Gender Prediction from Iris Recognition using Artificial Neural Network (ANN)

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Abstract—**Gender prediction from iris recognition techniques is widely used in human identification process namely biometric identification. Physical ageing is an important factor for bio-metrics. Now a days the biometric qualities such as face,,hand geometry and fingerprints etc are used by the researchers to obtain the characteristics like hair colour, age ,gender, weight, ethnicity and so on. The iris recognition gives more accurate result comparing with other biometric verifications. This is a more verified technique for authentication while comparing to other biometric recognition systems, because he iris of two eyes of same individual are not comparative. The performance of iris recognition system enhanced the gender prediction from their iris images .This work pointed to enhance the gender prediction from eye images using artificial neural network .**

Keywords—Gender prediction, iris, eye images, iris recognition

I. INTRODUCTION

Iris biometric is one of the most leading identification systems in the world. Many types of research are made under the iris biometric system.

Eye recognition emerges as one of the most useful tempers for bio-metrics recognition in the last few decennaries.. The steps for iris recognition consists of mainly four parts: image acquisition, iris segmentation, feature extraction, and pattern matching. Because of its high recognition rate the iris recognition is one of the most meticulous biometric modality. several countries in the overall world have been enrolled in the iris recognition system for convenient use of passports, automated border crossing pass, and other identification processes to reduces the fake identity of the peoples.

In the case of human beings, we can easily recognize the gender. But there is some difficulty to be faced when using the computer vision technique while using the iris some features are used to identify the gender of the people

To Identify a person's gender[5] from an iris image such identification is related to forensics applications and security surveillance systems. a recognition system can detect iris of the peoples who have already been enrolled in the system. For persons who are not yet enrolled and so cannot be recognized, it may still be useful if the system could yield some basic demographic information for the person...

Gender prediction is essential and critical for many applications in the commercial domains. It is simple for an independent to recognize the gender however it is exceptionally hard for the machines. Gender recognition is applicable in various fields, for example, security frameworks, forensic sciences, etc. Various strategies were utilized in previous years to characterize gender utilizing facial images although only a few types of research have used the features of iris images to foresee the gender. The biometric authentication system dependent on iris images is commonly viewed as more solid than other frameworks. Numerous researchers have used facial images for the recognition of gender. Iris images have been utilized for recognition purposes, but there exist some references revealing the use of iris images for identification of human attributes.

Ongoing through the paper is to predict the gender using the eye image data. the image is normalized after normalization the prediction can be done by using ANN.the prediction the gender by an assumption.

The discuss as follow in section II, III, IV . In section II will discuss the block diagram .section III will be the experimental result also section will conclude the paper.

II. BLOCK DIAGRAM

The gender prediction from iris recognition can be done by mainly seven stages. These stages are:

    A. Image acquisition
    B. segmentation
    C. Iris normalization
    D. feature encoding
    E. Classification
    F. Gender prediction

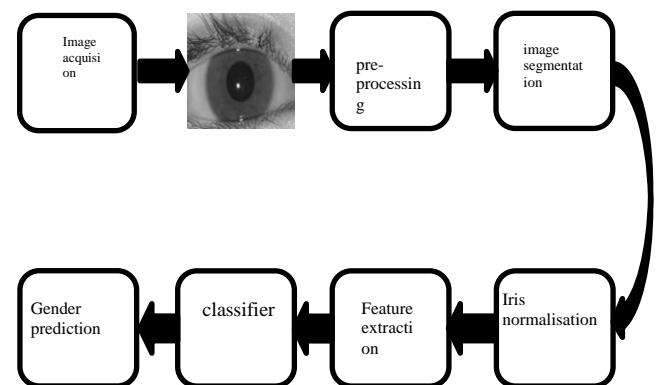
Fig1: block diagram of gender detection

A. Image acquisition

The iris image should be image quality abundant in iris texture. The eye image is collected from IT Delhi data set

B. Preprocessing

Iris Recognition is the most accurate biometric identification system. The image processing using concepts of neural networks the Iris Recognition of a person is identified by the iris which is the part of the eye . To identify a person's gender with high efficiency and high accuracy by analyzing the random patters visible within the iris. it can be implemented by using a modified Canny edge detection algorithm
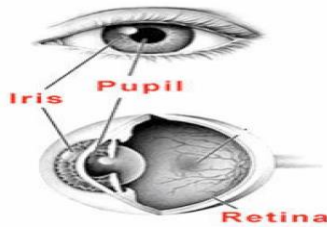

Fig2: the human eye

C. Image segmentation

In the primary step take the digital images then the iris recognition is to isolate the original iris region. The iris region, shown in the above figure2, can be approximated by two circles, one for the iris/sclera boundary and another, interior to the first circle, for the iris/pupil boundary. After completing the segmentation process, the segmentation depends on the imaging quality of the eye images. The outer radius of iris detected by using the pupil center. The inner boundary and outer boundary of the iris are placed .using Canny edge detection for finding the edge of the eye image.

The algorithm done is done 5 steps:
1.Smoothing: blurring and filtering is used to remove the noise of the eye image

Fig 3. Blurred and filtered eye image

2. Finding gradients: at the points/pixels where the colour pattern in a similar threshold area is together making a group.

3. Non-maximum suppression: The edges should be marked when a part of the image to be processed is circular and non-linear boundary region matching a similar shape is taken out for only local maxima.

Fig4. a portion of the eye image

4. Double thresholding: detect the Potential edges of the eye image by using the threshold

5. hysteresis is used for Edge tracking: vanquish all edges that are not connected to a certain edge when the edges are formed.

Fig 5.result of Canny edge image

The Hough transform is a standard computer vision algorithm that can be used to designate the parameters of simple geometric objects, such as circles and lines present in an image. The center and radius coordinates of the pupil and iris regions can be worn to deduce by using circular Hough transform

transform. thresholding the output can be done by an edge map is generated by calculating the first derivatives of intensity values in an eye image.

D. Normalization of image

After the iris segmentation, the upcoming step is to normalize this image, to enable the iris code and their comparisons. optical size of the iris, pupil position in the iris, and orientation of the iris are different in different peoples, it is required to normalize the iris image, so that the representation is common to all, with similar dimensions. To unwrapping the iris and transform it changes into its polar equivalent has done by using the normalization process. It can be done by using Daugman's Rubber sheet model . while considering the reference point will be the center of the pupil in eye image.

E. feature extraction

A transpire technique in this particular application area is the use of Artificial Neural Network implementations with networks worn specific guides to update the links or weights between their nodes. the networks can be fed the data from the graphic analysis of the input picture and trained to output characters in one or another form.

F. ANN and SVM classifier

To perform the project using artificial neural networks Backpropagation algorithm is a common method .to calculate, the desired output for any given input. It is also useful for feed-forward networks (networks that have no feedback,). Backpropagation requires that the activation function used by the artificial neurons (or "nodes") is differentiable. It has two parts: Training and Testing
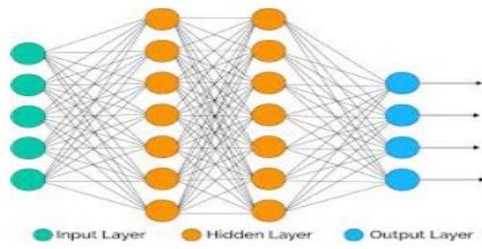
Fig 6:architecture of ANN

The input layer is the first layer which indicates the input and the last layer is the output layer that represents the output of the network. The remaining layers are called hidden layers. These layers are having interconnection nodes that are associated with weights. For a neural net with supervised training, the training is carried out by providing a sequence of Training data each with an associated target output. Finally, in the testing phase, the normalized eye image which is given as input is transformed to grayscale and then to binary, and the features are extracted. Then take the trained data, it is identified that, whether the testing iris belongs to male or female.

Every neuron has two units. The first unit adds products of input signals and weights coefficients. The nonlinear function is the second unit, called the neuron activation function. an output signal of the adder is e, and $y = f(e)$ is the signal output of the nonlinear element. The output signal of a neuron is signal is y. Need training data set to teach the neural network. The training data set consists of inputs assigned with the corresponding desired output. the first step is to start the teaching process with a large value of the parameter. the weights coefficients are being established the parameter is being decreased continuously is the second step.

support-vector machines (SVMs, also support vector networks) are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis.
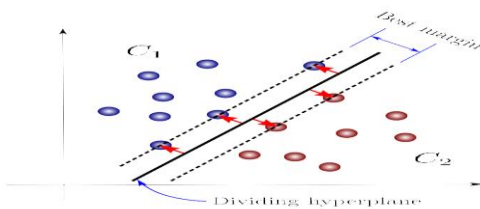

Fig7: SVM classifier

III. EXPERIMENTAL RESULT

The experimental setup used to do the pre-processing steps was Keras: The Python and Matlab 2017b is used to do the feature extraction and the training steps. data set of iris images were collected from IIT Delhi
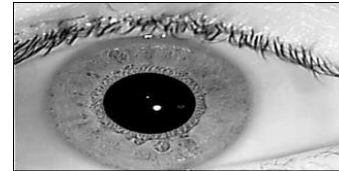

Fig. 8. An iris image from data set

For iris localization to detect the edges by applying the Canny edge detection, followed by Gaussian blurring to remove noises, finally, Circular Hough transform is applied on the Gaussian blurred image to detect the area of limbic boundary. Fig. 9shows the result of Canny edge detection and Fig. 10 shows the Gaussian blurred image. Using the values of center and radius returned, the limbic boundary is plotted on the iris image as in Fig. 11
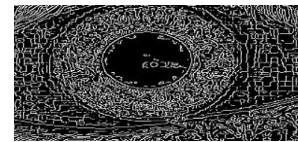
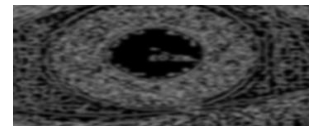

Fig.9 Canny edge detected image
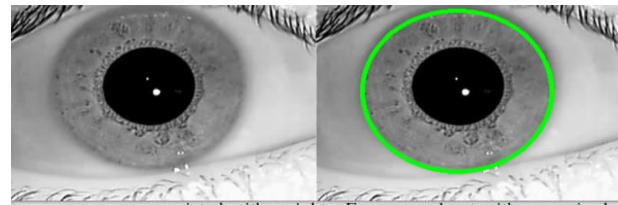

FIG. 10. GAUSSIAN BLURRED IMAGE

Fig11: Circular Hough Transformed Image

iris image is cropped in such a way that the limbic boundary is fit in that image as shown in Fig. 12

Figure12: iris image

To obtain the pupil region, the cropped image is binarized using thresholding. The morphological closing, eroding, and an opening is applied to get the pupillary region as in Fig.13.
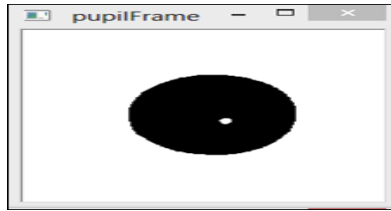
Fig. 13. Image after morphological operations

To get the pupillary region alone, a function is defined to return the rows and columns of the black region (pupil. Thus the radius and center of the pupillary boundary are easily found from these rows and columns returned. Using these centers and radius obtained, the limbic and pupillary boundaries are drawn on the cropped iris image as shown in Fig. 14
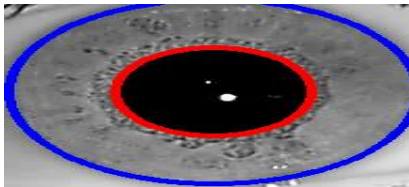

Fig14.limbic and pupillary boundaries detected

The width of the iris region can be obtained by subtracting the pupillary radius from the limbic radius. Daughman's Rubber Sheet model was applied to eye image to get a normalized image as shown in Fig. 15. Thus normalized images of 40 eye images were generated to create a database for training purposes. After the preprocessing steps, the remaining steps were done using Matlab software.

Fig15.normalized image

In feature extraction, Features are extracted after converting normalized images to gray, and then to binary40 normalized eye images were used to extract features such as centroid, area, and bounding box. Out of 40 normalized images, 20 images belongs to male and 20 to female. From the features calculated, it is noted that the area and bounding box calculated from the normalized images of females are smaller than the values obtained from the normalized images of males. Thus the feature includes x and y coordinates of the centroid, area of the region, and the bounding box values (x, y, w (width), h (height)). Therefore there are seven features to train the neural network.

Mean, Variance, and standard deviation of the normalized eye images were also calculated to get additional features to train the network. The mean value is 0.5, Variance is 0.0876, the Standard deviation is 0.2957 for all the images. Since those values are the same for all the images, these values cant be used as a feature to train the network. A target database is created in such a way that 1 is denoted to represent male normalized eye image and 2 to represent female normalized eye image. Giving the eye feature dataset as input

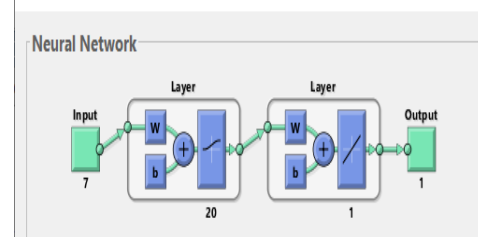and target gender dataset as target a neural network is created as shown in Fig. 16

Fig. 16. Neural Network

It is a feed-forward neural network with 20 neurons, 8000 epoch, and 0.01 learning rate. Seven features are the input to the neural network to get a single output. Then training function is applied to train the network and net function is used to obtain the output. In the testing phase, 10 normalized eye images were used, in which 5 belongs to females and 5to male. Here the normalized

eye image which is given as input is converted to gray and then to binary and the features are extracted. Here the labeled data is loaded. Then according to trained data and the value of the features of the testing image, gender label is detected as 1 if it is an eye image of females and 2 if it is an eye image of a male.

Fig. 17 shows the example of the values of features calculated when a testing image is given as input. Fig. 18 shows the result calculated according to the obtained features and trained data. Here this testing image is identified as the eye image of a male. If the testing image belongs to female an example of feature values obtained are shown in Fig. 19 and the gender recognition result is as shown in Fig. 20.

```
max_Centroid =

    232    103


max_Area =

        1219


max_BoundingBox =

  231.5000   102.5000    87.0000    51.0000
```

Fig. 17 features calculated(male)

```
Detected_Gender_Label =

      1

male
```

Fig 18 predicted the gender as male

```
max_Centroid =

   203.5000  104.0000


max_Area =

       1065


max_BoundingBox =

   201.5000  103.5000   59.0000   32.0000
```

Fig. 19 features calculated(female)

```
Detected_Gender_Label =

     2

Female
```

Fig 20 predicted the gender as female

IV.CONCLUSION

Identify a person's gender from an iris image that identification is related to security surveillance systems and forensics applications.

Gender prediction from an artificial neural network is used for the process. The neural network which can easily predict the gender from certain training process .the accuracy will depend on processing step .more better processing will give better accuracy. The gender classification features detect the area, center,bounding box of the normalized iris image .comparing the area and bounding box of the normalized iris images the values of females are smaller than males.

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