Optimization of Human Recognition from the Iris Images using the Haar Wavelet

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ABSTRACT:
Today, biometric recognition (based on biological signs) is a common and reliable method for recognizing and identity confirmation based on their behavioral and physiological characteristics. Physiological characteristics are consistent with the physical characteristics of individuals such as fingerprints, iris pattern, facial features, and the like. This type of property often does not change without external exertion. Behavioral characteristics such as signature, spoken pattern and iris are also a scale for identification and identity confirmation. In this study, using the wavelet method, the efficiency of human identification was increased by 75%.

KEYWORDS: Haar wavelet, Identification.

1. INTRODUCTION

People are a long time and naturally used the biometric features of others, such as face and voice or handwriting, to identify and recognize their identity for. One of these important features is identification through iris. In today's societies, identification of human, especially on security issues, has become increasingly important. With the rapid advancement of technology, many of the tools needed to achieve this goal will be available. The iris is referred to the area of the outer region of the eye, which lies in the middle of the eye and the pupil circumference. The iris consists of a thin diaphragm that is wrapped around the inside of the lens and is held lens by the lens. The iris function is the control of the amount of light entering the pupil, which is performed by expanding muscles in the volume that adjusts pupil size. The average diameter of the iris is 12 mm and the pupil size can vary from 10% to 80% of the iris diameter [1].

A different system of real-time eye tracking for large-scale scientific papers presented. For example, Vecchia and colleagues (1998) have developed an iris recognition system in which

The eyes are three-dimensional objects using face pattern detection algorithms found [2].

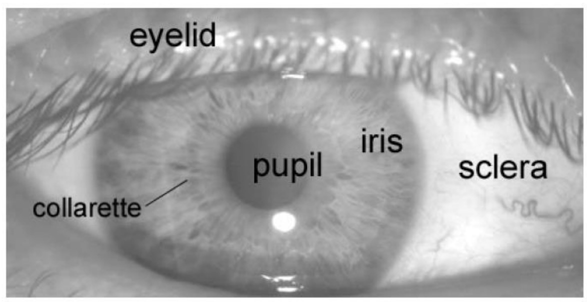

Fig. 1. an image of the front of the iris.

Also Haro and Associates (in 2000), a real-time eye tracker using the red-eye effect by reflecting proposed with retina [3]. Wildes et al. 1994, Kong and Zhang (in 2001) Tisse and colleagues (in 2002) and Ma and colleagues 2002 have used the Hough transform. Hough transform a standard computer vision algorithm that can be used to determine the parameters of simple geometric objects, such as lines and circles shown in an image to be used. Circular Hough transform for determining the coordinates of the center and radius of the pupil and the iris can be used areas. Circular Hough transform algorithm automatically based on the first, an edge map derived by first calculating the brightness values in an image of the eye, and then the result is thresholding. Hough space from the edge of the map, the circle passing parameters from anywhere edge candidate system set-up [4].

Rossant et al (in 2013) presents a complete iris identification system Based on Wavelet Packet Decomposition and Local Comparisons of the Extracted Signatures that including three main stages: iris segmentation, signature extraction, and signature comparison. An accurate and robust pupil and iris segmentation process, taking into account eyelid occlusions, is first detailed and evaluated. Then, an original wavelet-packet-based signature extraction method and a novel identification approach, based on the fusion of local distance measures, are proposed. Performance measurements validating the proposed iris signature and demonstrating the benefit of our local based signature comparison are provided .Moreover ,an exhaustive evaluation of robustness, with regards to the acquisition conditions, attests the high performances and the reliability of our system. [4].

Zaffar and et al (in 2013) the richness and apparent stability of the iris texture make it a robust biometric trait for personal authentication. The performance of an automated iris recognition system is affected by the accuracy of the segmentation process used to localize the iris structure. In case of wrong segmentation, wrong features will be extracted and hence, may lead to false identification results. Most of the authors propose Circular Hough Transform to localize the boundary of IRIS. But the problem with this technique is its high consumption of time and memory. It also requires a precise estimated range of the boundary and it fails to localize the IRIS if the correct estimation is not provided. The proposed technique follows a basic strategy and obtains the major boundaries, by using canny edge detector. Features have been extracted using Curvelets Transform; Principal Component Analysis is then used to reduce the dimension of the features. Then SVM has been used as classifier. The implementation of the proposed Recognition method shows good results. In this method, more than 20 curve coefficients that obtained from the left-hand side of the histogram of the eye-database images can be used to develop an iris recognition system with a precision of up to 100%. The runtime of this system is very low. [5].

Garaged (in 2014) the biometric human identification technique based on the iris of an individual is well suited in providing authentication features for any system that demands high security. The proposed method iris recognition, including a powerful way to identify the center of the pupil using a gradient from normal circular shape of the pupil to determine the position of the iris with a high rate of accuracy of 90.95%, is used. According to calculations, this method in the detection of internal and external borders of the iris is compared with other operator's better differential calculus. Database used in this article is UPOL [6].

Abiyev (in 2009) presents the iris recognition system for biometric personal identification using neural network. Personal identification consists of localization of the iris region and generation of a data set of iris images followed by iris pattern recognition. The disadvantages of this approach include the lack of reception of high quality and good output performance [8].

Umer (in 2015) present an iris recognition system with improved performance using a novel morphologic method for feature extraction. The proposed system is able to verify as well as identify the subject's efficiently. Compared to existing methods, the proposed system shows better performance[8].

2. METHODOLOGY

In the proposed method, first, after the preprocessing steps of noise and the size of images by algorithm, the iris of the eye was detected in this chapter and then, using the feature harr wavelet, the texture of the iris was extracted and finally, using the Hamming distance work of Classification has been done. Finally, by performing a test on a dataset containing 40 images in different scenarios and locations, the presence of eye iris for 30 different individuals has reached 100% accuracy. The flowchart is explained below.

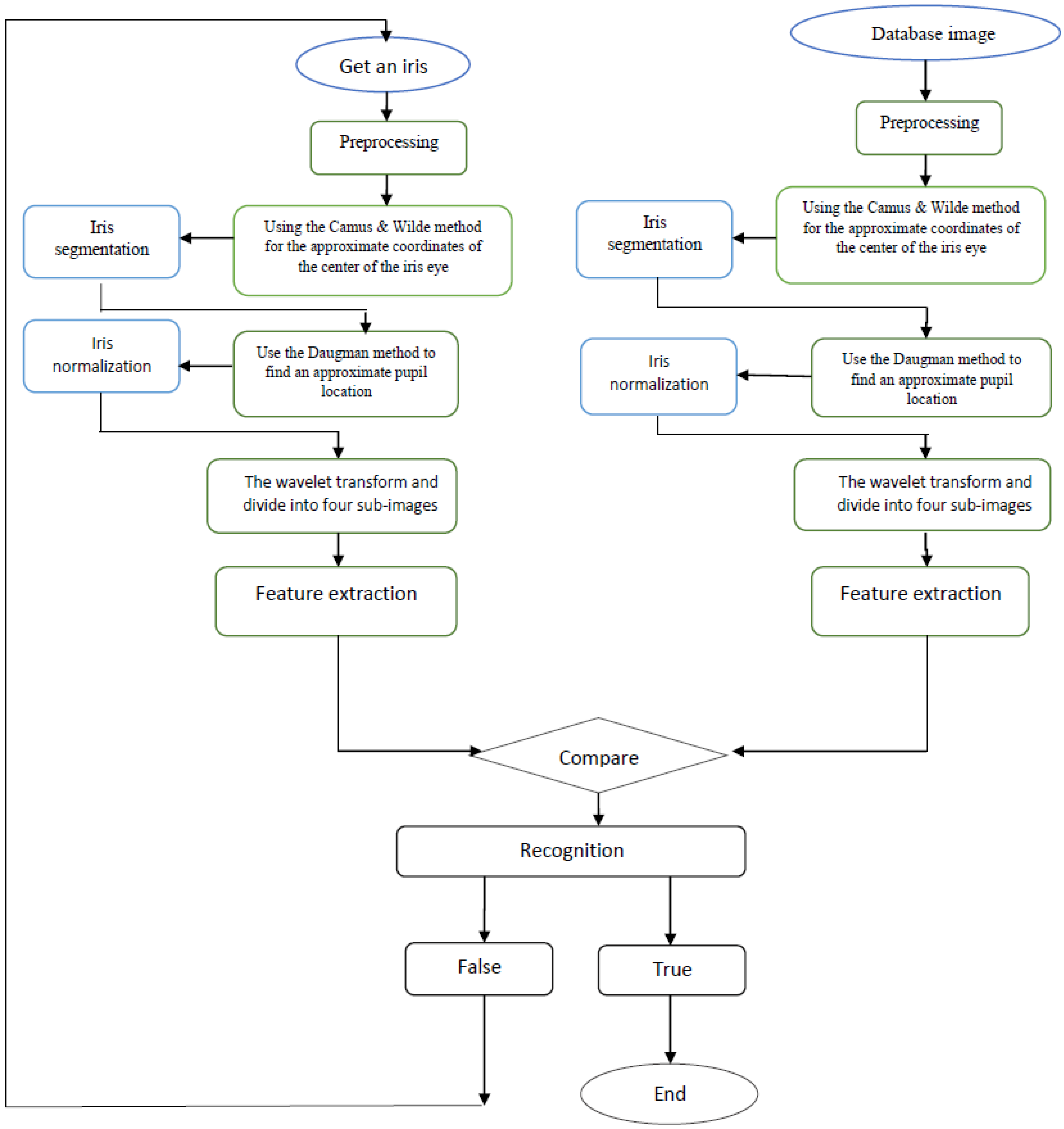

Fig. 2. Proposed Method Flowchart.

3. PREPROCESSING

In order to take advantage of image processing techniques, the first and perhaps most vital step that its results directly affecting the entire processing process is the preprocessing step. In this step, we try to obtain the input data of system's to stable and uniform structure, so that the the processing process, which involves feature extraction and classification more accurately. One of the most important steps in the preprocessing of any image processing system is the noise elimination of the data set, which can be various factors like the imaging environment or the imaging quality of the camera, or applied during image transfer or compression or image encoding.

Hence, in the preprocessing steps for the proposed system and the proposed method for identifying iris-based images, the following steps are taken.

3.1. Elimination of Noise

In the first step, the preprocessing of the image is taken to elimination the noise from the image. To elimination the noise from the image in the proposed method, the use of Wiener noise removal is proposed [10]. In this method, the local average and the variance around each pixel of the image are calculated with the following relationships.

$$\mu = \frac{1}{NM} \sum_{n_1, n_2 \in \eta} a(n_1, n_2) \qquad (1)$$

In the above formula local neighbors of the pixel of the size m at n are from the image a

$$\sigma^2 = \frac{1}{NM} \sum_{n_1, n_2 \in \eta} a^2(n_1, n_2) - \mu^2 \qquad (2)$$

In Wiener's method, these pixel values are used to create a winner filter based on the following relationship .

$$\mathrm{b}(\mathrm{n}_1, n_2) = \mu + \frac{\sigma^2 - \upsilon_2}{2}(a(n_1, n_2) - \mu) \qquad (3)$$

v^2 is the noise variance. In the absence of its value in the Wiener method, the average of the variances in the whole image will be used.

Fig. 3. Non Noise image from the image aboveF

1.2. Size Change

The next step in preprocessing is image resizing. Since the imaging of the eye may have any size in image and the criteria for the extraction anesthetic of the eye, the constant size resizing of the image will help the iris detection process, which will accelerate the process of iris detection while maintaining the image quality. As a result, the second step is to resize its pre-image. For this purpose, cubic interpolation has been used.

Secondary cubic interpolation in developmental mathematics is based on a cubic interpolation that acts on two-dimensional regular table points. The level achieved using this interpolation is softer than the level obtained by other interactions such as interpolating the nearest neighbor or bilingual interpolation. In the application of image processing, if this does not require speed, this interpolation will typically be used. This interpolation uses texture instead of 4 tow line interpolation points from 16 neighbor points.

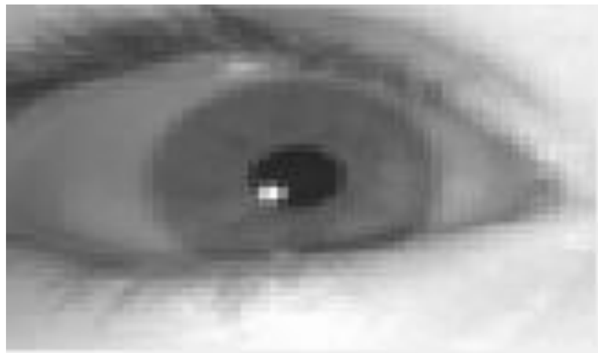

Fig. 4. a sampel of image resizing

4. FEATURE EXTRACTION

Feature extracting is a process which it is characterized by its operation on the data, its prominent and determinant characteristics. The purpose of extracting the feature is to make raw data more usable for subsequent statistical processing. In the problem posed by the proposed method here, in order to extract the feature, we must first identify the iris of the eye, and then the texture-based property Extract the discrete wavelet waveform from the iris.

5. RECOGNITION OF IRIS OF THE EYE

In this step, they intend to extract the image segmentation of the iris of the eye from the eye image. For this purpose, using the Camus & Wildes method, the coordinates of the center of the eye iris will first be extracted. Then, using the Daugman method, an approximate pupil's eye center will be found, and the neighborhood of the exact boundary between the pupil and the iris will be extracted.

The Camus and Wildes method provides a real-time and reliable algorithm for locating iris and pupil boundary in a closed image of the eye. It uses a multi-resolution method to quickly and accurately detect borderlines, even in low-quality image or mirror image. In this algorithm, to identify both the iris and pupil boundary, a suitable fitting scale is used for the possible boundary parameters to be check to provide the probable center. This fitting component is defined as follows:

$$c = \sum_{\theta=1}^{n}((n-1)\left\|g_{\theta,r}\right\| - \sum_{\phi=\theta+1}^{n}(\left\|g_{\theta,r} - g_{\phi,r}\right\| - \frac{I_{\theta,r}}{n} \qquad (4)$$

n is the total number of possible directions and $I_{\theta,r}$, $g_{\theta,r}$ respectively, the illumination of the image and the derivatives of the polar coordinate radius of the system. This method is for images with iris and pupil boundaries and a noisy image. Further, the Daugman method maps the coordinates of the center of the pupil to 10×10 neighboring iris center and the pupil eye radius continues until it reaches the maximum optimum size. This will be done using the probable relationship between the size of pupil and iris radius.

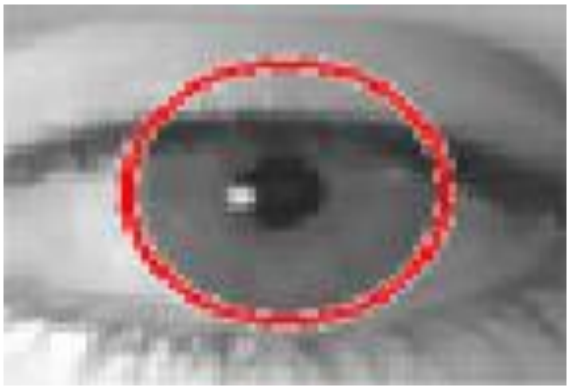

Fig. 5. Output of recognation iris with red squre around iris.

In Fig 5, the result of implementation the iris recognition is shown, which is indicated correctly in the image of the iris. In the next step, the feature (signature) related with each iris should be extracted from it. In the following, the proposed method for identifying using an iris is to analyze the detected iris using a random wavelet and four sub image the base, vertical, horizontal, and diagonal image, as shown below.

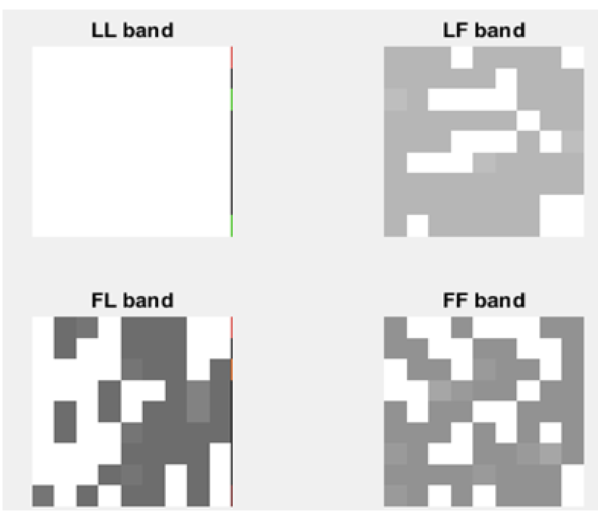

Fig. 6. A harr discrete wavelet transform and 4 different image sub bands.

In the following, using the information of three vertical, horizontal and diagonal sub bands as an feature or signature of the iris to identify and using the Hamming distance.

6. CLASSIFICATION

In machine learning and classification statistics, the problem of identifying the belonging of a new observation to which set of class (sub-populations), based on a set of data used (feature), is to teach the observations that membership in their class is known. In the term "machine learning", the classification is a kind of supervised learning that there is a set of data for train. In the subject matter, since the discussion is the classification and identification and the individuals in a group for authentication, the number of people surveyed in the bank is high for iris signatures It is best to use the first-nearest neighbor class based on the distance scale. This class, independent of the number of classes examined (the number of people in the iris bank), only matches the closest person. For this purpose, we need to have a proper definition of the parameter or scale. There are different methods for defining the distance between signatures and we used Hamming distance in the proposed method.

7. EXPERIMENTS

The 30-person sggsie and UBIRIS datasets were randomly selected. The size of these images is pix 201 × 241. Of about 40 images available for each person, ٠/٨ were used for training, and the remaining 0.2 was used to test and identify the individual. Using the first-nearest closest near neighbor's, based on the distance scale, is the correct percentage that is considered by the k-fold cross validation method to be stable and non-linear in the end with the following formula: The results are presented in Table 2.

(5)

$$\frac{1}{n}\sum_{i=1}^{n}(y_i-\alpha-\beta^T x_i)^2=\frac{1}{n}\sum_{i=1}^{n}(y_i-\alpha-\beta_1 x_{i1}-....-\beta_p x_{ip})^2$$

Simulation was performed in MATLAB environment and the results were presented in the form of confusion matrix.

Table 1. Valuation index

Fmeasure	Precision	Recall
0.72908	0.75905	0.74376

Table 2. Validation results

TN	76.25	FN	23/75
TP	74.48	FP	25/52

The gold of identity confirmation was through iris; for identity confirmation from iris in different images, the most import ant challenge is to not identify the dimensions and location of iris in images. Initially, with a review of the history of work done in the field of identifying iris from different methods, we propose after these reviews, wavelet transform of the appropriate extractor operator is detected. For this purpose, Camus & Wildes will first extract the approximate coordinates of the eye iris center. In the next step, using the Daugman method, an approximate center of the pupil's eye will be found, and the neighborhood of the exact boundary between the pupil and the iris will be extracted. In the Daugman method, the coordinates of the center of the pupil of the eye are obtained by searching the 10×10 iris windows and the radius of the pupil increases as long as the optimum size reaches its maximum. . In the next step, the feature (signature) associated with each iris should be extracted. We analyze the authenticity of the harr wavelet using four under the base, vertical, horizontal, and diagonal image. Finally, for identity confirmation through the iris, the features are applied to the appropriate classifier, at this step, a very important challenge There is a mismatch between the number of iris and other locations that iris contain a very small percentage of the image, so the number of features ۰and 1, or -1 and ۱do not match the inputs of the classmates, and to solve this problem, a The matching step will have the number of selected features. The fact that the number of features of parts without images is almost equal to the number of properties of the iris windows in the selected image; with this, the classification are stable in terms of training and experimentation, and the percentage is correct to a relatively reasonable number. From the class of the different classification, finally, the first-nearest neighbor's, based on the distance scale, has the best correct percentage, which was finally evaluated by the k-fold cross validation method.

8. CONCLUSION

In this work, the proposed method for identifying through iris is presented. The proposed method in this work consists of preprocessing steps for noise reduction and image resizing. In the feature extraction step, Camus & Wildes method extracted the iris from the closed image from the eye, and finally, using a random wavelet transform, three sub bands of horizontal and vertical detail Considering the diagonal as a feature, and finally, using the Hamming distance and the first classifier of the nearest neighbor, the classification work has been done. The gold of identity confirmation was through the iris ; for identifying confirmation from iris in different images, the most important challenge is to not identify the dimensions and location of iris in images. Initially, with a review of the history of work done in the field of identifying iris from different methods, we propose after these research, the transformation of the harr wavelet transform of the appropriate extractor operator is detected. For this purpose, Camus & Wildes will first extract the approximate coordinates of the eye iris center. In the next step, using the Daugman method, an approximate center of the pupil's eye will be found, and the neighborhood of the exact boundary between the pupil and the iris will be extracted. In the Daugman method, the coordinates of the center from the pupil of the eye are obtained by searching the 10×10 iris center and the radius of the pupil increases as long as the optimum size reaches its maximum. In the next step, the feature (signature) associated with each iris should be extracted. We analyze the authenticity of the harr wavelet using four under the base, vertical, horizontal, and diagonal image. Finally, for identity confirmation through the iris, the features are applied to the appropriate classifier, at this step, a very important challenge There is a mismatch between the number of iris and other locations that iris contain a very small percentage of the image, so the number of features ۰and 1, or -1 and 1 do not match the inputs of the classmates, and to solve this problem, a The matching step will have the number of selected features. The fact that the number of features of parts without images is almost equal to the number of properties of the iris windows in the selected image; with this, the classification are stable in terms of training and experimentation, and the percentage is correct to a relatively reasonable number. From the class of the different classification, finally, the first-nearest neighbor's, based on the distance scale, has the best correct percentage, which was finally evaluated by the k-fold cross validation method.

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