ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 6, Issue 3, May 2017

Attendance System Using Face Recognition

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Abstract— Traditional attendances system are taken manually in the classroom by faculty. This is convenient if the strength in the class is small. But for large class strength it is difficult and time consuming. As well it is difficult to verify the presence of student. This paper aims at implementing attendance system using face recognition to overcome difficulties in traditional attendance system. The face recognition is implemented with the help of viola Jones algorithm and Eigen faces for recognition. The system will recognize the face of the student and saves the response in database automatically and avoids proxy attendance. The proposed work saves time, ensures correct data of the student attendance status and avoids manipulation of entries.

***Index Terms*—algorithm, attendance, Eigen faces, recognition.**

I. INTRODUCTION

Biometrics refers to the automatic identification of a person based on his or her physiological or behavioral characteristics. Physiological biometric traits provides better recognition rate than behavioral biometric traits. Face recognition is one of the physiological biometric techniques used in security and in access control applications.

Two basic methods for face recognition are adopted by many designers. The first method deals with extraction of feature vectors from the features of the face and converted into template for matching purpose. The second method is based on information theory which uses principal component analysis. The information which defines the face is represented as Eigen functions and the faces are referred as Eigen faces. Recognition system is implemented using these Eigen faces with principal component analysis (PCA) and artificial neural network. PCA is used to recognize the faces in the image. It involves the calculation of the Eigen value decomposition of a data covariance matrix. It compresses a set of high dimensional vectors into a set of lower dimensional vectors and reconstructs the original sets.

In the proposed work second method is employed. The face recognition system uses camera to capture images. Viola-Jones algorithm is used to detect faces in captured image. Eigen faces algorithm is used to extract features of face. The faces are compared with images stored in the database and the recognized faces are marked as present in attendance database.

The proposed work allows the lecturer to check student attendance automatically by using personal computer (PC) without any extra cost and effort. It camera, personal computer, local network a tool for implementation is MATLAB.

II. RELATED WORK

Face recognition system using artificial neural network with Eigen faces is discussed in [1]. Small set of 2-D characteristics are considered for recognition system instead of 3-D geometry. The principal components which are referred as Eigen vectors are taken as a weighted sum of Eigen faces.

A new approach for face recognition is proposed in [2] uses Eigen faces in which the intensity of an image is calculated. The Jacobi's method is adopted to find the Eigenvalues and Eigenvectors with artificial neural network.

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The problems associated with Eigen faces are discussed in [3]. The solution for the mentioned problems are overcome using principal component analysis method with Euclidean distance. Most of the face recognition system requires front view of the face. But the work presented in [4] is insensitive to posture of the face and requires only one sample view of the person.

Automated attendance system in a classroom environment is presented in [5]. The system discussed in the paper is different from that of traditional recognition face system. A 3-D model is proposed to recognize a student face in the classroom environment.

Students Attendance management is very tedious and time consuming. Now a day's biometrics are employed to make the attendance system easy and accurate. A face recognition system is presented in [6] involves continues tracking of the movement of the students in the class.

Hardware implementation of face recognition system is presented in [7]. The proposed work is reliable and efficient which uses an image processing algorithm to detect faces in classroom. The proposed work recognizes the faces accurately to mark the attendance.

An Automatic Attendance System in a classroom environment is presented in [8]. Ada-Boost algorithm is used to detect the face. Features are extracted using Histogram of Oriented Gradients (HOG) and Local Binary Pattern (LBP) algorithm. Support Vector Machine (SVM) classifier is used to recognition of faces.

III. METHODOLOGY

The system uses Viola Jones algorithm to detect the faces from a captured images, then the Eigen face approach for face recognition. The method analyses and computes Eigen faces which are faces composed of eigenvectors. The method also compares the Eigen faces to identify the presence of a person (face) and its identity.

A. Components

The MATLAB is used to for the purpose of implementing the proposed work. It has toolbox for image processing and also for database management. It is used to detect faces and to recognize the faces by implementing the algorithms with the help of the toolbox. The MATLAB also has features to design a GUI which creates an interactive environment. From this GUI the user can load the images and the system recognizes the faces, the attendance is marked against the recognized faces. The updated database can be viewed from the GUI.

The Mysql workbench is used to create the sql database for the student attendance maintenance. The database has tables having column and rows. The sql query are used to perform operation on the database like to add data and to remove the data likewise. The rows corresponds to a student's data.

B. Process

The lecture have to take the images of the classroom for the purpose of attendance. The captured images can be loaded to the system to recognize the faces and mark the attendance against it. The GUI has options to enter the date, semester, and subject id. These data are entered in the database and the database is updated. After the detection, the detected images are cropped and those images are stored in the respective folders according to the semester entered.

Fig 1 depicts the overview of the Face recognition system. The steps involved in the recognition process as follows:
i) The faces cropped are compared with those in the database
ii) If the image is matched the name of the photo in the database is extracted which is the roll no of the student.
iii) The attendance is marked for that roll no and the 'Last updated' field is updated with the date provided earlier.
iv) The updated database can be viewed from the GUI.

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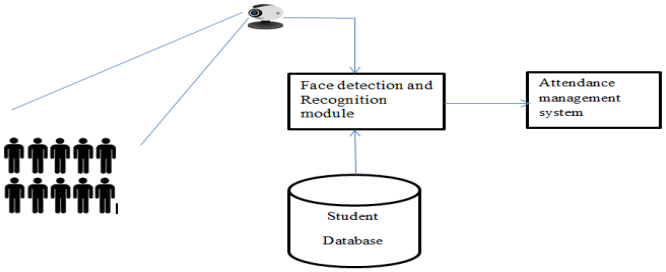

Fig.1: Face recognition system overview

C. Algorithm

The Viola-Jones algorithm has the following stages:

1) **Haar Feature Selection**: Haar like features are rectangular digital images which can be computed quickly than individual pixels. It consists of a class of local features that are calculated by subtracting the sum of a sub region of the feature from the sum of the remaining region of the feature.

2) **Creating an Integral Image:** Integral image evaluates rectangular features (Haar like features) in constant time. Each feature's rectangular area is always adjacent to at least one other rectangle. The integral image at location (x,y),is the sum of the pixels above and to the left of (x,y), which can be calculated in single pass.

3) **Adaboost Training:** Adaboost algorithm creates classifiers by searching set of all weighted classifiers. Adaboost Training and cascading classifier to select the single rectangle feature and threshold that best separates positive (faces) and negative (non-faces) training.

4) **Cascading Classifiers:** It removes negative regions of the image while including all positive ones. This provides quicker computation and also reduce s overall falls positive weights.

D. Eigen Face Recognition

The relative distance between eyes, nose, mouth. are calculated. These characteristics features are called Eigen faces .These features can be extracted out of original image data by means of mathematical tool called Principal Component Analysis (PCA).

IV. IMPLEMENTATION

First, the original images of the training set are transformed into a set of Eigen faces E. Later, the weights are calculated for each image of the training set and stored in the set W. Upon observing an unknown image X, the weights are calculated for that particular image and stored in the vector W_X. The W_x is compared with the weights of the training set W.

Calculate an average distance D between the weight vector from $W_{x..}$ If this average distance exceeds some threshold value, then the weight vector of the unknown image W_x lies too far apart from the weights of the faces. In this case, the unknown X is not considered as face else its weight vector W_X is stored for later classification.

SYSTEM IMPLEMENTATION

Three basic steps are used for implementing the proposed system.

1) Detect and extract the face image and save in 'cropped images' folder.

2) Calculate Eigen value and eigenvector for the training image.

3) Recognize the face depending on the measured Euclidian distance between the projected test image and the projection of all centered training images

4) Depending on the recognized image the Mysql database is updated.

Fig 2 depicts the flow of Face recognition algorithm based on Eigen face. It mainly consists of two passes.

Pass 1: Face detection and extraction: The MATLAB image processing toolbox has Cascade Object Detector that detects objects using the Viola-Jones algorithm. It creates a System object that detects objects using the

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ISO 9001:2008 Certified
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Volume 6, Issue 3, May 2017

Viola-Jones algorithm. The function step (SYS) computes the step response Y of the dynamic system SYS to which we pass the object detector's object.

Pass 2: Recognition and Identification: The function T=CreateDatabase(Traindatabasepath) reshapes 2D images of the training database into 1D column vectors. Then, it puts these 1D column vectors in a row to construct 2D matrix 'T'. The matrix T is passed to function EigenFaceCore () that return mean of the training database matrix, Eigen vectors of the covariance matrix of the training database, matrix of cantered image vectors which is used by the Recognition() to recognize the test image and return the name of matched image in the trained images database.

Initially face detection algorithm is tested on images with different positions and lighting conditions. Then the algorithm is applied to real time image to detect faces. The algorithm is trained for the images of faces and stored in the database as shown in Fig 3. It is then applied on the class room image for detection of multiple faces in the image.

After this step the face recognition done by cropping the detected face from the class room image. This image is compared with the images stored in the database. The students are verified one by one with the face database using the Eigen Face method.

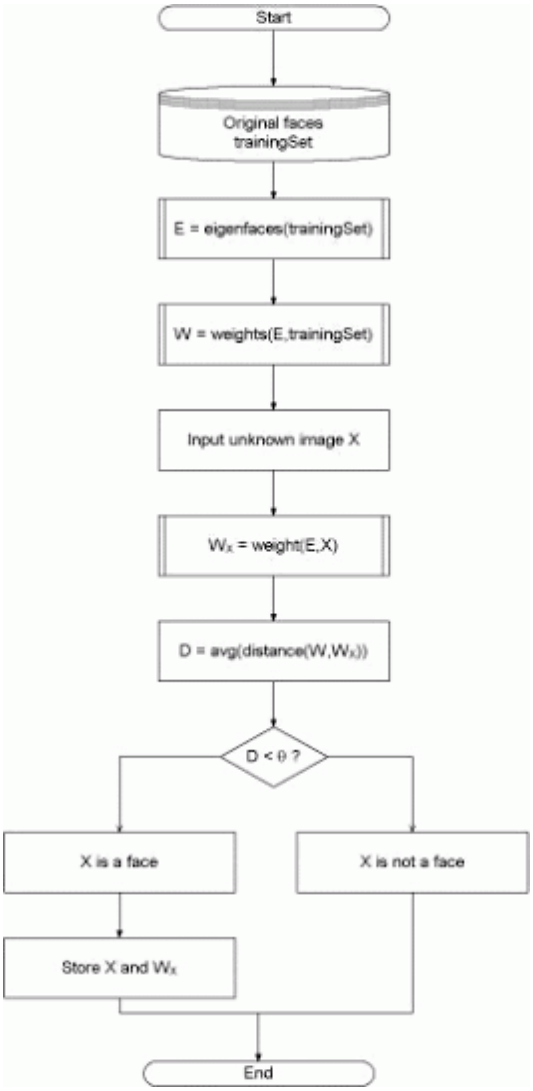

Fig. 2: Eigen face based Face recognition algorithm

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ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 6, Issue 3, May 2017

Fig. 3: Trained face samples in database

V. RESULTS

The results of the proposed work is evaluated in two steps. There are analysis and discussion. For both steps the performance is executed by considering the database consisting of trained samples of the faces of the students of a particular class (class strength is 60).

A. Analysis

The analysis process involves the following steps:

Step 1: Face Detection and Extraction:

Images can be captured with the help of webcam on the user side. The captured image should be processed and extracted. The eigenvalue of the captured image should be calculated and should be compared with eigenvalues of existing face images in the database. If the eigenvalues matches recognition is done.

Step 2: Face Recognition:

The basis for the face recognition is principal component analysis (PCA) algorithm. The information about the matched face image can be found from the database by the extracting the name of the matched image. The image are named as per the roll number of the student by obtaining the image name (which is the roll no of the student) and the corresponding field in the database is updated.

B. Discussion

The designed graphical user interface (GUI) is shown in Fig 4 depicting the class room image. The detected faces are cropped and compared with the images stored in the database. Fig 5 depicts the detected image of the class room image.

Fig. 4: Class room image

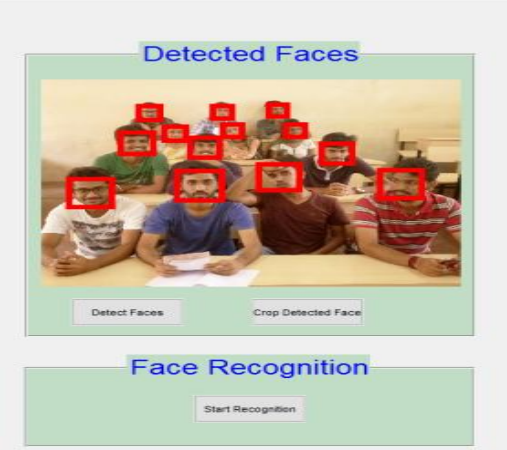

Fig. 5: Detected faces

Likewise all the cropped images are verified one by one with the faces in the database. If any face is recognized then the attendance is marked against such student. Fig 6 depicts the cropped images from the test image. A time table module is attached with the system which automatically gets the subject, class, date and time.

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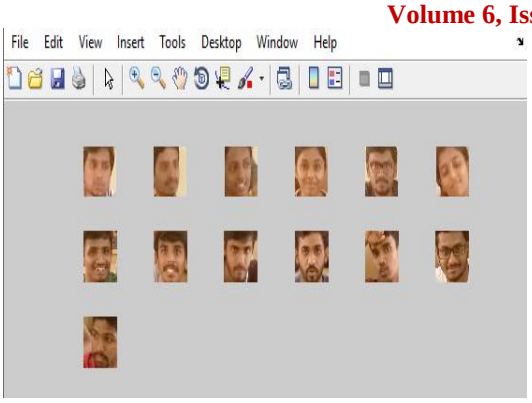

Fig. 6: Cropped images

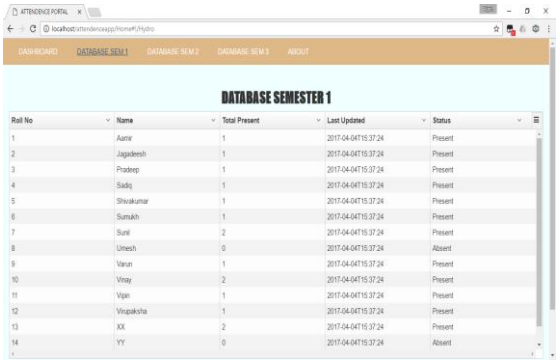

Fig. 7: Attendance portal

Attendance is maintained on the personal computer and data is accessed in the server. This information can be used for purposes like administration, parents and students themselves. Additionally updates can be done by taking the images continuously to detect and recognize all the students in the classroom. The attendance data is uploaded to website as shown in Fig 7.

Table 1: Performance criteria

Number of samples in The faces database	Success Rate (in %)
2	*69*
20	*73*
30	*78*
40	*84*
50	*88*
60	*82*

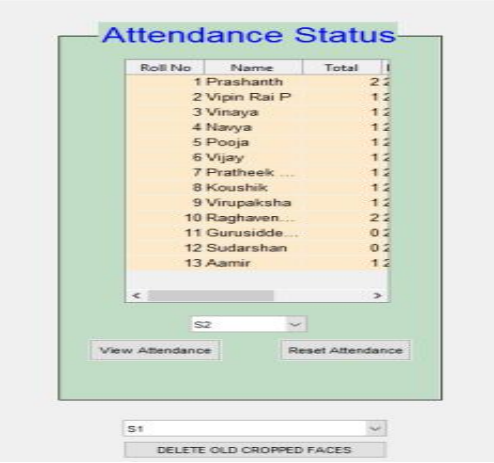

Fig. 8:Attendance Marking

Fig 8 updated attendance data of the student after marking the attendance. The success rate was dependent on the number of samples that we have taken in the database, with less number of sample the success rate observed less. If we take more samples of single person the problem of fault detection can be seen database such that there could be many alternative samples. Thus the probability of those matching with the wrong test images will be more. The success rate and the number of samples are recorded as in Table 1. The constrained in the proposed work is that it detects that objects that are closer to face as a face. This is due to the Viola Jones algorithm which has a problem of false-positive result. The proposed work is unable to detect all faces when the entire class was covered in a single photo. To overcome this, multiple frames (column wise) has to be taken. Sometimes Fault recognition happens when the orientation of the faces in both test and train image was same. As the number of samples increases recognition time increases

VI. CONCLUSION

The proposed system is implemented in MATLAB and the attendance statues are uploaded into website. This system reduces effort of lectures, reduces time consumption and eliminates the maintenance of attendance register. The Viola-jones algorithm is adopted for object detection and eigen faces algorithm for face recognition. Clarity of images influence on the face detection, frontal view of images required to detect faces, adaboost algorithm and cascaded classifiers are implemented to reduce the false detection of face and to increase the face detection rate.

ISSN: 2319-5967
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Attendance database is created using Mysql and is used to compare the detected faces. For recognized students faces attendance are marked present in attendance database. Eigen faces are generated using mathematical model principal component analysis to recognize the detected faces. The classroom images can be captured using mobiles and cameras. The face recognition system doesn't requires attention of students to capture images.

The system with further improvements can be implemented in schools and colleges to automate the process. The improvements has to be made in both the detection and the recognition part, fault recognition might add a fake attendance. This can be avoided by some efficient recognition system that takes into consideration most of the constraints. Thus more the constraints we take while designing the lesser will be the fault detection. The system can be further improved by combing multiple frames of a class and using that for the purpose of attendance taking. The Android application can be developed so that the student can check his/her attendance status through mobile phones. A GSM module can be interfaced to send SMS to student regarding the confirmation of the attendance.

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ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 6, Issue 3, May 2017

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