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Haar Features Based Face Detection and Recognition for Advanced Classroom and Corporate Attendance

Tiwari Priti Anilkumar[1], Kalyani Jha[2], Karishma P Uchil[3], Naveen H[4]

U.G. Student, Dept. of ECE, M S Engineering College, Bangalore, India[1,2,3]

Assistant Professor, Dept. of ECE, M S Engineering College, Bangalore, India[4]

ABSTRACT:Face of a person is its recognition. Methods are implemented to exploit this physical feature have seen a great change after the image processing techniques came into existence. The attendance is taken in every schools, colleges, library and corporate offices. It takes some time to record attendance.In this approach, we are using face detection and recognition system. This face detection differentiates faces from non-faces and is therefore essential for accurate attendance. To avoid wastage in time, we are about to use an automatic process which is based on image processing. In the present approach along with the face recognition we are using face detection system. This face detection system detects faces of individuals on the basis of intensities of pixels in the snap shots. The ARM Processor module is used for displaying Number of Presentees and the people present. The camera will be connected to the ARM. The student or employees database is collected. The database includes name of the students/employees, there images. This webcam module will be installed at the front side of class in such a way that it can capture entire class or in front of a main office door. Thus with the help of this system, time will be saved and it will be very much convenient to record attendance.

KEYWORDS: Face Detection, Face Recognition, ARM, Attendance, intensities, pixels

I. INTRODUCTION

Face recognition is an old concept because of the practical importance of the topic and theoretical interest from cognitive scientists. Despite the fact that other methods of identification (such as fingerprints, or iris scans) can be more accurate, face recognition has always remains a major focus of research because it is people's primary method of person identification. Face recognition technology is gradually evolving to a universal biometric solution since it requires virtually zero effort from the user end while compared with other biometric options. Biometric face recognition is basically used in three main domains: time attendance systems and employee management, visitor management systems, and last but not the least authorization systems and access control systems.

The human faces represent complex, multidimensional, meaningful visual stimulant. Developing a computational model for face recognition is difficult [II]. Face detection can be regarded as fundamental part of face recognition systems according to its ability to focus computational resources on the part of an image containing a face. The process of face detection in images is complex because of variability present across human faces such as: pose expression, position and orientation, skin colour, presence of glasses or facial hair, differences in camera gain, lighting conditions and image resolution [3]. The analysis of facial expression was primary research field for psychologists in the past years [4]. At the same time, advances in many domains such as: face detection [5][6], tracking [7] and recognition [1], pattern recognition and image processing contributed significantly to research in automatic facial expression recognition.

Face detection should be performed before recognition system. This is done to extract relevant information for face and facial expression analysis. Two classes of techniques for face representation, relevant information extraction and geometrical feature extraction relies on parameters of distinctive features such as eyes, mouth and nose. At the same

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time, a face is represented as an array of pixel intensity values suitably pre-processed in appearance based approaches (texture). This array is then compared with a face template using a suitable metric [4]. Research [8] compared the performances of these representation techniques in face recognition. Over the past decade, many approaches for improving the performance of face detection have been proposed [9][10][11][12][13][14][15][16][17][18][19]. At the same time, many literature studies focused on survey on face detection techniques [20][21][22][23].

This paper shows how face recognition can be used for an effective attendance system to automatically record the presence of an enrolled individual within the respective venue. Proposed system also maintains an excel file to keep records of the entry of every individual and marks the attendance.

II. RELATED WORK

The first attempts to use face recognition began in the1960's with a semi-automated system. Marks were made on Photographs to locate the major features; it used feature such as eyes, ears, noses, and mouths. Then distances and ratios were computed from these marks to a common reference point and compared to reference data. In the early 1970's Goldstein, Harmon and Lusk created a system of 21 subjective markers such as hair colour and lip thickness. This proved even harder to automate due to the subjective nature of many of the measurements still made completely by hand. Fisher and Elschlagerb approaches to measure different pieces of the face and mapped them all onto a global template, which was found that these features do not contain enough unique data to represent an adult face.

Another approach is the Connectionist approach, which seeks to classify the human face using a combination of both range of gestures and a set of identifying markers. This is usually implemented using 2-dimensional pattern recognition and neural net principles. Most of the time this approach requires a huge number of training faces to achieve decent accuracy; for that reason it has yet to be implemented on a large scale. The first fully automated system [5] to be developed utilized very general pattern recognition. It compared faces to a generic face model of expected features and created a series of patters for an image relative to this model. This approach is mainly statistical and relies on histograms and the grey scale value.

III. AIMS & OBJECTIVES OF PROPOSED PROTOTYPE

This proposed system prototyped is aimed to design & implement uniquely identifiable face detection and recognition device which can be easily implemented and operated.

The objectives of proposed model are summarized below:

1. Establish a real time face detection and recognition system with required accuracy.
2. In case of absence detected
    a) Marks absent for the absent student in existing database.
    b) Sends the message to parents of respective students.
3. Display the total number of students present on LCD display.

IV. LITERATURE REVIEW

Automated face recognition is a relatively new concept. Developed in the1960s,the first semi-automated system for face recognition required the administrator to locate features (such as eyes, ears, nose, and mouth) on the photo-graphs before it calculated distances and ratios to a common reference point, which were then compared to reference da-ta. In the 1970s, Goldstein, Harmon, and Lesk used 21 specific subjective markers such as hair color and lip thickness to automate the recognition. The problem with both of these early solutions was that the measurements and locations were manually computed. In 1988, Kirby and Sirovich applied principle component analysis, a standard linear algebra technique, to the face recognition problem. In 1991, Turk and Pentland discovered that while using the eigenfaces techniques, the residual error could be used to detect faces in images Although the approach was somewhat constrained

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by the environmental factors, thenonetheless created significant interest in furthering auto-mated face recognition technologies.The technology first captured the public's attention from the media reaction to a trial implementation at the January 2001 Super Bowl, which captured surveillance images and compared them to a database of digital mug shots. This demonstration initiated much-needed analysis on how to use the technology to support national needs while being considerate of the public's social and privacy concerns.

The PCA method was developed in 1991 [Turk and Pentland, 1991]. In [Belhumeur, Hespanha and Kriegman1997], the PCA method is used for dimension reduction for linear discriminate analysis (LDA), generating a new paradigm, and called fisherface. The fisherface approach is more insensitive to variations of lighting, illumination and facial expressions. However, this approach is more computationally expensive than the PCA approach.

In this paper, they propose a new method for face recognition using PCA and RBF neural networks. The RBF neural networks have been used due to its simple structure and faster learning ability [Moody and Darken, 1989; Girosi and Poggio, 1990]. The face features are extracted by the PCA method, reducing the dimensionality of input space. It has been seen that variations between the images of the same subject due to variation in pose, orientation, etc. are quite high. Therefore, to achieve high recognition rate, structural information of face images of the same subject is considered for classification process. This has been realized by identifying sub-clusters corresponding to a subject separately using a clustering algorithm. Then the prototypes of these sub-clusters are used to model the hidden layer neurons of the RBF neural networks. This process also improves its generalization capabilities

V. NEED FOR PROPOSED SYSTEM

Automate the whole process of taking attendance, manually which is a laborious and troublesome work and waste a lot of time, with its managing and maintaining the records for a period of time is also a burdensome task.
Computers that detect and recognize faces could be applied to a wide variety of practical applications including criminal identification, security systems, identity verification etc.
Face detection and recognition is used in many places nowadays, in websites hosting images and social networking sites.
Face recognition can be used for an effective attendance system to automatically record the presence of an enrolled individual within the respective venue.
One of the main advantage of a biometric time and attendance system is it avoids "buddy-punching". Buddy punching was a major loophole which will be exploiting in the traditional time attendance systems.

VI. PROBLEM STATEMENT

- Wastage of time and resources in taking attendance manually.
- Unidentified individuals accessing and exploiting valuable information about clients.
- Other methods of identification (such as fingerprints or iris scans) requires separate tools and can be deceived.
- Moreover these methods alert the suspect.

VII. BLOCK DIAGRAM

DESCRIPTION:

We are using a two-step mechanism. First comes to be face detection then followed by face recognition. For face detection we are using Viola Jones face detection algorithm while for face recognition we are using hybrid algorithm from PCA and LDA, and then it is interfaced with the hardware, where the LCD displays the no. of Present students. And GSM sends message to the students who are absent.

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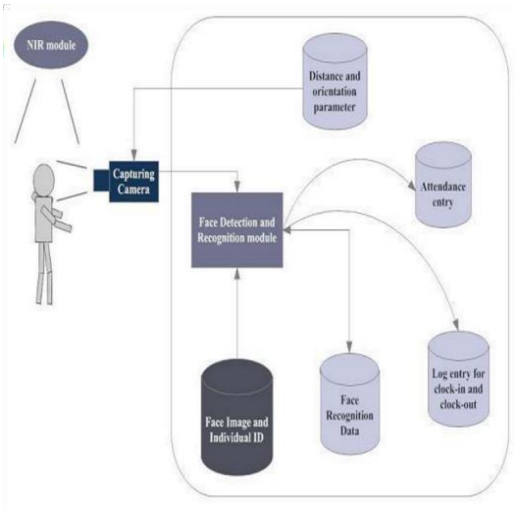

Fig 1: Architecture of the system

The figure 1 and figure 2 describes the architecture of the system , from capturing of the image , planning,to face detection and recognition and then updating attendance as required..

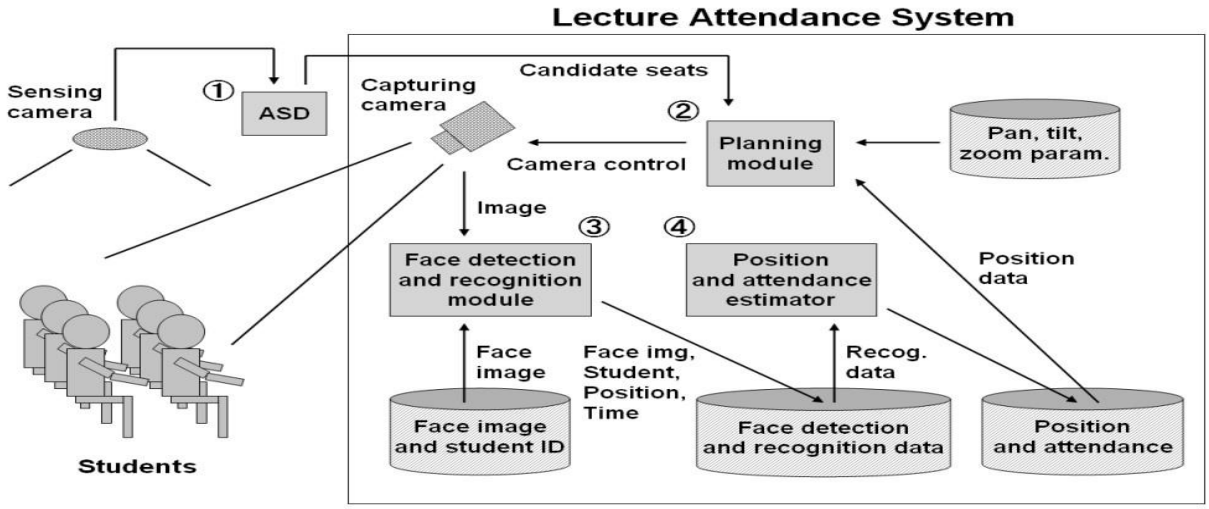

Fig 2: Architecture of the system

Viola-Jones algorithm

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 Ada-boost. Ada-Boost provides an effective learning algorithm and strong bounds on generalization performance.

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 [23]. The following steps summarize the PCA process.

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First,Code is executed and the detection part is done and the person detected is saved in the excel file.Then the recognition code is executed if the faces are detected in the excel sheet it is marked as present (P) else absent. The optional final step is that if an unknown face is seen repeatedly, it shows not recognized. The architecture is as shown in the figure.The Hardware Part of the System Contains the ARM processor, LCD display, GSM module, LM317, USB to UART. The input from the laptop is sent to the ARM, it is processed. The number of students present is shown in the LCD display. The ARM also sends a signal to the GSM which sends the message to the respective phone number of the student's parents who are absent.The Hardware is as Shown in the figure below in figure 2.If the system is used for offices, messages will be sent to the respective employee as well as to their team leader or head of department.

VIII. SIMULATION RESULTS

In this paper, our proposed system consists of two kinds of cameras. One is the sensing camera on the ceiling to obtain the seats where the students are sitting. The other is the capturing camera in front of the seats to capture images of student's face. Seats information processing: this process determines the target seat to direct the camera. We adopt the approach called Active Student Detecting method (ASD). The idea of this approach is to estimate the existence of a student sitting on the seat by using the background subtraction and inter-frame subtraction of the image from the sensing camera on the ceiling. Shooting plan: our system selects one seat from the estimated sitting area obtained by ASD, directs the camera to the seat and captures images.

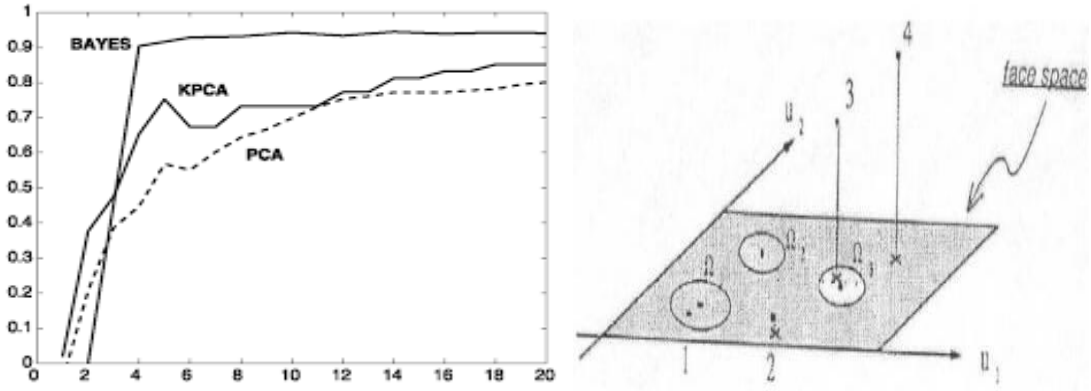

Fig 4 (a): Comparison of thresholds supported by different algorithms
(b): Space between face features

The threshold value which we are using in our proposed system is greater than 5000 dB but PCA algorithm supports thresholds of very small scale which can be seen from Fig 4 (a). Above figure shows comparison between different algorithms for different thresholds. Fig 4 (b) shows space between face features which is used to distinguish between different faces. The system processes the face images which are detected from the captured image, archived and recognized. Face detection data and face recognition data are recorded into the database. Attendance information processing: this process estimates the attendance by interpreting the face recognition data obtained by continuous observation. The module obtains the most likely correspondence between the students and the seats under the constrained condition. The system regards a student corresponded to each seat as present. The position and attendance of the student are recorded into the database. The procedure is repeated during lecture, and estimated the attendance of the students in real time.

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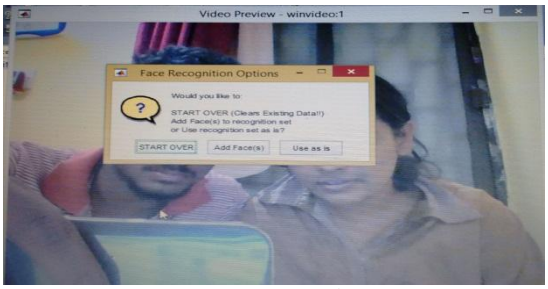

Fig 5(a): Selection of required process

As shown in the above Fig 5(a) options will be available for three different processes 1.Start Over 2.Add Faces 3. Use as is. The Start Over option will erase all the entries of database and registration can be done from the beginning, the Add Faces will allow user to add new entries into the existing record while Use as is will start recognition and updating process

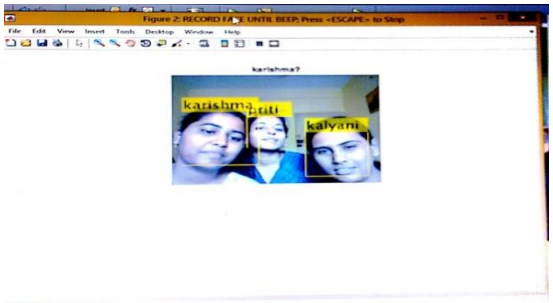

Fig 5(b): Detection and Recognition

Once the detection is done, The Recognition code is automatically executed and names of the individuals given during detection is recognized is shown as shown in the figure 5(b)

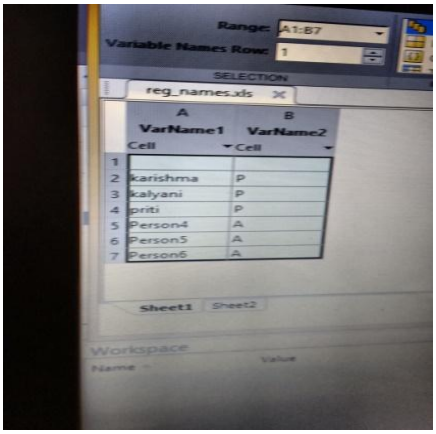

Fig 5(c): Marking Attendance in Database

After the Recognition is done, The code automatically redirects and the attendance is automatically updated in the excel as shown in the figure 5(c). The individuals who are recognised are marked as present (P) and the individual who are not recognised and are registered is marked as absent (A).

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IX. CONCLUSIONS

We came to know that there are wide range of methods such as biometric, RFID based etc. which are time consuming and non-efficient. So to overcome this, above system is the better and reliable solution from every perceptive of time and security. Thus we are set to achieve and develop a reliable and efficient attendance system to implement an image processing algorithm to detect faces in classroom and to recognize the faces accurately to mark the attendance. In order to obtain the attendance of individual student and to record their time of entry and exit, the system takes attendance of each student by continuous observation. Current work is focused on the face detection algorithms from images or video frames**.**

X. FUTURE ENHANCEMENT

The following future enhancement can be made into proposed system by devising software algorithms and hardware implementations:

1. System can be modified for the detection of low intensity pixels so that even in darker areas persons can be detected.
2. System can be programmed in such a way that reduces the effect of variation of distances on detection.
3. Programming can be done using proposed system for security purposes.

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