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Artificial Intelligence using Neural Network D.S.S. For Iris Detection

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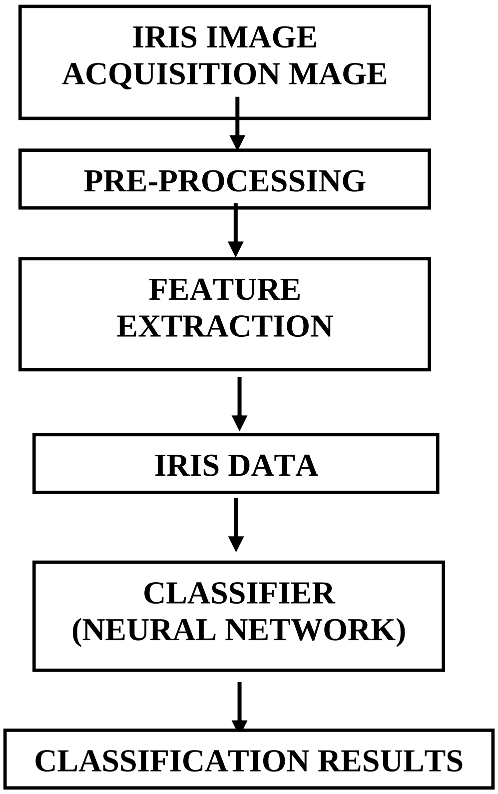
ABSTRACT
Our main aim is to develop a secure biometric recognition system to identify individual person both Irises other than physical or behavioural characteristics. One such method is iris recognition which is one of the most secure and unique features of any person. God has created every individual with an exclusive iris pattern on this earth. The iris recognition technique consists of iris localization, normalization, feature extraction and matching. Their unique feature was extracted and given to the neural network using MATLAB Simulation for detecting the Iris. The match results shows that the individual is identified accurately both the iris of a same Person.
Keywords - Iris recognition, localization, normalization, neural network, person identification, MATLAB.

Introduction –

Identity verification and identification is becoming increasingly popular. Biometric measures [1] such as recognizing one's fingerprints, face, iris and voice greatly help in person identification authentication, and authorization. Pair of iris recognition has the high potential and non-invasive personal verification. Advances in the field have expanded the options to include biometrics such as iris and retina. Among the large set of options, it has been shown that the iris is the most accurate biometric. The iris is the elastic, pigmented, connective tissue that controls the pupil. Dougman [2] proposed an iris recognition system representing an iris as a mathematical function. Mayank Vatsa proposed a support-vector-machine-based learning algorithm selects locally enhanced regions from each globally enhanced image and combines these good-quality regions to create a single high-quality iris image.[3] proposes algorithms for iris segmentation, quality enhancement, match score fusion, and indexing to improve both the accuracy and the speed of iris recognition Further, Tests on another set of 801 images resulted in false accept and false reject rates of 0.0005% and 0.187% respectively, providing the reliability and accuracy of the biometric technology[5]. Leila Fallah Araghi used Iris Recognition based on covariance of discrete wavelet using Competitive Neural Network (LVQ). A set of Edge of Iris profiles are used to build a covariance matrix by discrete wavelet transform using Neural Network.[4]. Today with the development of Artificial Intelligence algorithm, Iris recognition system may gain speed, hardware simplicity, accuracy and learning ability. The experimental results have shown the effectiveness of the proposed system in comparison with other previous Iris recognition system.

Our Proposed Work Flow Chart

The complete iris recognition system consists of 4 stages, they are image acquisition, Pre-processing, Feature extraction and Matching. Figure 3.1 shows the flow diagram of Iris recognition system.



Flow Diagram of Iris Recognition Systems

Image Acquisition

This is very first step of the entire process. When a person wishes to be identified by iris recognition system, his/her eye is first photographed. The camera can be positioned between three and a half inches and one meter to capture the image. Today's commercial iris camera typically used infrared light to illuminate iris without causing harm or discomfort to the subject. In the manual procedure, the user needs to adjust the camera to get the iris in focus and needs to be within six to twelve inches of the camera. This process is much more manually intensive and requires proper user training to be successful. We must consider that the occlusion, lighting, number of pixels on the iris are factors that affect the image quality. Figure 1.2 shows the sample iris images.

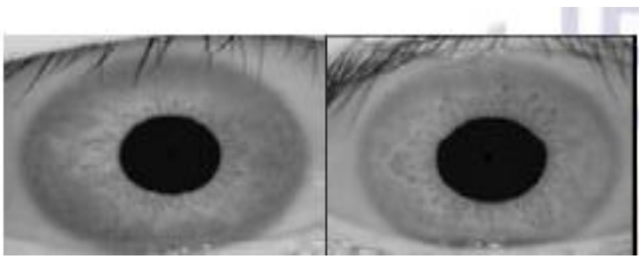


Fig. .1.2 Sample Iris Image

Pre-Processing:

The acquired iris image has to be pre-processed to detect the iris, which is an annular portion between the pupil (inner boundary) and the sclera (out boundary). The first step in iris localization is to detect pupil which is the black circular part surrounded by iris tissues. The centre of pupil can be used to detect the outer radius of iris patterns. The important steps involved are :

1. Pupil detection
2. Outer iris localization

The Hough Transform is used for a quick guess of the pupil center and then the Integro-Differential Operator is used to accurately locate pupil and limbus using a smaller search space.
Canny Edge Detection can be used for detecting edges in the entire eye image and Circular Hough Transform for detecting outer boundary of iris by using pupil center and inner boundary of iris. Figure 3.1.2 shows the localized iris image.

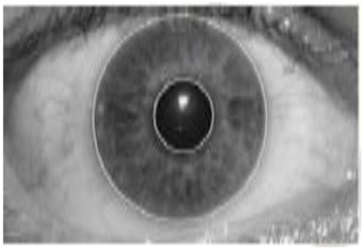


Fig. .1.3 Localized Iris Image.

Normalization:
For the purpose of accurate texture analysis, it is necessary to compensate this deformation, since both the inner and outer boundaries of the iris have been detected so it is easy to map the iris ring to a rectangular block of texture of a fixed size. The Cartesian to polar reference transform suggested by Daugman authorizes equivalent rectangular representation of the zone of interest as shown in figure 1.3.

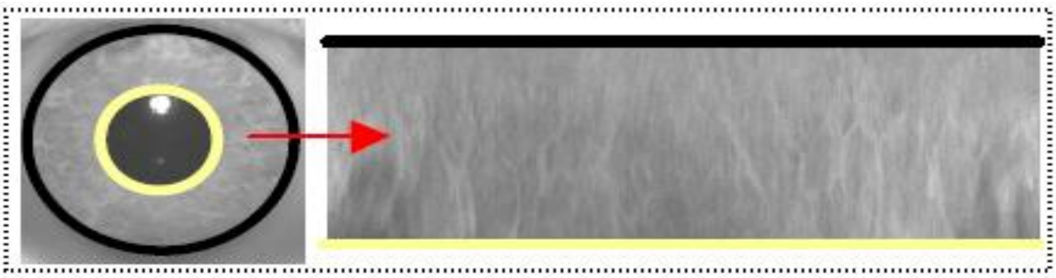


Fig. .1.3 : Iris Rectangular Representation
Pre-processing is a step, which is performed to obtain iris from the eye image. But here we have used standard iris database (i.e. UBIRIS database) so we have extracted features directly using the images.

In order to provide an accurate recognition of an individuals, the most discriminating information present in an iris pattern has been extracted. Only the significant features of the iris have been encoded so that comparison between templates is done. Below figure 1.4 shows the feature extraction stages.

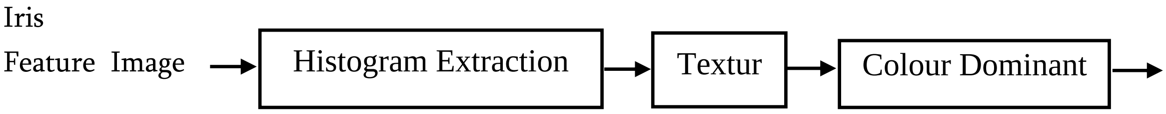


Fig. 1.4 : Feature Extraction Stage

Feedforward Network:

Feedforward networks consist of a series of layers. The first layer has a connection from the network input. Each subsequent layer has a connection from the previous layer. The final layer produces the network's output.

Feedforward networks can be used for any kind of input to output mapping. A feedforward network with one hidden layer and enough neurons in the hidden layers, can fit any finite input – output mapping problem. trainlm is a network training function that updates weight and bias values according to Levenberg – Marquardt optimization as shown in figure 1.5 trainlm is often the fastest backpropagation algorithm in the toolbox, and is highly recommended as a first – choice supervised algorithm, although it does require extra memory than other algorithms.

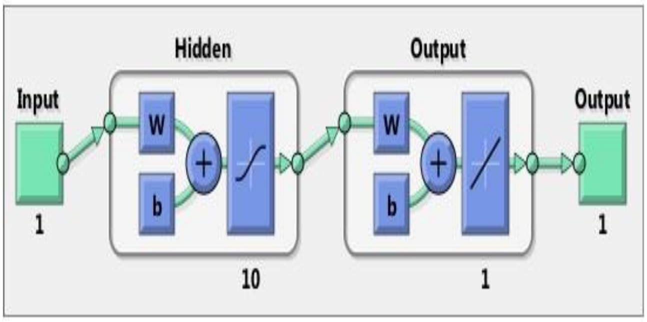


Fig. 1.5 Feedforward Network

Training of Neural Network For Right Iris :

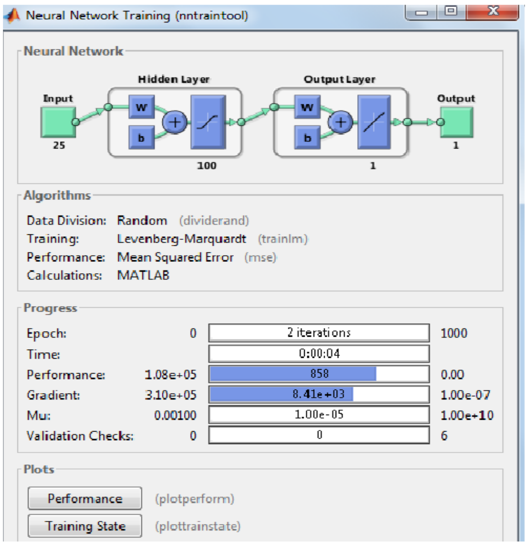


Fig. 1.6Resultsof training Network for Right Iris

If the train button is pressed on the menu the neural network training (nntraintool) would be activated from the neural network toolbox. The result of train network is show in fig. 1.6.

In this figure the neural network algorithm would be displayed with 25 input two layers with weight and bias. Hidden layer is 100 and one output layer. According to the present result of training system the epoch is 2 iterations for 100 epochs. Running time is 0.004 hours. The performance is 858 for 1.08e + 05 target. The gradient is 8.41e + 03 for 1.00 e – 07 and validation check is 0 for 6 must be displayed on the command window. According to the fig. 1.6 the neural network training system has been accomplished and known by the user neural network toolbox is very useful to simulation of this right iris recognition.

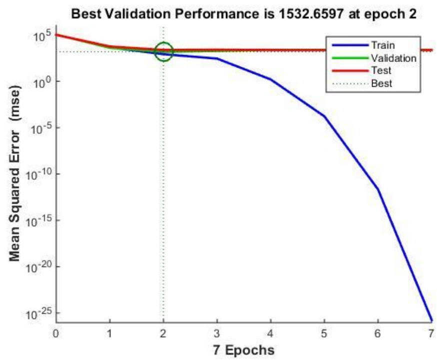


Fig. 1.7 Mean square error of Feedforward Neural Network

The results are found by the algorithm and we can get the number of epochs used and which epoch gives the best result as shown in figure 1.7. As shown in fig. a plot of epoch MSE has been plotted. The epochs get the best validation performance at epoch no. 2. The MSEW is the lowest at this point and hereafter no significant changes take place and no further decrease takes place. Hence this is the best validation performance is 1532.6597 at epoch 2. As shown in fig. 1.8. The training data are shown in the blue colour, validation is shown in blue colour, test data is shown in red colour and zero error is shown from the histogram.

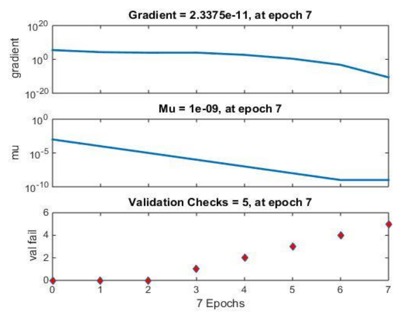


Fig. 1.8 Feedforward Neural Network Gradient versus Epoch

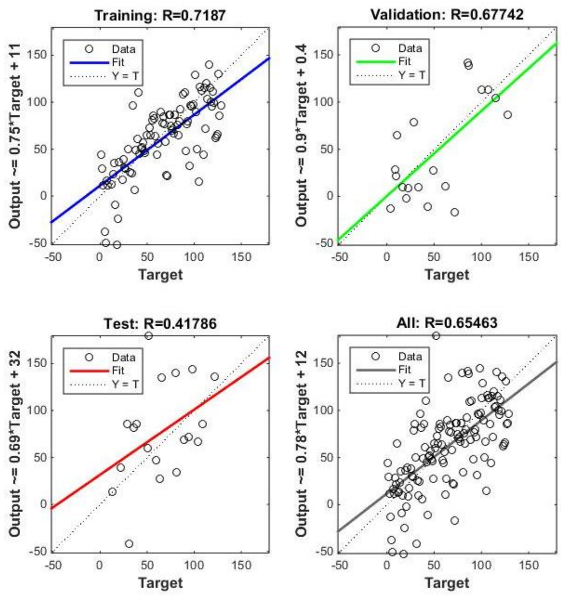


Fig.1.9 Regression plots for training, testing and validation of ANN

The four plots represent the training, validation, and testing data. The dashed line in each plot represents the perfect result – outputs = targets. The solid line represents the best fit linear regression line between outputs and targets. The R value is an indication of the relationship between the outputs and targets. If R = 1, this indicates that there is an exact linear relationship between outputs and targets. If R is close to zero, then there is no linear relationship between outputs and targets. For this example, the training data indicates a good fit. The validation and test results also show R values that greater than 0.9. The scatter plot is helpful in showing that certain data points have poor fits. As shown in figure.1.9.

CONCLUSION

The proposed methodology uses Levenberg – Marquardt feedforward network. Trainlm is often the fastest backpropagation algorithm in the toolbox. According to the fig. 1.6 the neural network training system has been accomplished and known by the user neural network toolbox is very useful to simulation of this right iris recognition The results are found by the algorithm and we can get the number of epochs used and which epoch gives the best result as shown in figure 1.7. In this paper gives the training of neural network for detection of right iris from the used database.

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