. The templates of the iris are shown in the **FIGURE (6).**

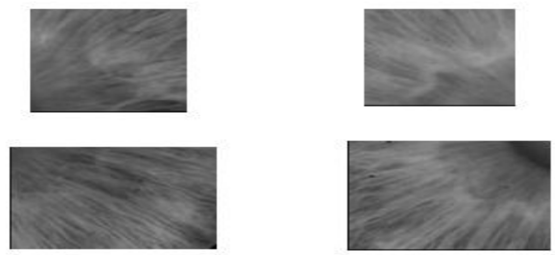

FIGURE 6. Templates of the iris image.

Iv.Experimental Results:

The Iris recognition steps, feature extraction, Pattern matching are performed using NI Vision Assistant and NI Lab VIEW. The NI vision script for iris recognition using template matching is shown in Figure (6).
.Template matching script required 27.94ms.

Results ...	1
X Position	144.00000
Y Position	366.50000
Angle	0.000000
Score	1000.00000

Figure 7.Results of template.

The front panel of Iris recognition is shown in Figure (8).This compares the Iris image of the user and the already stored user's image in the database.
The Iris images are compared using Lab VIEW tool.

Figure 8 .Comparison of Iris images.

The Figure 9 shows selecting an Iris image in an ATM system.

Figure 9.Selecting the iris image in an ATM system.

V.Conclusion And Future Work:

This paper describes an alternate method to identify individuals using images of their iris. Pattern matching is performed using NI Vision Assistant. This script is tested on 30 images from database. NI Lab VIEW is used for developing graphical user interface. This identification system is quite simple requiring few components and is effective enough to be integrated within security systems that require an identity check. And our future work is to include some mathematical parameter along with the templates which is stored in the database to reduce the processing time of the system for the large number of users.

Bibliography

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