Face Recognition based ATM system

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Abstract— Face recognition is the biometric technology for the purpose of authentication of the person for particular applications. It has wide range of applications such as banking access control, human computer interaction, information security, database retrieval, virtual reality etc. In proposed system face recognition system based on Principal Component Analysis is implemented. In this system, face gets recognized after feature extraction and principal component analysis. System sends one time password to person's mobile number through GSM modem. This is the second level authentication of the person. The whole algorithm is implemented in MATLAB.

Key words: Face Recognition; MATLAB; Principal Component Analysis; GSM Modem; Verification

I. INTRODUCTION

Face recognition has become a popular research area of computer vision. A face recognition system identify a person from a digital image database or from a video sequence based on comparison of the visual features of the images by using different techniques of feature matching. Some face recognition algorithms identify facial features by extracting features of the face image. For example, an algorithm finds the relative position of the features such as size and shape of the eyes, cheekbones, nose and jaw. These extracted features are used to search for other images in the database with the matching features. Recognition algorithms are divided into two types geometric and photometric systems. In geometric approach it concentrates on distinguishing visual features, face recognition is done using visual features .In statistical approach images are converted into values and we compare values with templates to eliminate variances. Mostly used recognition algorithms are linear discriminant analysis, principal component analysis using eigenfaces.
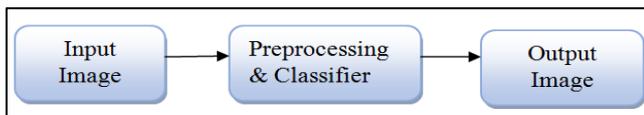
A. Generic Face Recognition System

Fig. 1: Generic Face Recognition System

Generic system of face recognition is shown in figure1.First stage is data acquisition. We get input image. We create database of the images. Face images is collected from different sources. These sources include camera or data collected from the website. After we get images we need to do the pre-processing of the images obtained as it affects the performance of the face recognition system due changes in the background ,illumination condition, lighting conditions, camera distance which leads to change in the orientation of the image. We perform feature extraction on the preprocessed image and then apply classifier in order to perform recognition of the face based on the features.

This paper discusses about the face recognition system and software design flow in section II. Principal Component Analysis and its implementation is given in section III. Results of the system are given in section IV. Applications of the face recognition system are given in section V. Finally the work is concluded in section VI.

II. PROPOSED SYSTEM

A. Block Diagram of the system:

Block diagram of the proposed system is shown in figure 2.In proposed system we have implemented face recognition algorithm based on principal component analysis. First, We have created the data base of the face images in which extract features of these stored images which a recognition takes place.

We extract color and shape of the eyes, nose etc. Then, we capture image which we need to recognize. Perform preprocessing of the image like noise removal.RGB to Gray conversion of image. Then, perform feature extraction of the desired face image. Then, apply Principal Component Analysis which recognize and gives decision as person is authorized. MATLAB creates one time password and send it to mobile number of the registered person. If the person enters valid OTP person gets authorization. Two level authorization is done in proposed face recognition system.
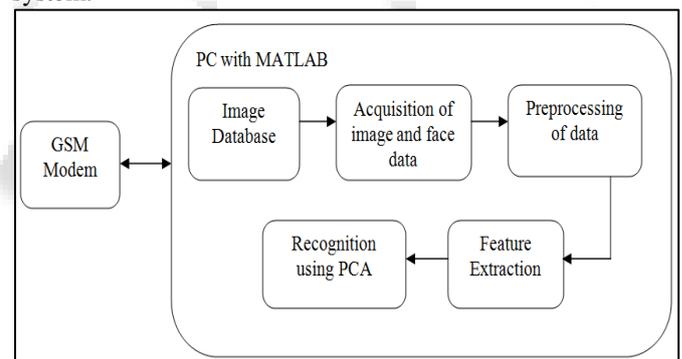

Fig. 2: Block Diagram of the proposed system

Steps in the proposed system for object detection and tracking:
1) Read Image: Read frames of the image.
2) Grayscale conversion: It converts the colour image into a gray image. This method is based on different colour transform. According to the R, G, B value in the image, it calculates the value of gray value, and obtains the gray image at the same time.
3) Feature Extraction: During feature extraction, we extract visual features of the image like shape and color of the image.
4) Principal Component Analysis: Apply PCA algorithm after feature extraction.
5) GSM Modem: Sends OTP to mobile number of the person.

B. Software Design

1) MATLAB

MATLAB is a high-performance language whose basic data element is an array that does not require dimensioning.

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Matrix and vector formulations allows us to solve many technical computing problems. It integrates programming visualization and computation which gives easy-to-use environment where problems and solutions are expressed in the mathematical notation. Areas in which MATLAB toolboxes are available include control systems, simulation, signal processing, neural networks, wavelets, fuzzy logic, and many others. Simulink is developed by MathWorks, it is a graphical programming environment for simulating, modeling and analyzing multiple domain dynamic systems. It has a customizable set of block libraries and a graphical block diagramming tool.

III. PRINCIPAL COMPONENT ANALYSIS

A. *Principal Component Analysis*

Principal components analysis is a algorithm which identifies smaller number of uncorrelated variables, these uncorrelated variables are called as "principal components", from a large set of data. This method gives high amount of variance with the less number of principal components. PCA is mostly for data analysis. In Principal Component Analysis, we do eigen value decomposition of a data correlation matrix.

B. *Steps in the Principal Component Analysis*

1) Get set of database images and then find mean of the images.
2) Find the difference between mean desired image and each image in the database.
3) Find covariance matrix of the matrix which we obtained in step 2.
4) Find Eigen vectors and Eigen values then find the Eigen faces which has larger eigen values.
5) From eigen Eigen faces find weight vector
6) Similarly find the weight vector for the desired image which is to be tested.
7) Measure Euclidian distance between weight vectors of desired image and database images.
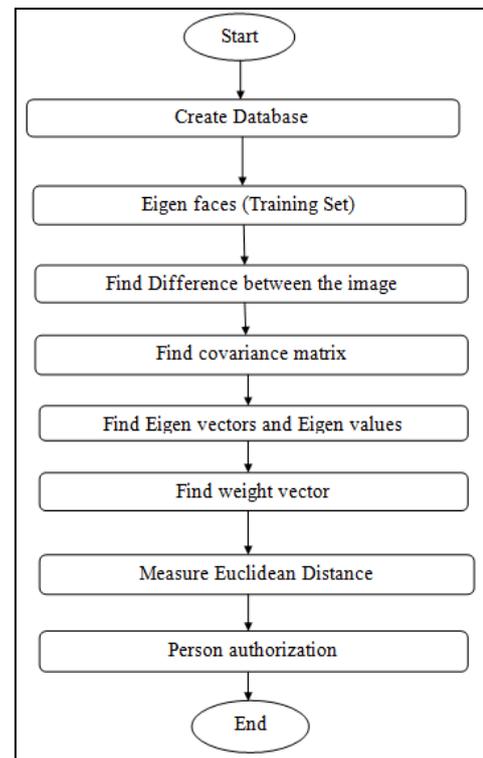8) If the euclidean distance is less than threshold defined then desired test image is considered as authorized image.

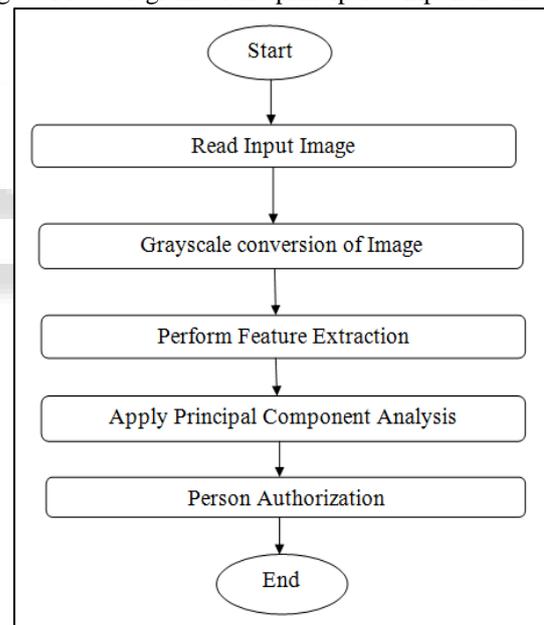Fig. 3: Flow diagram of the principal component analysis

Fig. 4: Proposed System Flow

IV. IMPLEMENTATION RESULTS

A. *Image Preprocessing Results:*

Input face image is the RGB image we convert RGB image to grayscale image.RGB to grayscale image is shown in figure 5.

Fig. 5: RGB Input Image

B. Training Set:

Fig. 6: Grayscale Image

C. PCA Results

1) Mean Face Image

Fig. 7: Mean Face Image

2) Eigen Faces

Fig. 8: Eigenface ranked according to usefulness

V. APPLICATIONS

Areas	Applications
Information Security	Access Security, Data Privacy (Medical Records),User Authentication (On line Banking)
Access Management	Secure Access Authentication, Permission based Systems, Access log or audit trails
Biometrics	Person Identification(Voter Registraton), Automated Identity Verification
Law Enforcement	Video Surveillance, Suspect Identification, Forensic Reconstruction of faces from remains
Personal Security	Driver Monitoring System
Entertainment - Leisure	Home video game systems, Photo Camera Applications

VI. CONCLUSION

This paper discusses the face recognition system based on principal component analysis. The system also consists of GSM modem. In a given system, we create image database and extract the features of the images in the database. These features of database images are compared with the feature vector of the desired image using principal component analysis we find euclidean distance. The whole algorithm is implemented in MATLAB. Second level authentication of the person is done through GSM modem.

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