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CLASSROOM ATTENDANCE SYSTEM USING SURVEILLANCE CAMERA

Ketan N. Mahajan
Computer Science and Engg. Department Rajarambapu Institute of Technology, Rajaramnager, Maharashtra,
Nagaraj V. Dharwadkar
Computer Science and Engg. Rajarambapu Institute of Technology, Rajaramnager, Maharashtra, India

Abstract— A classroom attendance system using face recognition is most important research topic in computer technology. There are automated systems which are used for recording the attendance of a person within the organization, but the limitation is that the attendance is registered only when entering and leaving the work area. In this paper, we proposed the attendance system using surveillance camera which is used to record the attendance of students in a classroom with some time interval in a day. This system is also used to avoid proxy attendance of students. This automation reduces human efforts of paper work, maintaining the attendance registers, generating reports as needs of academics.

Keywords— Face recognition, Classroom attendance, Attendance reports.

I. INTRODUCTION

Face recognition is a big research area which takes more attention of many researchers in computer technology. The human face recognition from video sequences is a challenging task, because there are variations present in the background of the images, facial expression and illumination [1]. Most of face detection methods focus on detecting the frontal face of human and ignore other things like buildings, trees and background in image [2]. Generally the face recognition system is used for the security purpose, but nowadays this system is used in many other applications.

The main purpose of the automated attendance system is record the availability of peoples inside the organization. The automated attendance system is used to reduce the manual attendance work and also reduce the time used for maintaining attendance records. In this system, the high resolution surveillance camera is used for capturing the video in a classroom. By using this video the attendance of students is marked. And also this system is generate the attendance reports as needs of academics.

II. RELETED WORK

Automated face recognition system is a big challenging task and from the last few decades, it has gained much attention. Many researchers develop various methodologies for face detection and face recognition [3], [7-10], [11], [12]. The recent development in this field has facilitated us with the high capacity, high accuracy and increase the rate of face detection [13]. The Literature survey consists of collecting and studying the papers on the existing attendance system, which described in following paragraphs.

In paper [7], the authors discussed about past, present and future of face detection technique. During the last 15 years, there is more change has been made in this technique due to the availability of data on the unconstrained capture condition through the internet. The effort made by the community is publicly available and also progress in the development of the algorithms. In this paper, the authors survey the recent advances in real-world face detection techniques and different methods of face detection. There are many face detection and face recognition methods, but the majority of these early works were not able to provide the best performance in unconstrained conditions and not directly applied in real-world settings. This drawback is overcome by Viola and Jones algorithm that made practically feasible in real-world applications.

In paper [8], the authors discussed a two-stage hybrid face detection scheme which uses Probability-based Face Mask Pre-Filtering (PFMPF) and the Pixel-Based Hierarchical-Feature Adaboosting (PBHFA) method used to solve the problems in Haar Cascade effectively. Haar features in a standard sub-window are takes more time, which makes feature adaptation difficult in a specific environment. The two stage approach for face detection provide far less training time than specific environment cascade Adaboosting and thus reduce the computation complexity of face detection.

In paper [3], the authors present the half face template face detection method. In a classroom the camera is used for capturing the video, sometimes this video contains the half face of students. The half face template can capture side face images in great angle, which improves the correctness of side face detection. This method reduces the time complexity in face detection and adopts face in greater angle. The half face template increase the speed of face detection.

In paper [10], the authors propose an approach that uses multidimensional scaling (MDS) to continuously transform the feature from poor quality images to high quality gallery images in such a way that the distance between these two images approximate the distance that the probe image being captured in the same conditions. In this paper the authors proposed MDS based approach for matching low resolution facial images captured from cameras with some variation in poses and illumination in high resolution gallery images in frontal pose. The tendor analysis is used for facial localization in low resolution uncontrolled image for computing the features.

In a paper [11], the authors propose a face detection algorithm using 3*3 block rank pattern of gradient magnitude images

and geometrical face models. The 3*3 block rank pattern is used to determine the detected face candidate region contain face or not. This algorithm is relatively less sensitive to illumination than pixel based method and less affected by illumination changes because the preprocessing steps correct the distortion of illumination.

In a paper [12], the authors proposed face recognition systems which are important fields of computer vision. There are four steps in this approach. In the first step, face detection algorithm is used to extract the faces in video frames and generating the face database. In a second step, filtering and preprocessing is applied to face images obtained in the previous step. In the third step, the machine learning algorithms are trained using input data the face obtained in the previous step. In a final step, the classifier is used for classifying face, which is obtained from video frames. The experimental results show that suitability of this approach for analyzing large collections of video.

In a paper [14], for a feature extraction author combined the techniques such as image contrasts, integral image, Ada-boost, Haar-like features and cascade classifier. With the help of these integrated algorithms, the proposed system gives better accurate results and requires less computational cost. There is some variation present such as noise, scaling, illumination, pose. Other techniques are failed to detect and recognize the faces in this environment, so this issue is overcome by using the proposed method. In this paper the face recognition takes place using the advanced local binary pattern technique for getting better result.

In paper [15], the authors developed automated classroom monitoring system using the webcam. This automated system is developed using following six steps.

(1) Webcam Deployment.

(2) Capture and store in database.

(3) Security.
(4) Application Attendance.

(5) Functioning/Working.

(6) Report Generation.

In this system the wired webcam is deployed to capture the video in the classroom, next the captured video is sent to the database. In a third step, the system privileges are given to the class-teachers, faculties and others to manage the system. In a next step the attendance is marked if the student is present in the classroom otherwise not. And this attendance is sent to the students/faculties via SMS or mail. Finally the attendance reports are generated as per needs.

In this project, there is necessary to calculate the results of face recognition with frontal face images and also half face images for checking the accuracy of the system. In paper [6],the authors use two face database UMIST and ORL face database. The UMIST contains side face image database and

in ORL the frontal face images are present. The authors were implemented these two databases for checking difference of accuracy using PCA and LDA methods. The UMIST and ORL face databases are shown in following Fig 1. and Fig 2.

Fig. 1. Faces from UMIST database

Fig. 2. Faces from ORL database

By using these two databases the authors have measured the accuracy of face recognition. They applied both the algorithms on face database and getting results shown in following Table 1 and Table 2 [6].

TABLE 1   Accuracy table for UMIST database

Number of train images	Accuracy (%)	
	PCA	LDA
30	100%	100%
50	85%	90%
100	80%	83.33%
Avg:	88.33%	91.11%

TABLE 2   Accuracy table for ORL database

Number of train images	Accuracy (%)	
	PCA	LDA
30	100%	100%
50	95%	98%
100	93.33%	96.67%
Avg:	96.11%	98.22%

III. PROPOSED WORK

Automated systems make everything easy, so the student's attendance will become an automated system. We have studied the existing attendance systems, their advantage, limitations and proposing the new attendance system. The main blocks of the proposed system are shown in Fig. 3.

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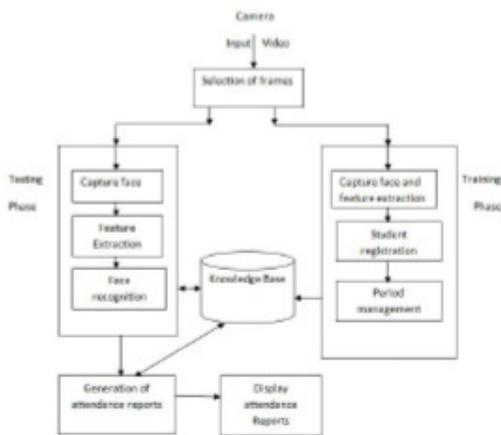
Fig. 3. System Architecture

The two main phases of proposed system are training phase and testing phase explained in following subsections.

A. Training Phase-

There are two main steps in this phase explained in following points

1. Face detection

In this phase, we take the video captured by the surveillance camera for the student registration purpose. The Viola-Jones face detection algorithm is used to detect the faces from the video.

This algorithm is widely used for object detection task. Viola-Jones face detector also known as Haar classifier because they uses Haar functions. Haar features contain a complete set of two dimensional Haar functions used to encode appearance of objects such as nose, mouth and eye [4]. The Haar features consist of two or more rectangular regions enclosed in the template. It is used to sums up the pixel intensities in these regions and calculates the difference between them and this difference is used to categorize subsections of an image [5], which helps detection of facial image from video. By using this approach we get 100% face detection ratio, this is calculated by using the following equation.

$$\text{Face detection ratio} = \frac{\text{No. of face detected}}{\text{Total no. of faces in video}} \times 100 \ \%$$

But there is faulty detection is takes place, the face like shapes such as spots or things present in the background are detected as face. So this drawback will be overcome in our project.

2. Feature Extraction

After detecting the faces from the video, the feature is extracted using the Principle Component Analysis method [6]. This method is used to reduce the dimensionality of data space to the similar feature space [6].

PCA performs mathematical operations in face recognition. Here we create the database of student faces to calculate the eigenvalues and corresponding eigenvectors. To calculate eigenvalue, first calculate the mean and standard deviation of face images stored in database. Then by using this value we calculate variance, covariance and corresponding covariance matrix. And finally from the covariance matrix PCA calculates the eigenvalue and corresponding eigenvectors [6].

The student faces and their respected eigen-value shown in Fig. 4 and Fig. 5 respectively.

Fig .5. Image name and respective Eigen-values

Images	Eigen-value
1.jpg	1.2113e+06
2.jpg	9.9789e+05
3.jpg	7.3667 e+05
4.jpg	6.1698 e+05
5.jpg	5.3651 e+05
6.jpg	3.7332 e+05
7.jpg	3.2491 e+05
8.jpg	2.1138 e+05
9.jpg	1.4590 e+05

Fig .5. Image name and respective Eigen-values

In the surveillance camera, there are a partial face of students is also captured. So we calculate the eigen-value of students in different angle and stored in the database. There is a registration of the students that include information like name, roll number, class and face image and this information is stored in the database. In period management module, we

store all information about period i.e. period no, period name, start and end time of period.

B. Testing phase

In this phase, we are going to partition our dataset into two parts namely training dataset and testing dataset and this partition will be done randomly. The input image will be matched with the image from the dataset. So the attendance of the student will be considered if it is present in the database. The modern technique will be used to get more accurate result.

IV. CONCLUSION

The proposed method is able to recognize the half face present in video stream captured by the camera. This method will be useful to provide 100% accurate results. We will use the technique which gives 100% accuracy with low computational cost. This system will generate attendance reports as needs of academics which make working of organization effective.

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