

# An Automated Student Attendance System Based on Face Recognition

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**Abstract.** As results of the challenges of the manual method of taking student attendance in colleges and universities, an automated attendance system requires to be applied. The challenges consist of effort in keeping the attendance list over a long period of time, unnecessary time waste during calling and checking student's name, students forgetting to sign the attendance list, lecturers forgetting the attendance list in the classroom, students passing illegally for an absentee among others. There are many automatic methods available for this purpose i.e. a biometric attendance system. All these methods, however, also waste time because students have to make a queue to touch their thumb on a scanning device. In this paper, we propose an efficient method that automatically marks the attendance without human interference. This attending is recorded by using a camera attached in front of classroom that is continuously capturing images of students, detect the faces in images and compare the detected faces with the database and mark the appearance.

**Keywords:** automated attendance system; face detection; face recognition; local binary patterns; verification

## 1 Introduction

It is necessary to check the performance of students in the classroom to enhance their academic performance. Students are expected to attend 75 percent of the class time before they are allowed to the course examination. Traditional method of marking attendance students require to call student's names and then mark in the attending list. The problems related to this method vary from unnecessary time wastage to incorrect attendance, students forgetting to put their hand up during attendance time or students signing on behalf of other students who are absent from the class.

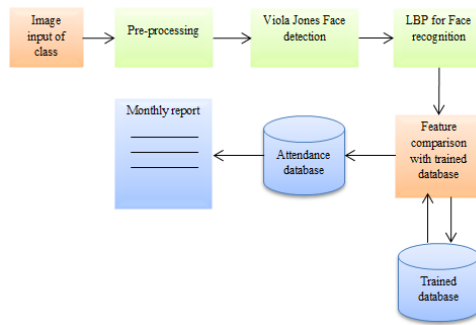
For saving manual labor and increasing the accuracy, an automated attendance system has replaced traditional attendance marking activity. Automated attendance systems are mostly biometric based, smartcard based and web based. These systems are widely used in different educational institutions. It has advantage over traditional method as not only saving time but also can be used for security purposes. The next

sections in this paper are related works, detailed descriptions of proposed system, results and conclusions and future works.

## 2 Related Work

In [1] the authors have proposed a finger print based attendance system. A portable fingerprint device has been developed which can be passed among the students to place their finger on the sensor during the lecture time without the instructor's intervention. The problem with this approach in marking the attendance is that passing of the device during the lecture time may disturb the attention of the students.

Amount of works related to Radio Frequency Identification (RFID) based attendance systems exist in the literature. In [2] the author have proposed a RFID based system in which students carry a RFID tag type ID card and they need to place that on the card reader to record their attendance. There is a problem that an unauthorized person may make use of authorized ID card and enter into the organization.



**Fig. 1.** System architecture

Iris is another biometric that can be used for attendance systems. In [3] the authors have proposed attendance system based on Iris recognition. This system uses iris recognition management system that does capturing the image of iris recognition, extraction, storing and matching. But one of the disadvantages is that the equipment is very expensive and the iris is a small target and a scan not be performed properly if the person is more than a few meters way.

In [4] authors have proposed a system based on real time face recognition which is reliable, secure and fast which needs improvement in different lighting conditions. Face recognition consists of two steps that are detection and recognition. An amount of methods have been proposed for face detection i.e. Voila and Jones [5] and Ada-Boost algorithm [6]. Face recognition techniques can be divided into two types, appearance based which use texture features as Linear Discriminant Analysis (LDA) [7], and Local Binary Pattern (LBP) [8] and feature based which uses geometric features like mouth, nose, eyes, eye brows etc. and relation between them. Table 1 is shown the disadvantages of various attendance systems.

**Table 1.** Disadvantages of various attendance systems

Types of system	Disadvantages
RFID-based	Fraudulent usage
Fingerprint-based	Time consuming for students to wait and give their attendance
Iris-based	Invades the privacy of the user

### 3 Proposed Method

Detailed system architecture is shown in Figure 1, basic steps of our proposed method are: Image input, Face detection using Viola Jones, Face recognition using Local Binary Pattern, Feature comparison, Attendance database and Monthly report.

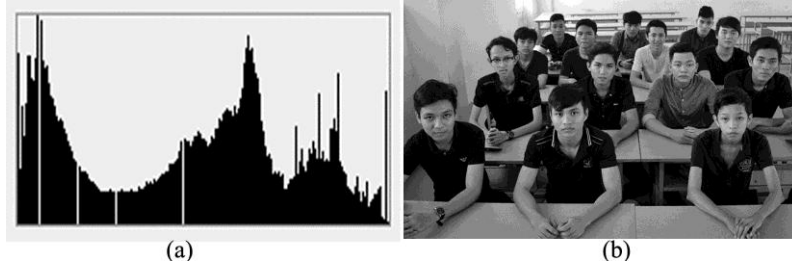
#### 3.1 Image Input

Image is acquired from a high definition camera that is connected above the white board. This camera is connected to the computer. Image input of class will be taken from camera. This image will consist of all the students present in class for that particular lecture. Figure 2 shows a captured input image of classroom.

**Fig. 2.** The captured classroom image

#### 3.2 Pre-processing

This preprocessing step involves with histogram equalization and noise filtering of input image. Histogram normalization is good technique for contrast enhancement in the spatial domain. Because captured image sometimes have brightness or darkness in it which should be removed for good results. After histogram equalization stage, we apply low pass filtering technique for removal noise in the input image.



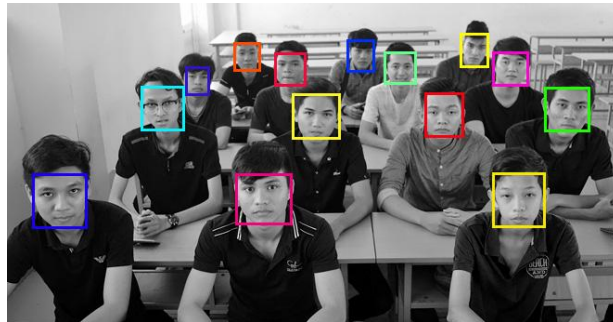
**Fig. 3.** (a) Histogram of input image (b) Histogram equalized class image

### 3.3 Face Detection

In this section faces are detected and shown in the Figure 4 by marking rectangle on the faces of students. This step based Viola Jones algorithm which consists of four phase's integral image, Haar-like Features, AdaBoost, and Cascading Classifier. In integral image we assign each pixel a value. And these values are converted by summing up all the pixel values present above and at the left side.

Haar-like features consists of special pattern which is compared with image pixels and accordingly 1 or 0 is assigned. In AdaBoost only some necessary features are selected removing redundant ones. In Cascading classifiers wear classifiers are cascaded to make a strong classifier.

Algorithm is trained for the images of faces, and then applied on the class room image or detection of multiple faces in the image. Figure 4 shows the detection face.

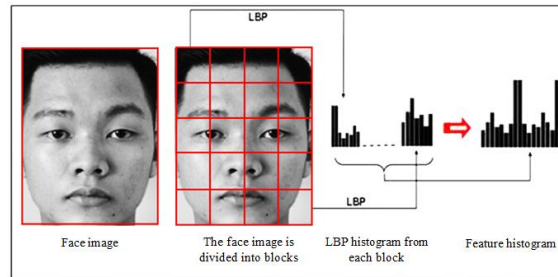


**Fig. 4.** Face detection

### 3.4 Face Recognition

After the face detection step the next is face recognition. This can be achieved by cropping the first detected face from the image and compare it with the database. We developed a fast and reliable algorithm for face recognition based on histograms of Local Binary Pattern (LBP) algorithm. Image is divided into several parts and on each part LBP is applied. Initially 3x3 top left corner window is taken and each pixel is converted into equivalent gray level.

After this center pixel value is compared with all the neighborhood values and if center pixel value is greater than surrounding pixel then it is 1 else 0. After this, the 8-bit code is converted into decimal equivalent and this procedure is repeated for the whole image. After this all the decimal values are plotted on histogram. Figure 5 shows the histogram feature extraction from LBP algorithm.



**Fig. 5.** LBP histogram feature extraction

### 3.5 Feature Comparison

To compare two face images, a sample and a model, the difference between the feature vectors has to be measured. In this step the calculated features are compared with stored features by Log-likelihood statistic [9].

### 3.6 Attendance Registering

If features match in comparison phase, then attendance for particular student is registered in the database. This database is stored in the backend of the system and the results drawn are all entered in the same.

### 3.7 Monthly Report

At the end of each month, monthly report will be generated and will be mailed to department. The report can be generated as per the institute norms. This reduces or finishes off the entire work of the faculties of the institute. Any alterations required to be done in the final report can be done by the respective authorities.

## 4 Results

Face detection and recognition has been a challenging task due to unconstrained condition. In our project using Viola Jones face detection method; LBP and CIT UDN database are being used which will give us an overall efficiency of 83.21%

**Table 2.** Performance evaluation of proposed system

No. of faces	No. of successfully detected faces	No. of successfully recognized faces	% of correct recognition	No. of false rejections	% false rejection
10	10	9	90.33	0	0
20	19	16	87.76	1	5.00
30	29	25	85.52	1	3.33
40	38	34	83.21	2	5.00

## 5 Conclusion

This paper introduces the efficient and accurate method of attendance in the classroom environment that can replace the old manual methods. This method is secure enough, reliable and available for use. No need for specialized hardware for installing the system in the classroom. It can be constructed using a camera and computer. The future work is to improve the recognition rate of algorithms when there are unintentional changes in a person like tonsuring head, using scarf and beard.

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