# Iris Recognition System And Analysis Using Neural Networks

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***Abstract*— Biometric methods, which identify people based on physical or behavioural characteristics, are of interest because people cannot forget or lose their physical characteristics in the way that they can lose passwords or identity cards. Among these biometric methods, iris is currently considered as one of the most reliable biometrics because of its unique texture's random variation. It is found that this method for Iris Recognition design offers good class discriminacy. The iris recognition technique consists of iris localization, normalization, encoding and comparison.The Neural Classifier will be a feed forward network with three hidden layers and be used after normalization and feature extraction phase. Simulation results will be very promising in person identification.**

***Index Terms*— Biometrics, Iris recognition, feed forward network, person identification**

## I. INTRODUCTION

Identity verification and identification is becoming increasingly popular. Initially fingerprint, voice and face have been the main biometrics used to distinguish individuals. 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 [1].The iris is the elastic, pigmented, connective tissue that controls the pupil.

Daugman [1] 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.[2] proposes algorithms for iris segmentation, quality enhancement, match score fusion, and indexing to improve both the accuracy and the speed of iris recognition. M. Gopikrishnan used hamming distance coupled with Neural Network based iris recognition techniques are discussed. Perfect recognition on a set of 150 eye images has been achieved through this approach ; 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.

## II. IRIS RECOGNITION SYSTEM

Iris images are taken by CASIA iris image database. The feature extraction is done by using wavelet transform. Data sets will be prepared using features obtained by the feature extraction technique. These obtained features are fed to the ANN for the classification.

The images from CASIA iris image database are taken. It contains 7 images of 108 persons of one eye at two sessions. They are of 320 x 280 bitmap images.

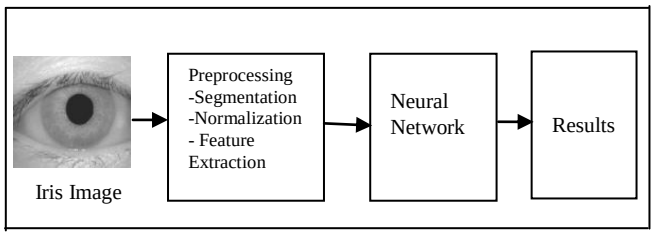



Fig 1 Block Diagram of Proposed System

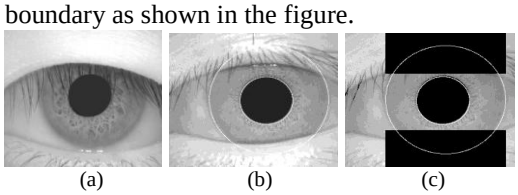
### A. *Iris Pre-processing*

The iris recognition system consists of image acquisition, iris segmentation, normalization, feature extraction and matching. A high quality image must be selected for iris recognition. In iris pre-processing, the iris is detected and extracted from an eye image and normalized. At first stage, the training of recognition system is carried out using Gray scale values of iris images [5]. Neural network is trained with all iris images. After training neural network performance validation is done.

## III. SEGMENTATION

The segmentation module detects the pupillary and limbus boundaries and identifies the regions where the eyelids and eyelashes interrupt the limbus boundary's contour. A good segmentation algorithm should involve two procedures, iris localization and noise reduction. The noise reduction process refers to localizing the iris from the noise (non-iris parts) in the image. These noises include the pupil, sclera, eyelids, eyelashes, and artifacts depict the iris segmentation step[4].

The main objective here is to remove non useful information, namely the pupil segment and the part outside the iris [6]. The technique used is canny edge detection method for detecting the iris and pupil boundary as shown in the figure.



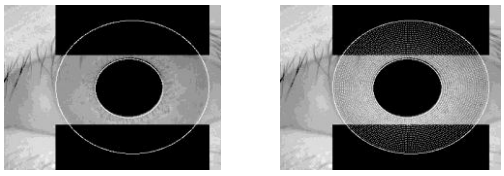
(a) (b) (c)

Fig 2. a) Sample image b) Localized image c) Noise Reduced image

## IV. NORMALIZATION

After the segmentation step has estimated the iris's boundary, the normalization process is used to transform the iris texture from Cartesian to polar coordinates. The process, often called *iris unwrapping* yields a rectangular entity that is used for further processing [2].

The variations in eye image due to optical size, position of pupil and the iris orientation change from person to person.



(a) (b)

Fig 3. a) Noise Reduced image b) Normailsed image

## V. FEATURE EXTRACTION

The feature extraction part is very important part for the entire iris recognition process. To provide accurate recognition of individuals, the most discriminating information present in an iris pattern must be extracted. The iris images thus obtained are then used for feature extraction.

$$G(x,y;\theta,\omega) = e^{\left\{-\frac{1}{2}\left[\frac{x'^2}{\delta x'^2}+\frac{y'^2}{\delta y'^2}\right]\right\}} e^{(i\omega(x+y))} \quad (1)$$

Where,

$$x' = x\cos\theta + y\sin\theta$$

$$y' = y\cos\theta - x\sin\theta$$

Gabor filter is used to provide the optimal resolution in both the domains [12]. The information about time is lost and it's hard to tell where a certain frequency occurs in Fourier Transform .Gabor function best analytical resolution in both domains.

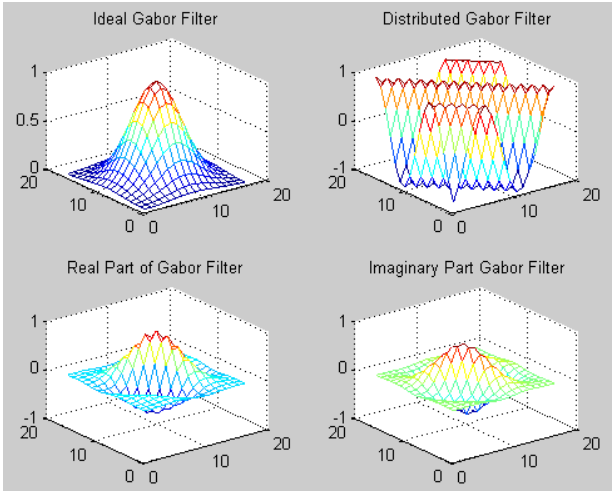



Fig 3. Output of Gabor showing real and imaginary part

Thus feature encoding is implemented by breaking the two-dimensional normalized Iris pattern into one-dimensional wavelets and then these signals are convolved with one-dimensional Gabor wavelet. The coefficients of all the persons are saved in a single matrix. The single value decomposition is applied to these coefficients for comparison to find the best performance [2]. Thus a Neural network tool is used to calculate the best validation performance and plot a graph of mean square error Vs number of epochs.

## VI. NEURAL NETWORK CLASSIFICATION

The word 'Neural Network' has been motivated from its inception by the recognition that the human brain computes in an entirely different way from the conventional digital computer. The brain is a highly complex, non-linear and parallel computer (information processing system) [3]. An **artificial neural network (ANN)**, often just called a "neural network" (NN), is a mathematical model or computational model based on biological neural network [5]. It consists of an interconnected group of artificial network and processes information using a connectionist approach to computation.

## VII. BPNN BASED IRIS RECOGNITION

Back Propagation Neural Network (BPNN) is a systematic method for training multi-layer artificial neural network [9]. It is a multi-layer forward network using extend gradient descent based delta-learning rule known as back propagation (of errors) rule [10]. The network is trained by supervised learning method.

The basic structure of the BPNN includes one input layer, at least one hidden layer (single layer / multiple layers), followed by output layer. Neural network works by adjusting the weight values during training in order to reduce the error between the actual and desire output pattern [9].

The algorithm for Iris recognition using BPNN [11] is as follows:

(i) Load normalized Iris data set (contains feature vector values ranges from 0 to 1 for different subjects).

(ii) Use this normalized data for training set and testing set by randomly drawing out the data for training and testing.

(iii) Create an initial NN architecture consisting of three layers, an input, an output and a hidden layer. The number of nodes in the input layer is equal to dimension of the feature vector that characterizes the iris image information. Randomly initialize the nodes of the hidden layer. The output layer contains one node. Randomly initialize all connection weights within a certain range.

(iv) Train the network on the training set by using Back Propagation algorithm until the error is minimum for a certain number of training epochs specified by the user.

(v) Present the test data to the trained network and evaluate the performance.

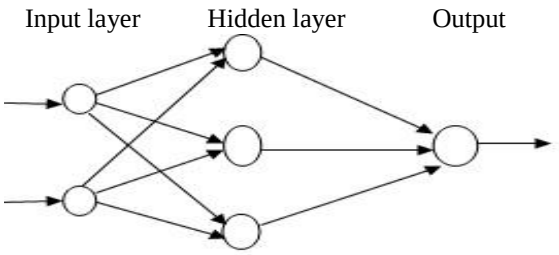



Fig.6 Back Propagation Neural Network Model

## VIII RESULTS

An input image is compared with the CASIA database and taken for evaluation in which we calculate the best validation performance Vs the mean square error using neural network toolbox

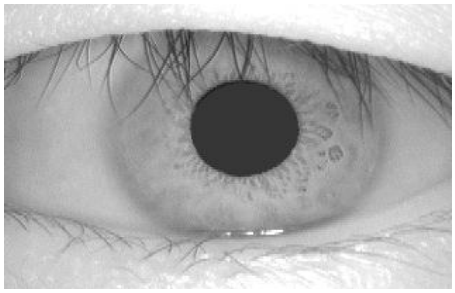


Fig.7 Input test image chosen

The result is found by the algorithm and we can get the number of epochs used and which epoch yielded the best results as shown in fig.8. Here a plot of epochs (MSE) has been plotted, the epochs gets the best validation performance at epoch no. 2, the MSE is the lowest at this point, and hereafter no significant change takes place and no further decrease takes place. Hence this is the best validation performance.

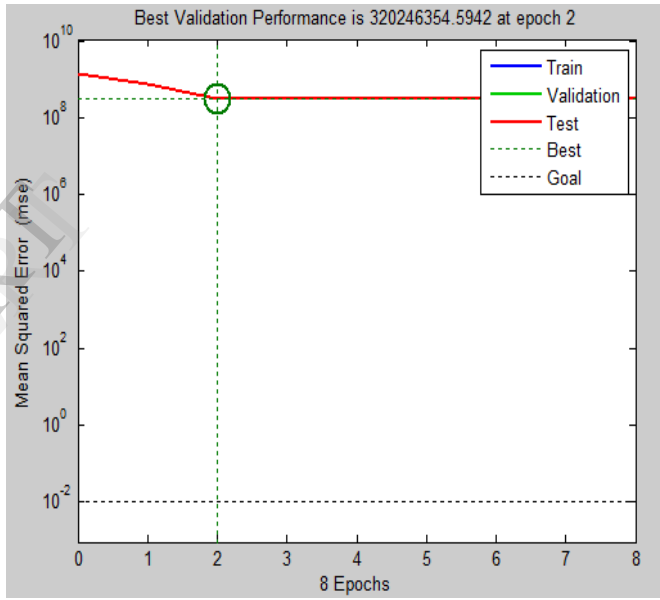



Fig.8 Plot of Epochs Vs MSE

## IX CONCLUSION

The proposed methodology uses canny edge detection with Hough transform to segment iris images for locating the iris and remove noise. Normalization method is used for unwrapping of iris to obtain polar coordinates if the image. Results of feature extraction will used for feature matching. Supervised learning Neural Network tool which will used in order to increase the matching accuracy and compares these results with the traditional results. Classification using Neural Network gave the best results as described in [5], [8], [12] and this method high accuracy rate.

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