Multimodel Authentication System using Artificial Neural Network

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ABSTRACT
Security and authentication of a person is a crucial part of any industry. There are many techniques used for this purpose. One of them is face and iris recognition. Face and iris recognition is an effective means of authenticating a person. The advantage of this approach is that, it enables us to detect changes in the face and iris image pattern of an individual to an appreciable extent. The recognition system can tolerate local variations in the face or iris image of an individual. Here the performance of both the recognition system is evaluated by comparing its recognition rate and accuracy. Hence face and iris recognition can be used as a key factor in crime detection mainly to identify criminals. There are several approaches to face and iris recognition of which Principal Component Analysis (PCA) and Neural Networks have been incorporated in this paper.

General Terms
Face and iris recognition, Principal Component Analysis (PCA) and Neural Networks

Keywords
Principal Component Analysis (PCA) and Neural Networks.

1. INTRODUCTION
The demand for reliable personal identification in computerized access control has resulted in an increased interest in biometrics to replace password and identification (ID) card. The password and ID card can be easily breached since the password can be divulged to an unauthorized user, and the ID card can be stolen by an impostor. Thus, the emergence of biometrics has addressed the problems that plague the traditional verification methods. Biometric which make use of human features such as iris, retina, face, fingerprint, signature dynamics, and speech can be used to verify a person's identity. The biometrics data have an edge over traditional security methods since they cannot be easily stolen or shared. The face recognition system has the benefit of being a passive, non-intrusive system for verifying personal identity. The proposed face recognition system consists of face verification, and face recognition tasks. In verification task, the system knows a priori the identity of the user, and has to verify this identity, that is, the system has to decide whether the a priori user is an impostor or not. In face recognition, the a priori identity is not known: the system has to decide which of the images stored in a database resembles the most to the image to recognize. The primary goal of this paper is to present the performance evaluation carried out using artificial neural network for face verification and recognition. There has been a rapid increase in the need of accurate and reliable personal identification infrastructure in recent years.

Biometrics has become an important technology for security. Iris is the colored part round the pupil of the eye, which is unique, stable, inoffensive and can be collected easily. Iris recognition is an identification method based on texture features of the human eye iris to determine the identity, it is one of the most accurate biological recognition methods, and it has been applied in the security domains such as identity authentication. Compared with other biological specificity such as face and fingerprint, iris patterns are more stable and reliable. Furthermore, iris recognition system is non-invasive to the users. So the iris recognition technology has become the research focus in the current biological recognition region.

2. SYSTEM OVERVIEW

The face and iris recognition system consists of two phases which are the training phase and recognition phase.

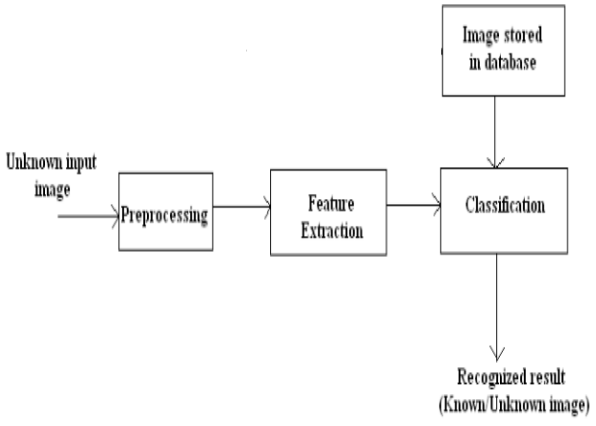

Fig.1 Block diagram for face and iris recognition system

First, the image acquired is trained and stored in the database. The acquired image are normalized from which the characteristic features are extracted and the feature vectors known as eigenvectors are formed. The system is trained on these eigenvectors which means adjusting the weights of hidden and output neurons to minimize the output error. Minimizing the error to an acceptable level marks the end of the training phase after which the recognition phase starts. The unknown input image is fed into the system for recognition the main features are extracted and computed to find the distance between the input image and the stored images. Then it is compared with a threshold value to decide upon whether it is a known or unknown image in identifying a person.

3. METHODOLOGY

3.1. Preprocessing

The purpose of the pre-processing module is to reduce or eliminate some of the variations in image due to illumination. The image is acquired using a web camera. The acquired image may have some gaussian noise present in it. So, the image has to be trained. By training, the image is preprocessed and original image is restored. Here we are applying the algorithm based on neural network called shunting inhibitory cellular neural network to restore the image.

Fig.2 Test image taken from a web camera representing face and iris with noise

Fig.3 Test image of face and iris after preprocessing the image using neural network

Shunting inhibitory Cellular Neural Network is a model of visual processing, which can provide contrast and edge enhancement, Image restoration, reconstruction and dynamic range compression. A new class of Artificial Neural Network, called Shunting inhibitory Cellular Neural Network (SICNN) based on the physiologically plausible mechanism of shunting inhibition. A Shunting Inhibitory Cellular Neural Network (SICNN) is an interconnected group of artificial neurons that uses a mathematical model or computational model for information processing based on a connectionist approach to computation. In most cases an SICNN is an adaptive system that changes its structure based on external or internal information that flows through the network.

A SICNN also known as a parallel distributed processing network, is a computing solution that is loosely modeled after cortical structure of the brain. It consists of interconnected processing elements call nodes or neurons that work together to produce an output function. The output of a neural network relies on the cooperation of the individual neurons within the network to operate. Processing of information by neural networks is characteristically done in parallel rather than in series (or sequentially) as in earlier binary computers or Von Neumann machines. Since it relies on its member neurons collectively to perform its function, a unique property of a neural network is that it can still perform its overall function even if some of the neurons are not functioning. In other words it is robust to tolerate error or failure. Additionally, SICNN are more readily adaptable to fuzzy logic computing tasks.

3.2. Feature extraction

The purpose of the feature extraction is to extract the feature vectors or information which represents the image. The feature extraction algorithm used are Principal Component Analysis (PCA). Principal component analysis (PCA) for face and iris recognition used is based on the information theory approach. It extracted the relevant information in an image and encoded as efficiently as possible. It identifies the subspace of the image space spanned by the training image data and decorrelates the pixel values. The classical representation of a image is obtained by projecting it to the coordinate system defined by the principal components. The projection of images into the principal component subspace achieves information compression, decorrelation and dimensionality reduction to facilitate decision making. In mathematical terms, the principal components of the distribution of faces or the eigenvectors of the covariance matrix of the set of images, is sought by treating an image as a vector in a very high dimensional face space.

3.3. Classification

The purpose of the classification sub-module is to map the feature space of a test data to a discrete set of label data that serves as template. The classification is done using Correlation technique. Correlation is a robust and general technique for pattern recognition and is used in many applications, such as automatic target recognition, biometric recognition and optical character recognition. The design, analysis and use of correlation pattern recognition algorithms require random variables and processes, matrix or vector methods, detection and estimation theory. Here the image stored in the database and test image from the web camera is considered. The correlation of the trained image and the test image are taken. The two images are multiplied (pixel-wise) and the values in the resulting product array are summed to obtain the correlation value of the trained image with the test image for that relative location between the two. This calculation of correlation values is then repeated by shifting the trained image to all possible centerings of the trained image with respect to the test image. Euclidean distances between the projected test image and the projection of all centered training images are calculated. Test image is supposed to have minimum distance with the corresponding image in the training database. And thus the test image is detected whether it is a known image or unknown image.

4. CONCLUSION

The paper has presented a face and iris recognition system using artificial neural networks. The performance of both the system is evaluated. By evaluating the performance of both face and iris recognition, both the systems have high accuracy and 100% recognized result.

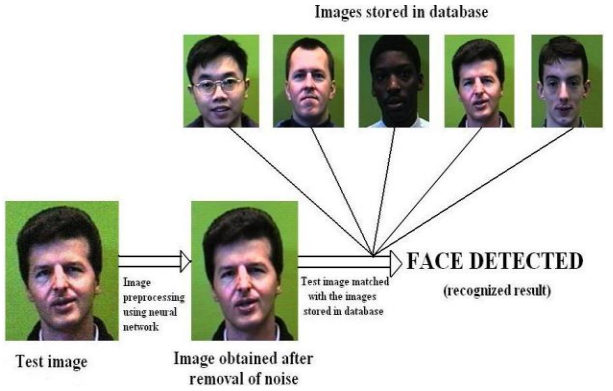

Fig.4 Face recognition system

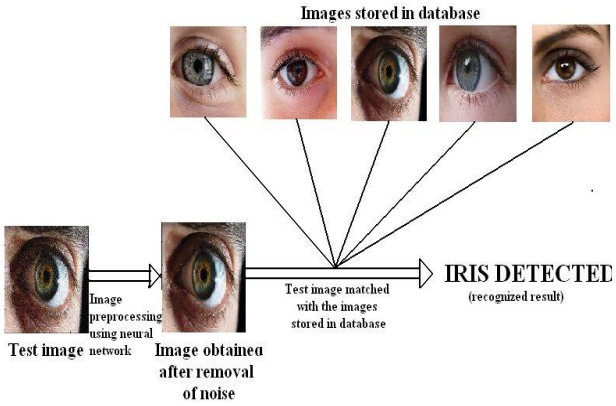

Fig.5 Iris recognition system

5. RESULT

Therefore the simulated result for face recognition is shown below:

Fig.6 Test image given as input in text format for face recognition

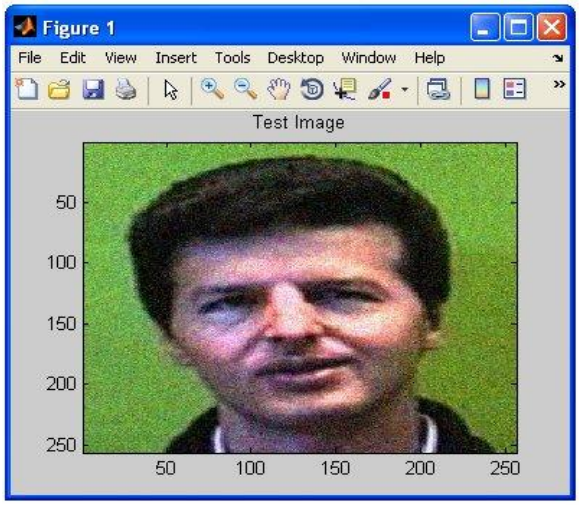

Fig.7 Test image for face recognition

The value of weight is entered and PSNR ratio is calculated in order to obtain the output whether it is matched or unmatched image.

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Enter a value for the weight between <8. 7

PSNR =

   28.3582

Matched image is :1.jpg
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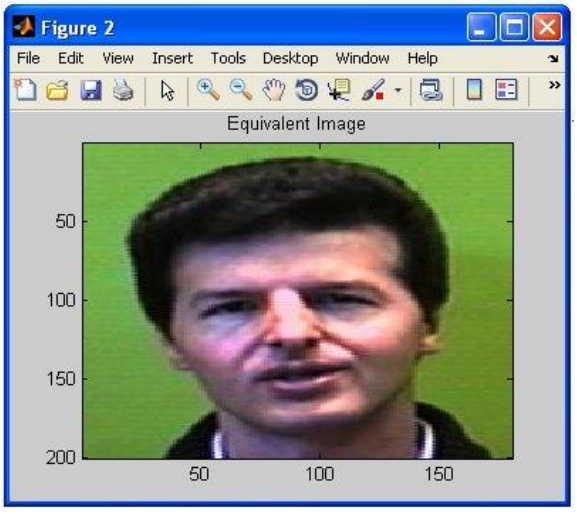

Fig.8 Matched image (Face detected)

The simulated result for iris recognition is shown below:

Fig.9 Test image given as input in text format for iris recognition

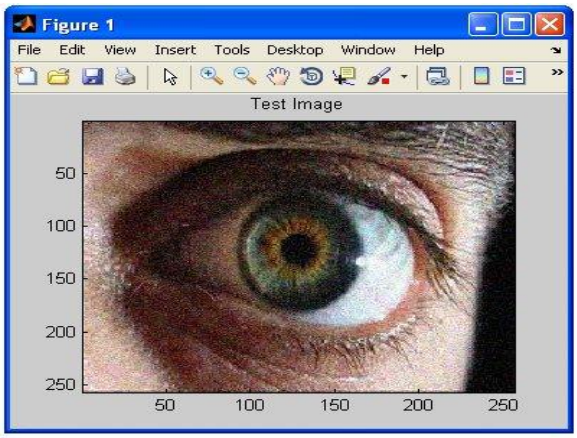

Fig.10 Test image for iris recognition

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Enter a value for the weight between <8. 2

PSNR =

   28.5246

Matched image is :5.jpg
Iris detected
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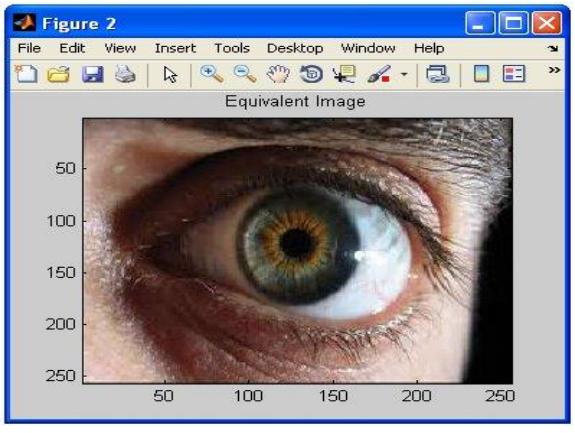

Fig.11 Matched image (Iris detected)

The experimental results shows that both face and iris recognition obtain a recognized result but iris recognition system have higher recognition rate and accuracy than face recognition system in evaluating a persons identity. Because in case of twins, both of them may look identical. Facial identification reads the nodal points of an individual's facial features sometimes both the twins may have same distance between the nodal points while face recognition is considered. But it is not in the case of iris recognition system, the iris varies from one individual to another and even in case of twins. Thus the evaluation of both face and iris recognition is performed.

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7. REFERENCES

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