

Smart Attendance Monitoring System Using Face Registering

Ankush Kumar Ranjan^{1*}, MD Faishal Khan², Rahul³, Prof. Pavithra S⁴

^{1,2,3,4}School of Computing and Information Technology, Reva University, INDIA

Email: ¹akrarakush@gmail.com, ²khanfaishal987@gmail.com, ³rahulsulgunte360@gmail.com, ⁴pavithra.s@reva.edu.in

*Corresponding author's E-mail: akrarakush@gmail.com

Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 30 Nov 2023	Face recognition is one of the main branches of biometric verification as the face is the identity of an individual and it is utilized by many organizations to mark attendance of employees. Currently student attendance is recorded physically in the classroom by calling their unique ids, which utilizes more time and it is tedious to verify and identify each student if the number of students increases beyond normal range and it is tough to cross verify whether the authenticated students are actually responding. This project demonstrates a technique for attendance monitoring with facial recognition method by using two different algorithms one will be the existing algorithm such as Principal Component Analysis (PCA) algorithm and the other one is proposed by us which is Unconstrained FACE REGISTERING ALGORITHM. This method will automatically record the attendance of the scholars who are present in the classroom and it will also maintain a login and logout time of students and faculties and administration can easily access all the data of the students. However, it is difficult to estimate the outcome of facial recognition as most of the systems currently present have low detection rate and takes 20-100 images of a person for better identification. In this project attendance is marked by continuous observation which helps the system to improve and it also eliminates few features which affects the performance of the system that are different poses, light effects, partial occlusion etc. which helps the system to achieve better accuracy. This method will save approx 15-20 min of valuable class time and can be used to interact or clear doubts with teachers.
CC License CC-BY-NC-SA 4.0	Keywords: Face recognition, automatic attendance, continuous observation, PCA, biometric verification.

1. Introduction

Our Contribution: - It is an approach to improve the performance of existing face recognition methods that are presently being used by numerous organizations. Most of the system takes a huge number of dataset of facial image for high accuracy instead of that we adopted an optimal number and in turn we have applied image compression techniques in order to improve the performance of the system as well as maintaining unique face features for better accuracy. To gain high precision the system continuously monitors the face and records the attendance on the server. We suggest digitizing attendance by providing a system that records and manages students' attendance automatically during lectures.

Face detection and recognition is an interaction of framework to identify faces present in a frame. In face recognition the system identifies one or more than one face in the frame and then Unconstrained face registering algorithm will extract features of the face[10]. Then our algorithm will examine the features and compare them with the database present on the server. There are many other methods of verification like iris scan, fingerprints, etc. that are more precise but face recognition has consistently been a significant focus of analysis as it is a person's primary unique feature for identification and it is distinctive which makes it unique. Face recognition innovations are increasing rapidly as it takes less effort of the user when compared to other biometric alternatives. Face recognition can be mainly utilized in Educational Institutions for attendance management, Corporate Offices for employee management and Residential Societies for visitor management systems. Proposed system demonstrates how face recognition system can be efficiently used and it also maintains a record of login and logout time of each student in an excel file which is recorded on the server[8]. The identification process takes care of

face placement, unique features of face and matching the features with the database. It is further partitioned into two sections that is processing before detection where face placement and detection happen by standardization and localization[11] and then the recognition occurs by feature extraction and matching it with the database present on the server. This system marks attendance using continuous observation which is a part face recognition module and using this system will improve efficiency of face detection.

Literature Survey

Since there are many methods for face recognition which are using adaboost[1], deep neural network[6], sensors[9], raspberry pi[11], machine learning[2][10] and still they are getting low efficacy and it has a limited range of 4-7 feet which is too low. Most of the systems that had high accuracy took 50-100 images of an individual[10][11] to identify his/her identity. There are few systems which had used eigenfaces[7][14] for better identification, but they identified only one face at a time and they too had a restricted range of 4 feet.

We took a different approach where we will be taking optimal number of images of the user and will extract features from it by using Unconstrained Face Registering algorithm. Using this algorithm not only gives us high accuracy, but it can also detect multiple faces in a frame. In this approach partial occlusion[8], different poses, flash or light effects which degrade the system performance are eliminated by continuous observation[11]. This method will automatically record the attendance of the scholars who are present in the classroom and it will also maintain a login and logout time of students. Administration and faculties can easily access all the recorded data of the system.

Components Required

- Windows/Linux OS
- Python Libraries
- Webcam

2. Materials And Methods

The system takes snapshots of the students and then it forwards it to the image improvement section. After improvements are completed the snapshots fall within the face detection and recognition module. When the system is in use, the presence of the student is recorded in an excel file and all the data is stored on the server. While registering face pictures of every student are stored on the server. In this all the faces are identified from the input device i.e. webcam and our Unconstrained face registering algorithm cross verifies with the server data to avoid any duplications. While using the system if any face is recognized his or her presence is automatically recorded. System like this will improve efficiency of face detection and recognition processes. This system contains 2 databases that are the first one is face database which contains extracted features of faces during enrolment and second one is student attendance database to record attendance. This system is highly secure where nobody can bypass it as it continuously observes the students and all the data collected are stored on the server for administration purposes.

Unconstrained Face Registering algorithm

This algorithm contains 3 main steps :-

1. It works by extending facial images to an element space that propagates significant differences between facial images. These features are principal components of a face generally called as "eigenfaces".
2. Then concatenation is done using a single histogram with enhanced features representing face.
3. Matching is done by K nearest neighbour classifier with minimum error-based similarity measure. After matching the face is registered in the database for marking the attendance.

VI. IMPLEMENTATION

Attendance monitoring system using face registering contains 4 module :-

A. Face Detection - In this process face area is separated from the image and for video streams faces are tracked with the help of continuous observation. This module is responsible for detecting the face present in the current frame and this is achieved by HOG classifier which identifies the face present in the frame via the webcam and draws a bounding box around the face to show the detected/captured face.

B. Feature Extraction - After successfully detecting the faces then it will extract unique features of each faces and train it using our proposed Algorithm.

Algorithm:

- 1) resize all M faces to $N \times N$
 - 2) remove average
 - 3) create matrix A of faces each row $N \times N$ and total size of A is $(N \times N) \times M$
 - 4) calculate average face
 - 5) remove average face from A
 - 6) compute the covariance matrix C A^*A , C size is $M \times M$
 - 7) compute Eigen values and Eigen vectors, to process the Eigen faces need to go back to higher dimension.
 - 8) compute the linear combination of each original face.
 - 9) given new face project it to Eigen face and compute distance to each Eigen face this is the recognition.
- C. Face-Recognition** - This Module detects all the faces in a frame and recognizes them based on the training and classifies them and marks attendance in an excel sheet.

- 10) Initialize K to your chosen number of neighbours
- 11) For each example in the data.
- 12) Calculate the distance between the query example and the current example from the data.
- 13) Add the distance and the index of the example to an ordered collection.
- 14) Sort the ordered collection of distances and indices from smallest to largest (in ascending order) by the distances.
- 15) Pick the first K entries from the sorted collection.
- 16) Get the labels of the selected K entries.
- 17) If regression, return the mean of the K labels.
- 18) If classification, return the mode of the K labels

D. Face Registering - After all the above process is completed then the face data is stored in the database for further operations.

- 19) Register the face.
- 20) Registering algorithm

VI. FLOWCHART

First the student has to register by taking a clear photograph or a snapshot. Then the Unconstrained Face Registering algorithm will extract features of the face and notify the user whether the face features are extracted properly or not and then all the information of the student is recorded in the database(D1). When the system is in use it will automatically identify the student present in the frame by matching the facial features present in the database(D1) and it will record the attendance on an excel sheet database(D2) and will generate a report which will be stored on the server.

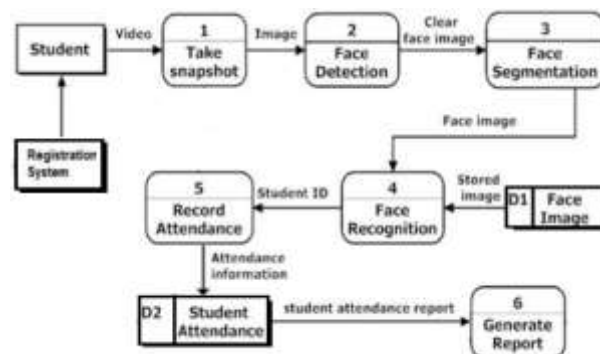


Fig. 1 Block diagram.

3. Results and Discussion

Smart Attendance monitoring system using Face Registering is easy to use and provides better accuracy. Once the student has registered then our proposed Unconstrained face registering algorithm will extract unique features of the face and will train itself (Figure 2). When the system is in use it will detect single or multiple faces in the frame (Figure 3) and will automatically record the attendance in an excel file based on the students details Figure 4.

```

C:\WINDOWS\system32\cmd.exe
img_path: datasets\R17CS502_Ankush\15.png
id: 502
img_path: datasets\R17CS502_Ankush\16.png
id: 502
img_path: datasets\R17CS502_Ankush\17.png
id: 502
img_path: datasets\R17CS502_Ankush\18.png
id: 502
img_path: datasets\R17CS502_Ankush\19.png
id: 502
img_path: datasets\R17CS502_Ankush\2.png
id: 502
img_path: datasets\R17CS502_Ankush\20.png
id: 502
img_path: datasets\R17CS502_Ankush\21.png
id: 502
img_path: datasets\R17CS502_Ankush\22.png
id: 502
img_path: datasets\R17CS502_Ankush\23.png
id: 502
img_path: datasets\R17CS502_Ankush\24.png
id: 502
img_path: datasets\R17CS502_Ankush\25.png
id: 502
img_path: datasets\R17CS502_Ankush\26.png

```

Fig. 2 Face Training

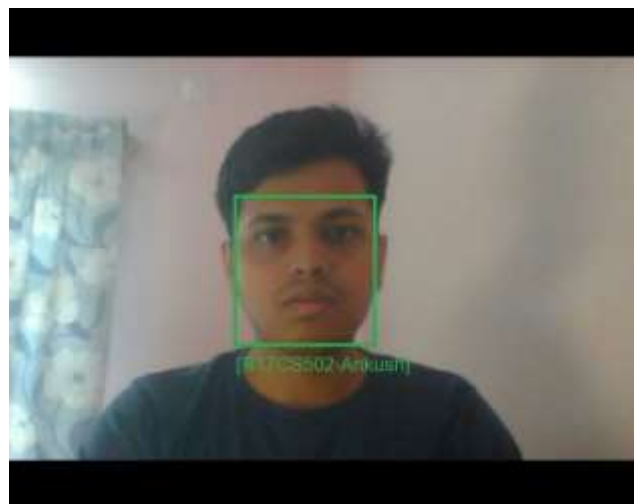


Fig. 3 Face recognition

	A	B	C	D	E
1	Student ID	Student Name	Period	Time	Date
2					
3					
4	16	Rahul S	2	10:10:20	12-04-2021
5					
6	302	MD Faishal Khan	2	10:10:24	12-04-2021
7					
8	502	Ankush	2	10:10:30	12-04-2021
9					

Fig. 4 Attendance Excel sheet

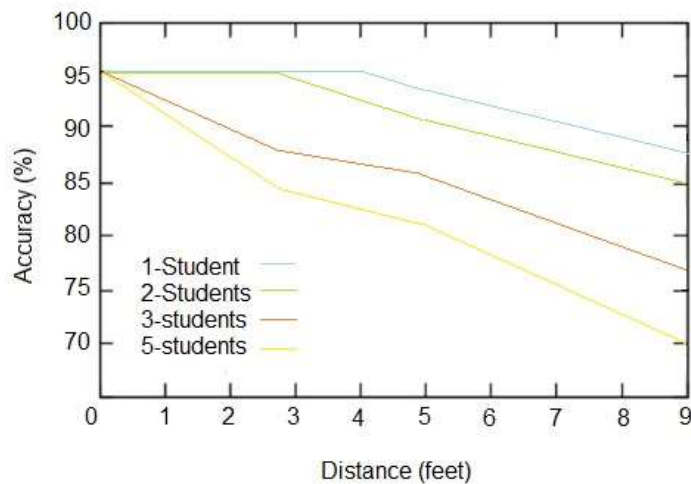


Fig. 5 Accuracy vs Distance graph

The figure 5 shows accuracy vs distance graph where testing is performed with different students with different angles, poses and distances.

4. Conclusion

To record students' attendance, we are proposing an attendance monitoring system which supports facial recognition. This system is capable of identifying multiple faces in the frame and it continuously notices the faces which helps to improve its efficiency. It will mark attendance of each student by continuous observation at the entry and exit points and will save it in an excel file. This method will save approx 15-20 min of valuable class time and that can be used to interact or clear doubts with teachers, especially when the number of students is more. This system shows utilization of face recognition for students' attendance system and this can also be used for candidate verification in institutions for authentication.

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