Automated Class Attendance System based on Face Recognition using PCA Algorithm

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Abstract— **Human face detection and recognition is an important technology in biometric verification and has been used in various applications such as video monitor system, interaction with human-computer and security. This paper describes about student attendance system. For every schools, colleges and library attendance is mandatory. Traditional method for taking attendance is lecture calling student name and record the attendance in sheet. For each lecture its wastage of time. It is very difficult to verify each and every student in a large classroom. To avoid these losses, we use automatic attendance system. The proposed system describes a method like when he\she enters the class room and marks the attendance by extracting the image using Personal Component Analysis (PCA) algorithm. The system will record the attendance of the student in class room environment automatically. The student database is collected. The student database includes name of the students, there images & roll number. It maintains a log report entry of each student with respect to each subject and also generates a report of the student attendance. Using Simple Mail Transfer Protocol (SMTP) the report of the attendance information will be sent to the faculty and also to the parents.**

Keywords—Face Recogniton, Principle Component Analysis, IOT(Internet of Things)

I. INTRODUCTION

Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Image processing is classified into two types. They are,
1. Analog image processing
2. Digital image processing

Analog image processing is any image processing task conducted on two dimensional analog signals. Digital image processing is the use of computer algorithms or perform image processing on digital images. Digital image processing generally refers to processing of a two dimensional picture by a digital computer.

Student attendance record plays a important role in every school, college and university. Student attendance can be classified into two types. They are,
1. Manual Attendance System
2. Automated Attendance System

The manual attendance system is very difficult for faculty to verify and maintain each and every student record in large class environment and requires more time for calculating the average and recording the attendance of each student. The automated attendance system will extract the face image when student enters the classroom and marks the attendance automatically. This project is based on Face Recognition technique. A face recognition system is a computer application for identifying or verifying a person automatically from a digital image or a video frame from a video source.

Facial Recognition algorithms identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw. These features are then used to search for other images with matching features.

Recognition algorithms are Principal Component Analysis (PCA) using eigen faces, Linear Discriminate Analysis, Elastic Bunch Graph Matching using the Fisher face algorithm, Hidden Markov model, Multi-linear Subspace Learning using tensor representation, and neuronal motivated dynamic link matching.

II. SYSTEM OVERVIEW

Face recognition system is to identify a person using his face image. Face recognition module that recognizes the individual student's face and update the student attendance database automatically.

The first step is that, the staff and student class representative are provided with their own Username and Password to Log-in. Next step is, the training image and their features are stored in the database. Then, testing image features are compared with the training images. Once the image is identified, the attendance will be registered. Finally, the attendance details of the student are send to staff and parent through E-Mail. The System architecture are shown in fig. 1.1.
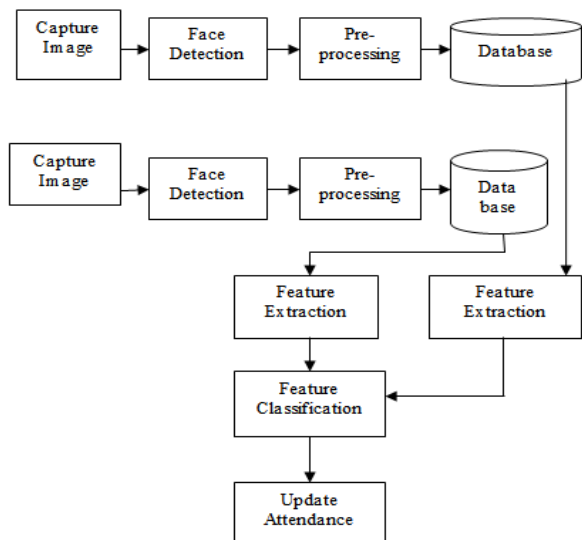
Fig.1.1: System Architecture

III.   METHODLOGY

a.   Login

The login phase is provided for the Lecturer and student class Representative. Login name and password is given to both the lecturer and Representative. In the absence of lecturer, the representative can login into the system. After log-in the input image is captured and sent for feature extraction.
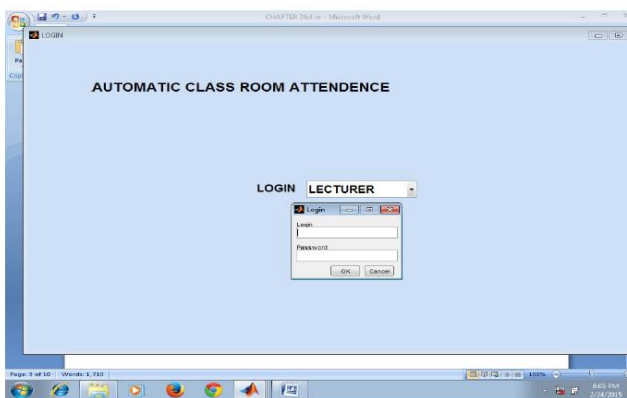

Fig. 1.2: Login.

b.   Staff and Student Information

Information about staff's such as their name, email id, mobile number, subject they are handling and their department. In student information the name of each student in the class are displayed with each student's image. In this module, we have update and clear button. Update button is used to take the student attendance details and clear button is used to clear the previous attendance details.

Fig. 1.3: Staff and Student Information

c.   Update Attendance

Once the update attendance button is clicked then the testing and training image features are extracted and classified. If Euclidean distance value is minimum then student attendance is registered. The percentage of the individual student is calculated.
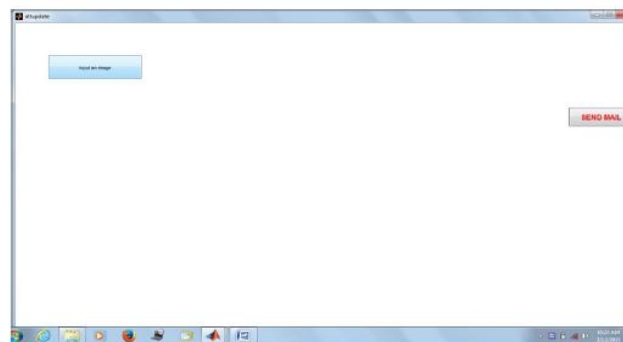

Fig. 1.4: Update Attendance

d.   Feature Extraction

Feature Extraction is applied to both training and testing images. It is used to extract the features of image. Feature Extraction is done using PCA Algorithm. PCA is used in Face recognition for finding patterns. Eigen faces approach is a principal component analysis method which is used to describe the variation between face images. Eigen faces approach is used due to its simplicity, speed and learning capability**.** Using Eigen face method, the images are represented as vectors instead of using Matrix representation.

e.   Feature Classification

The Extracted image from feature extraction is sent to the Classification Module. In feature classification the feature of both training and testing image are compared. The difference between the values of training and testing image is calculated using Euclidean distance. The value of Euclidean distance should be minimum that is between 0 to 1.
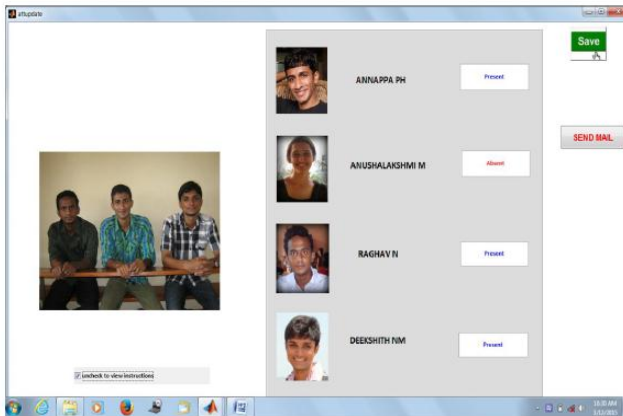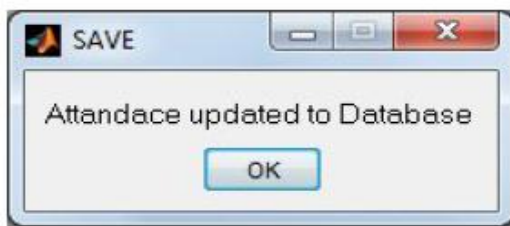
Fig. 1.5: Feature Extraction and Classification

Fig. 1.6: Updating Database

f. *IOT (Internet of Things)*

IOT means Internet of things. Internet of things is a machine to machine communication and it covers variety of protocols. The protocol used here is SMTP (Simple Mail Transfer Protocol). This protocol is used to send mail over the internet. Using IOT, the attendance of the student is sent to their Parents or staffs.

Fig. 1.7: Attendance stored in Spreadsheet

IV. PRINCIPAL COMPONENT ANALYSIS (PCA)

PCA is a useful statistical technique that has found application in fields such as face recognition and image compression, and is a common technique for finding patterns in data of high dimension. Eigen faces approach is a principal component analysis method, in which a small set of characteristic pictures, are used to describe the variation between face images. Eigen faces approach seems to be an adequate method to be used in face recognition due to its simplicity, speed and learning capability.

ALGORITHM STEPS

1. All training set images are resized and converted into a single vector and stored in the Database.

2. Then testing image is resized and converted into a single vector.

3. Mean image of all training set images and testing images are calculated.

4. Then the mean image is subtracted from each image of the training set as well as from the test image. After subtraction we will get new images called as difference images.

5. All difference images of training set as well as testing image are converted into a column vector i.e. column-wise concatenation of all images.

6. Then using covariance matrix the eigenvector and eigenvalues are calculated. Each eigenvector belongs to one of the eigenface.

7. Using product of each eigen images with the difference images will get the weight vector of each class as well as the weight vector of the test image.

8. Then the weight of the test image is subtracted from each weight vector of the difference image.

V. CONCLUSIONS AND FUTURE WORK

In order to obtain the attendance of individual student, this paper proposes the automatic attendance system based on face recognition technique using Personal Component Analysis (PCA) algorithm. The system will record the student attendance when he\she enters and exit the classroom automatically and also provide additional information to faculty by maintaining a log report for entry and exit time. Using SMTP protocol, student's attendance is sent to their parents through mail. By using this method the calculated attendance will be more effective and time saving. Comparing to manual attendance system this provides more reliable solution. In further work, our system can be used in mobile based face recognition. It can be implemented in real time applications using CCTV camera. Instead of PCA algorithm, various recognition algorithms can be implemented for effective results.

REFERENCES

[1] Yugandhara M. Bhoge and Surabhi S. Deshmukh,"A Survey Paper on Automated Attendance Monitoring System using Face Recognition", International Journal For Research In Emerging Science And Technology, vol.1 , Special Issue-1, March-2015.

[2] Nirmalya Kar, Mrinal Kanti Debbarma, Ashim Saha, and Dwijen Rudra Pal," Study of Implementing Automated Attendance System Using Face Recognition Technique", International Journal of Computer and Communication Engineering, Vol. 1, No. 2, July 2012.

[3] A. J. Goldstein, L. D. Harmon, and A. B. Lesk, "Identification of Human Faces," in Proc. IEEE Conference on Computer Vision and Pattern Recognition, vol. 59, pp 748 – 760, May 1971.

[4] M. A. Fischler and R. A. Elschlager, "The Representation and Matching of Pictorial Structures," IEEE Transaction on Computer, vol. C-22, pp. 67-92, 1973.

[5] S. S. R. Abibi, "Simulating evolution: connectionist metaphors for studying human cognitive behaviour," in Proceedings TENCON 2000, vol. 1 pp 167-173, 2000.

[6] Y. Cui, J. S. Jin, S. Luo, M. Park, and S. S. L. Au, "Automated Pattern Recognition and Defect Inspection System," in proc. 5th International Conference on Computer Vision and Graphical Image, vol. 59, pp. 768 – 773, May 1992

[7] Y. Zhang and C. Liu, "Face recognition using kemel principal component analysis and genetic algorithms," IEEE Workshop on Neural Networks for Signal Processing, pp. 4-6 Sept. 2002.

[8] J. Zhu and Y. L. Yu, "Face Recognition with Eigenfaces," IEEE International Conference on Industrial Technology, pp. 434 -438, Dec. 1994.

[9] M. H. Yang, N. Ahuja, and D. Kriegmao, "Face recognition using kernel eigenfaces," IEEE International Conference on Image Processing, vol. 1, pp. 10-13, Sept. 2000.

[10] T. D. Russ, M. W. Koch, and C. Q. Little, "3D Facial Recognition: A Quantitative Analysis," 38th Annual 2004 International Carnahan Conference on Security Technology, 2004.