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A Secure Mobile Network Environments Using Biometrics

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***Abstract*-- A security of computers network system depends upon real time face recognition technique is considered. The proposed work is consisting of two sections. The first section represents the computers network system, and the second section represents the face recognition technique as a type of biometrics. Computers network system is consisting of a number of clients connected to web server on internet. In addition to computers network system being secured by face recognition technique, the connection between the clients and web server is secured via secure socket layer to secure the http between each client and web server. Face recognition technique consists of four main phases which are image acquisition phase, pre-processing phase, features extraction phase, and classification phase. Acquisition means capture the face images of the users via webcam and pre-processing is used to enhancement the images. Features extraction is used to get features from face images, Principle component analysis is used to extract the best features that represent the users face image. Artificial feed forward neural network back propagation algorithm is used to training and testing the users face images in classification stage.**

***Keywords*—** Biometric, secure computer network, face recognition technique, principle component analysis, features extraction, artificial neural network, bayesian regular back-propagation algorithm.

I. INTRODUCTION

With the advent of electronic banking, e-commerce, and smart cards and an increased emphasis on the privacy and security of information stored in various databases, automatic personal identification has become a very important topic. Accurate automatic personal identification is now needed in a wide range of civilian applications. The worry of the security matter in the world is increased; in general this lead to interest of the biometrics. Face recognition technique is a type of the biometrics has attracted importance in several security applications. In this work, the face recognition technique consists of four main phases which are image Acquisition phase, pre-processing phase, features extraction phase, and classification or recognition phase. Acquisition means capture the face images of the users via webcam and pre-processing is used to enhancement the images. Features extraction is used to get features from face images, Principle component analysis is used to extract the best features that represent the users face image and these features represent as feature vector. Artificial feed forward neural network back propagation algorithm is used to training and testing the users face images in recognition stage.

II. BIOMETRIC

A more secure and reliable method have been used to establish person identity this method is called 'biometric'. Biometric is the science of establishing the identity of an individual based on the physical or behavioural attributes of the person. Biometric means "life measurement", and is derived from "Greek" word where, Bio means "life" and Metric means "biological process or measurement". Biometric authentication as well as verification has been widely used for access management, law enforcement, security system and entertainment over the past few years [2]. A biometric system is essentially a pattern recognition system that performs recognition based on some features derived from measurements characteristics. Biometric characteristics including: fingerprints, faces recognition, iris, hand geometry, gait, voice recognition, keystroke pattern and thermal signature etc. [4].

III. COMPUTERS NETWORK SYSTEM

Computers network system consists of a number of Clients connected to Server. This network may be local or global depending on application. Local mean all client and server are in the same location, while the global mean the clients may be separated in location but connected to central server. The main idea is each client takes an image of its individual via computer webcam and sends it to server. The server receives an image from each client to compare it with images stored previously to ensure if the person is authorized or not.

IV. FACE RECOGNITION TECHNIQUE

Face recognition is as old as computer vision, both because of the practical importance of the topic and theoretical interest from cognitive scientists [3]. Face recognition appears to offer several advantages over other biometric methods face recognition can be done passively without any explicit action or participation on the part of the user since face images can be acquired from a distance by a camera. This is particularly beneficial for security and surveillance purposes. There are four main phases to implemented this technique, image acquisition, pre-processing, feature extraction, and classification.

A. Image Acquisition Phase

This is the entry point for the face recognition process. It is the module where the face image under consideration is

presenting to the system. In other words, the user is asked to present a face image to the face recognition system in this module. An acquisition module can capture the face images with different conditions (smile, sad, eyes close, etc.) via HP Laptop camera 2.0 mega pixels. This is implemented in OpenCV package with C sharp Programming language to be able to treat easily with image processing in Microsoft virtual studio. The face image is detecting in red square and only the detected part is taken to use it in recognition technique. An image is defined as bmp image with two-dimensional equal to 100, 100 pixel respectively.

B. Pre-processing Phase

The second stage in recognition system is pre-processing, several operations is implement in this step to increase the enhancement and reduce the noise of the image. The first step is convert from RGB to Gray scale image then histogram normalization is applied to stretch the range of intensities. The original histogram is stretched, and shifted, to cover all the 256 available levels of Gray scale image.

C. Feature Extraction Phase

Feature selection in recognition system involves the derivation of certain features from the input grayscale image in order to reduce the amount of data used for classification. Principle Component Analysis algorithm is used to extract feature from image that used in the classification step. Principal component analysis transforms a set of data obtained from possibly correlated variables into a set of values of uncorrelated variables called principal components [1]. Principle Component Analysis determines the covariance matrix from gray scale image, the eigenvectors and eigenvalues is computed after determined the covariance matrix. They represent useful information about the data. The eigenvectors are sorted from high to low according to their corresponding eigenvalues. The eigenvector associated with large eigenvalue is one that reflects the greatest variance in the image. The smallest eigenvalues are associated with eigenvectors represent the least variance. The input Gray scale image with dimensions 100*100 pixel, principle component analysis is used to find the best features that represent the image. Each image is representing with 100 values known as features vector of that image.

D. Classification Phase

Face Classification or Recognition is done by using artificial neural network. It can be described as classifying a face either "known" or "unknown", after comparing it with stored known individuals. In a feed-forward artificial neural network model, Bayesian regulation back-propagation algorithm is constructed using layers where all nodes in a given layer are connected to all nodes or neurons in a subsequent layer. The network requires at least two layers, an input layer and an output layer. The network can include one or two hidden layers with numbers of neurons in each layer.

V. BAYESIAN REGULATION BACK-PROPAGATION ALGORITHM

Bayesian regulation back-propagation is kind of supervised algorithm. During training, the network tries to match the network outputs with the desired target values. In this work we are used batch learning that mean the weights are updated after all the input vectors and targets of the training are presented to the network**.** The neural network contains three layers. These are input, hidden, and output Layers. During the training phase, the training dataset is fed into the input layer. The data is propagated from input layer to hidden layer and then to the output layer. This is called the forward pass of the back propagation algorithm. In forward pass, each neuron in hidden layer gets input from all neurons in input layer, which are multiplied with appropriate weights and then summed. The tan sigmoid transfer function is used as activation function to compute the output at each neuron in hidden layer. Each neuron in output layer gets input from all the neurons in hidden layer, which are multiplied with appropriate weights and then summed. The tan sigmoid transfer function is used as activation function to compute the output at each neuron in output layer. The output values of the output layer are compared with the target output values. The error between actual output values and target output values is calculated and propagated back toward hidden layer. This is called the backward pass of the back propagation algorithm. The error is used to update the connection weights between neurons, weight matrices between input-hidden layers and hidden-output layers are updated. The algorithm tries to converge to a sum squared error to reach the goal error with 10^{-6}.

VI. TRAINING AND TESTING DATASET

The Dataset represents a total number of images for all persons, the dataset contain 108 images represents 18 persons and each person has 6 face images in different position [laugh, sad, close eyes, etc.] The dataset is divided into sub dataset training dataset and testing dataset. The total number of images in training dataset is 72 images that represent 4 images for each person. The total number of images in testing database is 36 images that represent 2 images for each person.

VII. DESIGN OF ARTIFICIAL NEURAL NETWORK STRUCTURE

The structure of artificial neural networks is dependent on the number of person. To design a multi-layer feed-forward network needs to select the number of layers, type of connection between the layers, number of neurons in each layer and a neurons activation function. Fig.1 shown the artificial neural network consists of three layers: input layer, hidden layer, and output layer. In this case, the input layer has 100 neurons to input features vector. The hidden layer has different cases of neurons [15, 20, 25, 30, 35, 40, and 45] to train and test the network with all cases and choose the best status and save weights. The output layer has 5 neurons to represent the output layer of the network.

Fig.2 shows the best recognition status, the curve of training between sum squire error and epochs. It reaches the goal in 234 epochs.

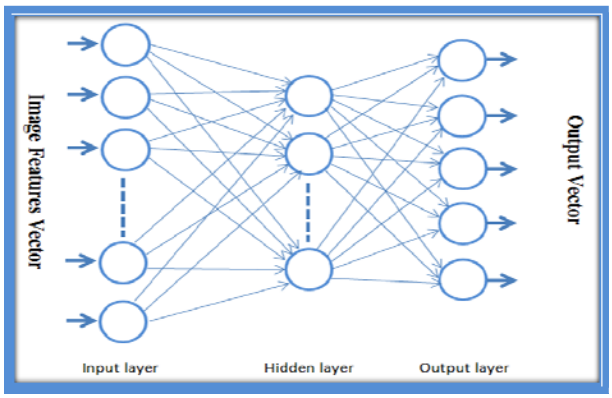

Fig.1 Artificial neural network structure

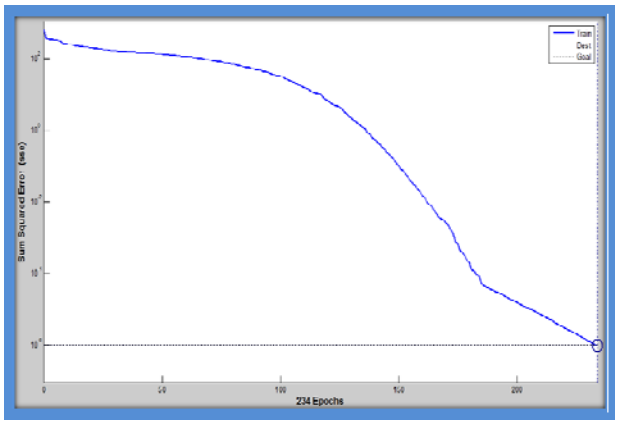

Fig. 2 Training process for best recognition status

TABLE 1

THE DETAILS OF ALL CASES

Network Architecture	Training Time	No of epoch	Sum Squire Error	Accuracy (%)
I - H - O				
100 – 15 – 5	05:51 min	271	7.9393 e-007	89.814
100 – 20 – 5	12:23 min	255	8.0296 e-007	89.814
100 – 25 – 5	15:54 min	204	7.6534 e-007	90.740
100 – 30 – 5	33:52 min	234	9.5567 e-007	91.667
100 – 35 – 5	1:42:31 hour	323	9.9246 e-007	89.814
100 – 40 – 5	53:34 min	177	6.8827 e-007	87.962
100 – 45 – 5	1:11:16 hour	171	9.0067 e-007	89.814

VIII. DISCUSSION

This study explains that the Principle component analysis is useful to extract features vector from gray scale image. Bayesian Regulation back-propagation neural network is provided the performance in term of accuracy, converge speed, and in the same time prevent the data to suffer from overfitting. Neural network structure for eighteen persons with 100 neurons at input layer, different number of neurons at hidden layer, and the output of the network is encoded with 5 neurons at output layer. The testing in each case is calculated and the best accuracy is 91.667 % when 30 neurons in hidden layer.

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