ATTENDANCE SYSTEM USING FACIAL RECOGNITION

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ABSTRACT: *In this paper, we propose a system that marks the attendance of students in a class. Our system takes the attendance automatically using face recognition. Attendance marking in a classroom during a class is a very hectic and a time-consuming task. There are certain problems in traditional attendance systems like: Additional efforts are required from the teacher who must make sure to correctly mark attending students, which at the same time wastes a considerable amount of time from the teaching process. It can also get much more complicated if one has to deal with large group of students. Identification of proxy attendances is very difficult in traditional attendance systems. The need of efficient and automatic techniques of marking attendance is a growing challenge in the area of face recognition.*

I. INTRODUCTION

In today's growing development in the field of recognition, Biometric recognition has the potential to become an irreplaceable part of many identification systems used for evaluating the performance of people working within an organization. Although biometric technologies are being applied in many fields it has not yet delivered its promise of guaranteeing automatic human recognition.

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. Using face recognition, we propose a framework or an application that can be used in organizations/institutes/classrooms to upload attendance of the employees or students.

In traditional attendance systems, the attendance is taken physically. For example, in an institution, the attendance is taken through attendance sheets which is a very tedious and repetitive task. It also consumes a lot of time and detection of false presence is very difficult. Therefore, using facial recognition for attendance is very effective and much easier as it won't consume much time and no false attendance could be marked as the attendance would only be uploaded for those students who are physically present in the class.

II. PROBLEM DEFINITION

Every time a lecture starts the lecturer delays the lecture to record students' attendance. This is a lengthy process and takes lot of time and effort, especially if it is a lecture with vast number of students. It also causes a lot of disturbance and interruption when an exam is held. Moreover, the attendance sheet is subjected to damage and loss while being passed on between different students in the class. And when the number of students enrolled in a certain course is huge, there is a huge chance of proxy attendances which are very difficult to detect. Finally, these attendance records are used by the staff to monitor the student's attendance rates.

III. CRITICAL REVIEW OF RESEARCH PAPERS

Liton Chandra Paul et al. [1] described the building of face recognition system by using Principal Component Analysis and explains it's working. Every image in PCA is represented as linear combination of weighted eigen vectors known as eigenfaces. The test image is projected on the eigenface space and Euclidean distance is found. The training set image which has the least Euclidean distance is selected as the best match. Euclidean distance provides measurement of similarity between two images. The process is divided into two processes: Initialization Process and Recognition Process. In initialization process, the images are uploaded as training set and eigenfaces are found and stored. In recognition

process, set of weights are calculated for input images by projecting input image on each eigenface, it is determined that the image is a face at all or not by checking if the image is close to free space. If it is a face, it is determined whether it is a known face or not using the weight pattern. If an unknown face is seen repeatedly, the weight pattern of that face image is captured and added into known faces.

Yohei Kawaguchi et al. [2] have implemented continuous monitoring and fixed seating for automatic attendance marking. It is done by capturing images of the students present in the class. In this system 2 cameras are used, one is sensing camera and other one is capturing camera. Sensing one is placed at the ceiling it captures the seats where the students are sitting whereas the capturing camera is in front to capture images of student's face. Face detection and recognition module detects faces from the image captured by the camera, and the image of the face is cropped and stored. In the proposed system, capturing and matching of picture is done again and again this is termed as "continuous observation". It improved the performance for estimation of the attendance.

Nirmalya Kar et al. [3] proposed a method for Student's Attendance System using PCA as facial recognition algorithm. Facial Recognition is not the most accurate biometric, but it is evolving to a universal biometric solution because it requires no effort from the user end. Firstly, the system is initialized by adding a face space which contains of training images of faces. Then, an eigenface is calculated for the face captured by the camera. On comparing it with known faces and after some analysis, it is determined that if the image is a face at all. If it's a face, then the system identifies if it is a known face or not. Also, if the system sees an unknown face repeatedly, it can learn to recognize it. PCA is used for finding patterns in data and expressing the data as eigenvectors. 30 images of 10 persons were used as training set and image was extracted using Paul-Voila face extracting framework detection method. Increasing face angle with respect to the camera decreases detection and recognition rates.

J. G. Roshan Tharanga et. Al [4] proposed a research aimed to implement a system that can identify the employees in an organization, mark their attendance and handle their leave requests in an automated way. Smart Attendance using Real Time Face Recognition (SMART-FR) provides flexibility to identify multiple employees at the same time and maintain leave requests. Two algorithms, PCA and Haar Cascade are used in the implementation. To handle the leave requests, a simple SMS has to be sent by the employee and NLP has been used to process that SMS. PCA is used for face recognition. Haar cascade is used for feature extraction. The change in contrast values between adjacent pixels is used instead of intensity of a pixel. Certain constraints are presented in the paper such as the picture quality should be good, the camera should be installed in an area with good lighting, if a person has worn spectacles or has a beard while entries in database are made, then he should have the same appearance during face recognition, otherwise the database needs to be updated. The accuracy of this system was 61%.

Abhishek Jha et al. [5] proposed a statistical technique PCA and also matched the image taken and the stored image for attendance marking. Color based detection and Principle Component Analysis (PCA) are used for face detection feature extraction. Color based technique was implemented, which depends on the detection of the human skin color with all its different variations in the image. The skin area of the image is then segmented and it is then passed to the recognition process. For recognition, PCA technique has been used. They extracted the features from the image for example outline of face, nose and eyes etc. The highest match score, the greater chance to get attendance marked.

Poornima et. Al [6] proposed an automated attendance system using facial recognition with audio output. Facial recognition is done in three steps, firstly image acquisition is done then these images are processed to reduce noise, sharpen

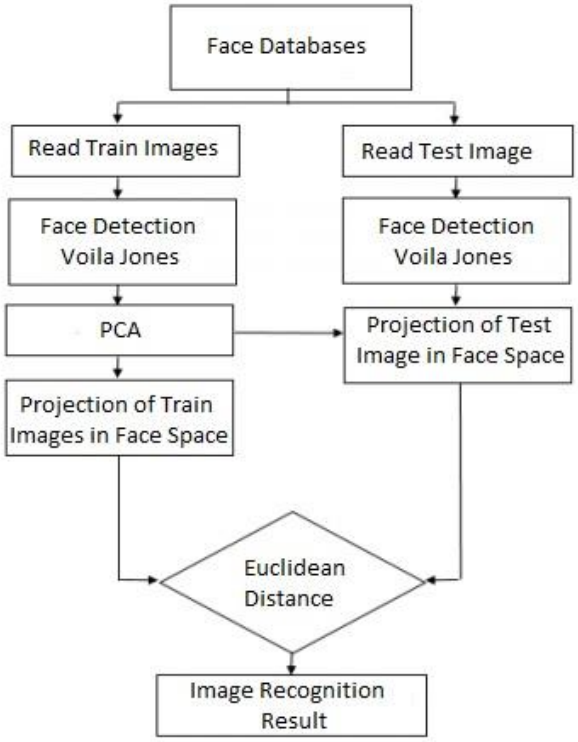
edges. After these two steps face detection is done by voila jones algorithm and features are extracted to be matched with the database. Names of matched images are marked as present and rest are marked as absent, then names of absentee are converted to voice to recheck. Further in this paper facial distance measure is used for gender classification.

PAN Xiang [7] proposed RFID card swapping and Face recognition technique has been used. To enter, first a person has to touch his card then the system reads the information in the card and meanwhile the video camera is started to take photos of the person. Then the face is captured. The information in the card is obtained and the face corresponding to the card is obtained. If the obtained and captured face is matched from the database, then the person will be passed, else he/she can't enter the room.

Manop Phankokkruad et al [8] proposed a method for face recognition using well known algorithms namely Eigenfaces and LBPH. The experiments conducted in the respects of the variation of facial expressions, and face viewpoints in the actual classroom. Eigenfaces refers to an appearance-based approach to face recognition that seeks to capture the variation in a collection of face images. Eigenfaces is based on the principal components analysis (PCA) of a distribution of faces. Local Binary Pattern Histrogram (LBPH) is the local feature based for face representation This method is based on local binary patterns(LBP). LBPH has the advantage of invariant to the light intensity, but it takes more processing time rather than the holistic approach. The facial expression that has the most impact on accuracy is the grin, and face viewpoints that affect accuracy are looking down and tilting left, and right respectively. Therefore, LBPH is the most suitable algorithm to apply in a class attendance checking system after considering the accuracy.

Nawaf Hazim Barnouti et al [9] introduced appearance-based features that focus on the entire face image rather than local facial features. The first step in face recognition system is face detection. Viola-Jones face detection method that capable of processing images extremely while achieving high detection rates is used. Feature extraction and dimension reduction method will be applied after face detection. Principal Component Analysis (PCA) method is widely used in pattern recognition. Linear Discriminant Analysis (LDA) method that used to overcome drawback the PCA has been successfully applied to face recognition. It is achieved by projecting the image onto the Eigenface space by PCA after that implementing pure LDA over it. Square Euclidean Distance (SED) is used.

IV. PROPOSED ALGORITHM



VIOLAJONES

Viola Jones is a framework for real time object detection, majorly used for face detection. Viola Jones has four stages:

Haar Features: Haar features are used to detect the presence of a feature in the given image. Each feature results in a single value calculating by subtracting the sum of pixels under white rectangle from the sum of pixels under black rectangle.

Integral Image: In an integral image the value at pixel (x,y) is the sum of pixels above and to the left of (x,y).

Adaboost: Adaboost identifies redundant features which are not relevant and removes them. Adaboost constructs a strong classifier as a linear combination of weak classifiers(features).

$$F(x) = a1f1(x) + a2f2(x) + \cdots$$

Cascading: Cascading classifier is composed of stages each containing a strong classifier. The features are grouped into several stages. The job of each stage is to determine whether a given sub window is definitely not a face or may be a face. If a sub window fails at any stage, it is discarded as not a face.

PCA

1) Training set of total M images are used to compute the Average Mean as shown in the equation below:

$$average = \frac{1}{M}\sum_{n=1}^{M} TrainingImages\,(n)$$

2) Original image will be subtracted from the Average Mean as shown in the equation below:

$$sub = TrainingImages - avg$$

3) Calculate the Covariance Matrix as shown in the equation below:

$$Covariance = \sum_{n=1}^{M} sub(n)sub^{T}(n)$$

4) Calculate the Eigenvalues and Eigenvectors of the Covariance Matrix.

5) Sort and choose the best Eigenvalues. The highest Eigenvalues that belong to a group of Eigenvectors is chosen, these M Eigenvectors describe the Eigenfaces. Given that new faces are encountered, the Eigenfaces can be updated or recalculated accordingly.

6) Project the training samples onto Eigenfaces.

7)Calculate Euclidean distance between test image and each of the image in training dataset.

$$EuclideanDistance(X,Y) = \sqrt{\sum_{n=1}^{No.\ of\ images} (X_n - Y_n)^2}$$

8) Find the face class with minimum Euclidean distance which shows similarity to test image.

V. RESULT

We have measured the accuracy of our project using following measure:

True positive: Actually positive and predicted positive
False positive: Actually negative but predicted positive.l
False negative: Actually positive but predicted negative.
True negative: Actually negative and predicted negative.

Predicted/Actual	Positive	Negative
Positive	**17 (TP)**	**0 (FP)**
Negative	**8 (FN)**	**5 (TN)**

$$\boldsymbol{Accuracy = \frac{TP + TN}{TP + TN + FP + FN}}$$

$$\boldsymbol{Accuracy = \frac{17 + 5}{17 + 5 + 0 + 8} = 73.33\%}$$

$$\boldsymbol{Precision = \frac{TP}{TP + FP}}$$

$$\boldsymbol{Precision = \frac{17}{17+0} = 100\%}$$

$$\boldsymbol{Recall = \frac{TP}{TP + FN}}$$

$$\boldsymbol{Recall = \frac{17}{17 + 8} = 68\%}$$

VI. CONCLUSION

We proposed an attendance management system using facial recognition. Current automated attendance systems based on facial recognition are not entirely efficient. These systems are generally based on a single algorithm for facial recognition, but in our proposed solution we intend to increase the efficiency by using multiple algorithms. The result of our preliminary experimental work shows slight improvement over some systems.

VI. REFERENCES

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