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Attendance Marking System Using Face Recognition

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Abstract

Background/objectives: To propose a suitable method for marking attendance automatically. Automating the attendance is necessary these days because many of the universities/institutions are particular about their student's attendance in the classroom. But the usual method of marking attendance is proven to be tedious, inaccurate and time-consuming when the number of students in a class is more. Proxy attendance is another big issue for the teachers. **Methods:** This study proposes a method for marking attendance automatically using Principle Component Analysis (PCA) as a face recognition technique. The image of all the students seated in the classroom is captured and then compared with the student's database, based on which attendance of individual students is marked. An e-mail is sent to those parents whose wards were not present in the class. **Findings:** The students are successfully detected using Viola Jones Algorithm and recognized/identified using PCA analysis method. The database constantly updates the status of attendance of every student. This system works well even in different light settings. It can identify a person even if some of his/her features are changed. For example, it could identify a person with different haircuts, a person with or without spectacles, a reasonably old photo vs new photo etc. **Novelty/improvements:** Thus, the classroom time can be effectively utilized without compromising attendance. Viola Jones algorithm accurately detects faces. PCA analysis algorithm utilizes the detected faces to recognize the students by comparing it with the database.

Keywords: Face Recognition, Face Detection, Attendance, PCA Analysis, Viola Jones Algorithm

1. Introduction

Attendance has been a major issue for universities these days. Lecturers are finding it hard to evaluate the attendance of students accurately due to time constraints. With time, the student strength per classroom is drastically going to increase and the syllabus is going is be vaster and difficult. The teachers will be able to focus their attention on these factors, only if their classroom time is not wasted. An effort had been made earlier to automate this process[1,2]; however, they were not accurate. Face recognition is gaining a lot of popularity in various domains as it is easy to use, accurate and faster in detection.

Biometric is the most widely used attendance marking system.[3–6] It uses fingerprint or speech to identify a person. However, biometric could be easily hacked or manipulated by students. Radio Frequency Identification (RFID) cards could be used to mark the attendance by providing different RFID tags to each student.[7] However, RFID has got its own set of disadvantages. Some of the disadvantages are: the student cannot enter the class if his/her card is not working, RFID tags could be misused by other students and RFID tags do not work in presence of other magnetic fields. By entering the database online: This method could be productive if a large number of databases need to be maintained and a lot of operations need to be performed on it. However, this method cannot be considered as effective as it is not completely automated.

Here in this study, an attendance marking system using face recognition is being proposed. A limited number of studies have been carried out in this area.[8] The method is to detect the faces of students in the image and match the faces with the database to identify the face and mark the attendance of the student for the class.

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2. Methodology

2.1. Viola Jones Algorithm

The present work uses the Viola Jones Algorithm. This algorithm is typically used to detect human faces in an image.[9,10] The algorithm has four stages, namely, HAAR feature selection, Creating an integral image, AdaBoost training, and Cascading classifiers. Human faces have many similarities and these similarities can be used to detect a human face in an image, like the region of the eyes is always darker than the cheek or forehead. Such features are called HAAR features and can easily be identified in an image. The Viola Jones Algorithm looks for such specific features of a face if this feature is found, the algorithm passes the image to the next stage or else concludes that the given image is not a face. Here the whole image is not considered; only a rectangular part of this image known as sub-window is considered. With this sub-window, the algorithm checks the whole image and detects the faces in the image.

2.2. PCA Analysis

After detecting the face in the image using the Viola Jones Algorithm the student's face has to be identified and matched with the database to mark the attendance of the student. The Principal Component Analysis (PCA) method is used to identify the face in the image. The PCA method uses the following steps for the recognition of faces[11] Prepare the Data, Obtain the Mean, Subtract the Mean from Original Image, Calculate the Covariance Matrix, Calculate the Eigen vectors and Eigen values of the Covariance Matrix and Select the Principal Components, Transform the New Face.

2.3. Experiment

This project requires a rotating camera to be placed in the center of the classroom and right after the stage dais. The camera rotates towards the board to click the image of the teacher and identifies who the teacher is. It later rotates itself to face the students, clicks a photo and marks attendance to all the students seated in the classroom after recognizing who the individual student is.

i. The project is coded in MATLAB. The human faces are detected using Viola Jones algorithm and PCA analysis is used in order to recognize the student by comparing it with the database. PCA Analysis used in the program fairly recognized all the faces correctly.
ii. Ultrasonic Sensors are used to detect if any student is moving out/entering the classroom. If the sensor detects someone entering the door, the classroom image is re-clicked, step (i) is followed and the attendance status is updated.
iii. In order to ensure that the attendance taken is accurate, the step (i) is repeated after 10 minutes irrespective of whether the sensor detects someone at the door or not.
iv. The attendance register is maintained as a document for further reference (Figure 1).
v. The attendance status of each student is updated to their parents through a mail. This was implemented using Ubidots (Figure 2).

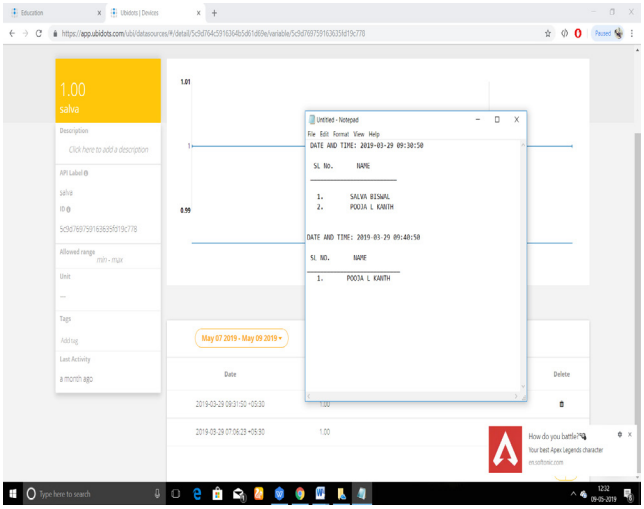

Figure 1. Screenshot of the attendance register.

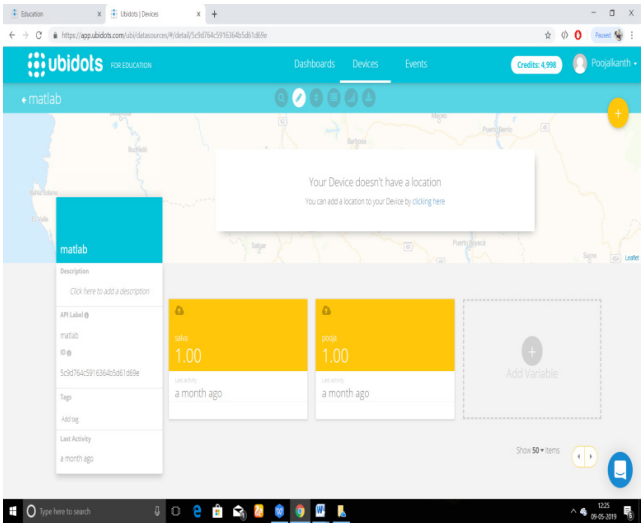

Figure 2. Screenshot of the message sent using Ubidots.

3. Results

Following are the results that one can draw from this system:

i. The students are successfully detected using Viola Jones Algorithm and recognized/identified using the PCA analysis method.
ii. The database constantly updates the status of attendance of every student
iii. This system works well even in different light settings.
iv. It can identify a person even if some of his/her features are changed. For example, it could identify a person with different haircuts, a person with or without spectacles, a reasonably old photo vs new photo etc.

4. Discussion

With the help of this system, students can easily be monitored as this system ensures whether the students are attending classes regularly or not. It can also ensure that the students do not waste their precious student time and use their time productively in the classroom. In the long run, this will ensure that students gain good knowledge from the subjects that were taught in the classroom. This system proves to be more cost-effective and reliable over other techniques like biometrics, RFID tags etc. This system is difficult to forge or cheat when compared to other systems. It is very easy to use and has the least maintenance. It does not require any human intervention and those can be called fully automated. There aren't any limitations as such for this system; however one needs to take care of the smaller parameters while this system is implemented. This includes placement of cameras, visibility of all students as per camera's view, camera quality etc.

5. Conclusion

An attendance marking system using the face recognition technology is implemented. A camera is installed in the classroom at an appropriate location to take the images of the teacher as well as the students. The Viola Jones Algorithm is used to detect the faces in the image and the faces are identified using the PCA analysis method by comparing it with the database and the attendance of the student is marked in the system. The system can also send the message of the absence of the student to the respective parents of the student. This will help the parents to take corrective action.

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