Automatic Attendance System Using Face Recognition.

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Abstract—Taking Attendance manually is a very tedious job and wastes a lot of time too. The existing biometric attendance also wastes a lot of time as it is not automatic and also requires the involvement of the students too. The work described aims at automating the whole process. The camera installed will take a picture of the whole classroom, followed by detecting individual faces in the image, recognizing the students and then updating their attendance. The image will be captured twice—once at the beginning of the class and once at the end to ensure that the student has attended the whole class.

Keywords—Facial Detection, Recognition, Attendance.

I. INTRODUCTION

Attendance maintenance is an important task in all the institutions to check the performance of students. Every institute has its own way to do so. Some use the old paper or file based approach and some have adopted methods of automatic attendance using some biometric techniques. There are many automatic methods available for this purpose. Face recognition is a technique of biometric recognition. It is considered to be one of the most successful applications of image analysis and processing; that is the main reason behind the great attention it has been given in the past several years. The facial recognition process can be divided into two main stages: processing before detection where face detection and alignment take place (localization and normalization), and afterwards recognition occur through feature extraction and matching steps.

This system uses the face recognition approach for the automatic attendance of students in the classroom without student’s intervention. This attendance is recorded by using a camera that captures images of students, detect the faces in images, compare the detected faces with the database and mark the attendance.

1.1 Face Detection

The main function of this step is to determine whether human faces appear in a given image, and where these faces are located at. The expected outputs of this step are patches containing each face in the input image. In order to make further face recognition system more robust and easy to design, face alignment are performed to justify the scales and orientations of these patches. Besides serving as the pre-processing for face recognition, face detection could be used for region-of-interest detection, retargeting, video and image classification, etc.

1.2 Feature Extraction

After the face detection step, human-face patches are extracted from images. Directly using these patches for face recognition have some disadvantages, first, each patch usually contains over 1000 pixels, which are too large to build a robust recognition system. Second, face patches may be taken from different camera alignments, with different face expressions, illuminations, and may suffer from occlusion and clutter. To overcome these drawbacks, feature extractions are performed to do information packing, dimension reduction, salience extraction, and noise cleaning. After this step, a face patch is usually transformed into a vector with fixed dimension or a set of fiducial points and their
corresponding locations. In some literatures, feature extraction is either included in face detection or face recognition.

1.3 Face Recognition

After formulating the representation of each face, the last step is to recognize the identities of these faces. In order to achieve automatic recognition, a face database is required to build. For each person, several images are taken and their features are extracted and stored in the database. Then when an input face image comes in, we perform face detection and feature extraction, and compare its feature to each face class stored in the database. There are two general applications of face recognition, one is called identification and another one is called verification. Face identification means given a face image, we want the system to tell who he/she is or the most probable identification; while in face verification, given a face image and a guess of the identification, we want the system to tell true or false about the guess.

II. PROBLEM DEFINITION

Taking attendance is a long process and takes lot of effort and time, especially if it involves huge number of students. It is also problematic when an exam is held and causes a lot of disturbance. Moreover, the attendance sheet is subjected to damage and loss while being passed on between different students or teaching staff. And when the number of students enrolled in a certain course is huge, the lecturers tend to call the names of students randomly which is not fair student evaluation process either. This process could be easy and effective with a small number of students but on the other hand dealing with the records of a large number of students often leads to human error.

III. PROPOSED SYSTEM

We propose a system that provides a solution to the above mentioned problems by automating the process of attendance management that can be used during exams or a lecture which will save effort and time.

The system consists of a camera that captures the image of the classroom and sends it to the image processing module which then forwards it to the comparison module at the beginning of the session. In the processing module the image is enhanced to facilitate the matching process. After this face detection and recognition is performed. The image is captured again at the end of the session, sent to the processing module and forwarded to the comparison module again. At this junction both the images are compared and the students who are present in both the images are marked present in the database. In case a student is present whose face is not recognized, the lecturer can update the system manually.

IV. IMPLEMENTATION

The system uses Viola-Jones algorithm for face detection and PCA algorithm for face recognition.

4.1 Face Detection

The Viola–Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones. Although it can be trained to detect a variety of object classes, it was motivated primarily by the problem of face detection. The characteristics of Viola–Jones algorithm which make it a good detection algorithm are:

- Robust – very high detection rate (true-positive rate) & very low false-positive rate always.
- Real time – For practical applications at least 2 frames per second must be processed.
• Face detection only (not recognition) - The goal is to distinguish faces from non-faces (detection is the first step in the recognition process).

There are three major blocks in Viola-Jones algorithm; Integral Images, Ada-Boost Algorithm and Attentional cascade. The integral image computes a value at each pixel for example \((x, y)\) that is the sum of the pixel values above to the left of \((x, y)\). This is quickly computed in one pass through the image. Viola Jones algorithm uses Haar like features. This is nothing but scalar product between the image & some haar like structures. Feature is selected through adaboost. Ada-Boost provides an effective learning algorithm and strong bounds on generalization performance. The overall form of the detection process is that of a degenerate decision tree, what we call a “cascade”. A positive result from the first classifier triggers the evaluation of a second classifier which has also been adjusted to achieve very high detection rates. A positive result from the second classifier triggers a third classifier, and so on. A negative outcome at any point leads to the immediate rejection of the sub window. The cascade training process involves two types of trade-offs. In most cases classifiers with more features will achieve higher detection rates and lower false positive rates. At the same time classifiers with more features require more time to compute. In principle one can use following stages.

i) the number of classifier stages, ii) the number of features in each stage, and iii) the threshold of each stage, are traded off in order to minimize the expected number of evaluated features.

4.2. Face Recognition

Face Recognition technique uses the Product Component Analysis (PCA) method. PCA could be used on a collection of face images to form a set of basis features. These basis images, known as Eigen-pictures, could be linearly combined to reconstruct images in the original training set. If the training set consists of \(M\) images, principal component analysis could form a basis set of \(N\) images, where \(N < M\).

![Figure 1:Eigenfaces](image)

A set of eigenfaces can be generated by performing a mathematical process called PCA on a large set of images depicting different human faces. Informally, eigenfaces can be considered a set of "standardized face ingredients", derived from statistical analysis of many pictures of faces. Any human face can be considered to be a combination of these standard faces.
4.3 Working

Students in a class enroll themselves and their faces are captured and entered in the database. Once all the students are entered in the database, the system can be used to mark attendance. To make the system fool proof, the images are captured twice - once at the beginning of the class and once at the end. Both the images are used to identify and recognize a student and the student is marked present only if he/she is recognized in both the images.

Figure 2. Sequence diagram

V. CONCLUSION

In this system we have implemented an attendance system by which lecturers or teaching assistants can record student’s attendance. It saves time and effort, especially if it is a lecture with huge number of students. Another application of this system is that it is capable of marking the presence of employees at any workplace. The system can be useful in many other areas and can replace the existing systems of attendance marking.

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