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Smart Cognitive Bot for Attendance Marking Using Principal Component Analysis Algorithm

Suraj Rawat

Undergraduate Student (B.Tech Student) , Department of Computer Science and Engineering ,ABES Engineering College, Ghaziabad , Uttar Pradesh, India

ABSTRACT: Face recognition is an essential field in many applications, one of which is marking Employee's Attendance . Now days taking the attendance of the Employees in Company had become a tedious job. Person identification is one of the most crucial building blocks for smart interactions. Among the person identification methods, face recognition is known to be the most natural ones, since the face modality is the modality that uses to identify people in everyday lives. Although other methods, such as fingerprint identification, can provide better performance, those are not appropriate for natural smart interactions due to their intrusive nature. In contrast, face recognition provides passive identification that is the person to be identified does not need to cooperate or take any specific action. So a company can recognize its regular employees while they are entering the company.
This Project is aimed for implementing a system that is capable of identifying the employees in an organization, marking their attendance. Therefore face recognition is used to mark the attendance of the employees. Smart Attendance using Real Time Face Recognition (SMART-FR) provides flexibility to identify several employees at the same time separately rather than identifying one by one. To increase the accuracy, efficiency and reliability of the recognition, algorithms are needed. Principle Component Analysis (PCA) and Haar cascade are used to address those tasks. The PCA is one of the most successful techniques that had been used in image recognition and compression
The software is to provide employers an easier and fool-proof way to mark attendance of the employees. The software will allow administrators enroll employees. The software will allow employees have their face captured for attendance marking purposes. Only administrators will have direct manipulation rights to the system. Employees will have no other interaction with the system except for having their faces captured whilst they are entering the office. It will be a console application and would require maximum uptime due to its sensitive purpose.

KEYWORDS: Active Appearance Model, Independent Component Analysis , Increment Sign Correlation, Principal Component Analysis, Receiver Operating Characteristics , Attendance Automation System using face Detection and Recognition, Smart Face Recognition, Automatic Target Recognition

I. INTRODUCTION

Organizations of all sizes use time and attendance systems to record when employees start and stop work, and the department where the work is performed. However, it's also common to track meals and breaks, the type of work performed, and the number of items produced. In addition to tracking when employees work, organizations also need to keep tabs on when employees are not working. Vacation time, compensation time, Family and Medical Leave Act (FMLA) time, and jury duty must be recorded. Some organizations also keep detailed records of attendance issues such as who calls in sick and who comes in late.
A time and attendance system provides many benefits to organizations. It enables an employer to have full control of all employees working hours. It helps control labor costs by reducing over-payments, which are often caused by transcription error, interpretation error and intentional error. Manual processes are also eliminated as well as the staff

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needed to maintain them. It is often difficult to comply with labor regulation, but a time and attendance system is invaluable for ensuring compliance with labor regulations regarding proof of attendance.
Face recognition is an essential field in many applications, one which is Attendance Management System. Now days taking the attendance of the Employees in Company had become a tedious job. Person identification is one of the most crucial building blocks for smart interactions. Among the person identification methods, face recognition is known to be the most
natural ones, since the face modality is the modality that uses to identify people in everyday lives. In contrast, face recognition provides passive identification that is the person to be identified does not need to cooperate or take any specific action. So a company can recognize its regular employees while they are entering and leaving the company premises.

II. LITERATURE SURVEY

Attendance as defined by the Merriam-Webster dictionary:
: The number of people present at an event, meeting, etc.
: The act of being present at a place
: A record of how often a person goes to classes, meetings, etc.
Companies with large employee numbers might need to install several time clock stations in order to speed up the process of getting all employees to clock in or out quickly or to record activity in dispersed locations.
Depending on the supplier, identification method and number of clocking points required, prices vary widely. A time and attendance system protects a company from payroll fraud and provides both employer and employees with confidence in the accuracy of their wage payments all while improving productivity.

Manual systems

Manual systems rely on highly skilled people laboriously adding up paper cards which have times stamped onto them using a time stamping machine such as the Boundary Clock. Time stamping machines having been in use for over a century are still used by many organizations as a cheaper alternative to time and attendance software.

Automated systems

Automated time and attendance systems can use electronic tags, barcode badges, magnetic stripe cards, biometrics (vein reader, hand geometry, fingerprint, or facial), and touch screens in place of paper cards which employees touch or swipe to identify themselves and record their working hours as they enter or leave the work area. The recorded information is then ideally automatically transferred to a computer for processing although some systems require an operator to physically transfer data from the clocking point to the computer using a portable memory device.

III. SYSTEM DESIGN (A)

As can be assumed, detecting a face is simpler than recognizing a face of a specific person. In order to be able to determine that a certain picture contains a face (or several) we need to be able to define the general structure of a face. Luckily human faces do not greatly differ from each other; we all have noses, eyes, foreheads, chins and mouths; and all of these compose the general structure of a face.

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Consider the following 5 figures:

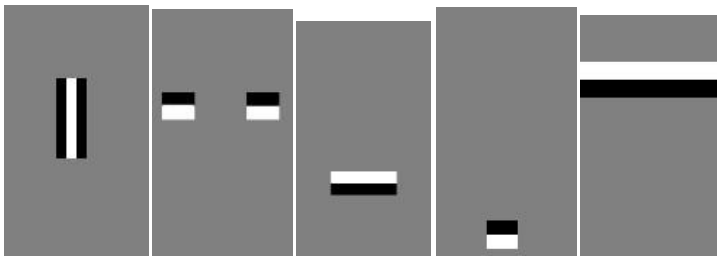

Fig 1: Different features of human face

Each of these figures represents a general feature of a human face. Combining all the features together we, indeed, receive something that resembles a face.

Fig 2: Combined image of all features

By determining if each of these features is similar to some part of our picture, we can conclude if the picture contains a face or not. Notice that this does not have to be an accurate match; we just need to know if, roughly, each of these features corresponds to some part of the image. The technique used for this purpose is Template Matching.
By gathering statistics about which such features compose faces and how, we can train our algorithm to use the right features in the right positions; and thus detect faces.
Let's see an example. See in the figures below how the above features can be used to detect a face (namely, the face of President Barack Obama).

Fig 3:Facial Feature extraction from a given image

Face Detection Example
In order for this process be quick, we design it in such a way that we first check the coarse features which represent the coarse structure of a face; and only if these features match, we continue to the next iteration and use finer features. In

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each such iteration we can quickly reject areas of the picture which do not match a face, and keep checking those which we are not sure about. In every iteration we increase the certainty that the checked area is indeed a face, until finally we stop and make our determination.
In other words, rather than determining if the image does contain a face, we can more quickly determine if the image does not contain a face; because eliminations can be done quickly, while acceptance of faces will require more time. We call such a process a cascading process.

SYSTEM DESIGN(B)

My approach to perform the face recognition is simple. It can be broken down into the following steps:
1. Load flattened training images into array
2. Perform Histogram Equalization on training images.
3. Perform principal component analysis on the Histogram Equalized images.

PCA (Principal Component Analysis) PCA method has been widely used in applications such as face recognition and image compression.
PCA is a common technique for finding patterns in data, and expressing the data as eigenvector to highlight the similarities and differences between different data [6]. The following steps summarize the PCA process.
1. Let {D1,D2,…DM} be the training data set. The average Avg is defined by:

$$Avg = \frac{1}{M} \sum_{i=1}^{M} Di$$

2. Each element in the training data set differs from Avg by the vector Yi=Di-Avg. The covariance matrix Cov is obtained

$$Cov = \frac{1}{M} \sum_{i=1}^{M} Yi.Yi^{T}$$

3. Choose M' significant eigenvectors of Cov as EK's, and compute the weight vectors Wik for each element in the training data set, where k varies from 1 to M'

$$W_{ik} = E_k^T.(D_i - Avg), \forall i,k$$

4. Load test image(s)
5. Perform Histogram Equalization on test images.
6. Perform principal component analysis on Histogram Equalized test image(s)
7. Calculate Euclidian distance from test image to each training image and pick result with the smallest distance (=recognized face)

IV. EXPERIMENTS AND RESULTS

The step of the experiments process are given below:
1. Face Detection: Start capturing images through web camera of the client side:
Begin:
//Pre-process the captured image and extract face image
//calculate the eigen value of the captured face image and compared with eigen values of existing faces in the database.
//If eigen value does not matched with existing ones, save the new face image information to the face database (xml file).
//If eigen value matched with existing one then recognition step will done.
End;

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2. Face Recognition: Using PCA algorithm the following steps would be followed in for face recognition:
Begin: // Find the face information of matched face image in from the database. // update the log table with corresponding face image and system time that makes completion of attendance for an individual.
end; This section presents the results of the experiments conducted to cap

TABLE 1

TABLE 1: DESCRIBES THE OPENCV FUNCTION USED IN THE PROPOSED SYSTEM AND ITS EXECUTION RESULTS.

Test data	Expected Result	Observed Result	Pass/ Fail
OpenCAM_CB()	Connects with the installed camera and starts playing.	Camera started.	pass
LoadHaar Classifier()	Loads the HaarClassifier Cascade files for frontal face	Gets ready for Extraction.	Pass
ExtractFace()	Initiates the Paul-Viola Face extracting Frame work.	Face extracted	Pass
Learn()	Start the PCA Algorithm	Updates the facedata. xml	Pass
Recognize()	It compares the input face with the saved faces.	Nearest face	Pass

Table 1 describes the various OPENCV functions used in the proposed system with their observed and expected results.

Fig 4. Training images

Fig 4 ,shows Training images of 5 persons taken at different angles to estimate the recognition rate and its relation with the face movement.

FACE ORIENTATIONS	DETECTION RATE	RECOGNITION RATE
0 degree (frontal face)	96.7%	98%
30 degree	74%	81%
60 degree	60%	61%
90 degree	0%	0%

Table 2: FACE DETECTION AND RECOGINITION RATE

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A set of experiments to demonstrate the efficiency of the proposed method is done. 20 different images of 5 persons are used in training set. Figure 3 shows a sample binary image detected by the ExtractFace() function using Paul-Viola Face extracting Frame work detection method. From Table 2 **it is been observed that with the increasing of face angle with respect to camera face detection and recognition rate is become decreases.**

V. CONCLUSION AND FUTURE WORK

Automated attendance systems are more efficient than manual systems as it prevents employees from falsifying entries.The project is just a blueprint for implementing a full functional automated attendance system. After this blueprint, a thorough research should be carried out on this system, laying more emphasis on the impact it has on attendance and how it has enhanced company's employee-hour-output. The impact that this system have on the business sector should be studied and compared to that of the manual system I have successfully designed and implemented an automated attendance system. The entire system should be studied properly so as to detect the faults of the system and ways of improving it. Research should also be carried out on how to integrate this system into a fully functional employee management system and payroll.
Employee Management Systems should be implemented A leave management system should be implemented also.

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