

PCA based Facial Recognition for Attendance System

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Abstract— *One of the most important issues about authentication from the long period of history is the user authentication. Among all the techniques for user authentication, human face recognition (HFR) is a well-known technique. As the human face recognition goes under the part of biometric confirmation, HFR has been generally utilized in numerous applications like surveillance systems, entrance of houses, mobile face unlock, and network security. This paper introduces a novel method for student attendance system in the classroom using face recognition technique. The human face attendance system is developing based on the current image recognition technology in order to detect the faces of the students in a classroom and mark attendance of the person if he or she is matched with the facial data in the given facial database. This HFR system will independently mark the attendance of the students in a classroom without disturbing the teacher, so that the teacher can enhance their teaching role in different ways. The time can be saved by using the proposed system. The idea is developed by using an open CV.*

Keywords— *Human face recognition, face capture, Eigen values*

I. INTRODUCTION

In today's world authentication plays an important role in many things like security etc. Now a days, facial recognition plays an important role in authentication. From the last few years, need for facial recognition has improved drastically. Face recognition is now a days of high demand for both commercial as well as security purposes.

The image recognition framework is categorized into 2 kinds, feature based framework and image-based framework. In the primary framework, features are extracted from the eye, nose, mouth, and so on which are then combined mathematically to decide the connection between these features. While in the subsequent framework the image pixels are subjected to algorithms like Principal Component Analysis, wavelet change, and so on which is then utilized for image characterization.

If the attendance marking is based on handwritten or printed it typed characters, it can be executed with the help of optical character recognition (OCR).[1] The recognized information generated could be used to update the attendance. Since this mode of taking attendance needs the handwritten data or the typed data, it takes time. Instead if

there is an attendance recognition which further minimizes the time by directly capturing the features of face in camera and converts into attendance. This idea is implemented with Principle component Analysis method for facial recognition.

In order to check the efficiency of the algorithm, the data used were the faces of students of same age. The attendance was automatically recorded whenever a face was recognized. The results took much less time compared to manual attendance.

II. REVIEW OF LITERATURE

One of the works related to HFR is by Olanike et al. They have given an idea of managing the attendance using finger print [2] In this system, a movable fingerprint device will be passed among the students and they will place their fingers on this device. So due to this, there will be a chance of procurator. This makes a disturbance in the classroom. It reduces the concentration ability of both teacher and student. It takes a lot of time in order to take attendance. A number of works related to Radio Frequency Identification (RFID) based attendance Systems exist in the literature.

The other work related to HFR is by Arulogun et al., [3]. Here, radio frequency Identity (RFID) is used..In this the students should carry the tags if they forgot to carry the tag they may lose attendance for the whole day and they can enter into the class easily by doing procurator.

There was a face recognition algorithm proposed by Lukas et al., [4]. Here face recognition system but was implemented by taking more than one image of a same person which takes more space to store.

In the idea given by K. Okokpujie et al., [5], GSM notifications are used to share data to user this makes more expensive user require GSM sim to receive result to use. Modified version of finger print verification is proposed by Saraswat et al., [6] and Shoewu et al.,[7]

Regarding the attendance system a QR code based attendance was implemented but in this the procurator was proposed. [8][9]. Dey et al., gave an idea of speech niometric [10].They have related speech based biometric attendance and has developed in this system if a student is suffering from any vocal cord problems. This will not recognize the voice so there will be no proper attendance.

Sivaganesan proposed an idea of developing Artificial intelligence enabled computing which can be used for IoT applications. [11]. Image recognition was applied for detecting leak in automobiles by Manoharan [12]

III. PROPOSED METHODOLOGY

The existing system attendance system has many ways to enter attendance like manually, fingerprint, etc. in these system's there are many problems

In manual method the attendance should enter manually and it takes time and effort and also sometimes there happened mistakes and proxy can be possible,

Fingerprint proxy is easily possible through fingerprint cast and there is a chance that finger can't be recognized. In that case, attendance cannot be taken, and hence there will be chances of failure.

There is one more method which is rarely used which is speech recognized in this method there are more of failure than success rate in speech attendance system if user is suffering from any throat disorder then detector cant recognize his voice .[13]

Previously the attendance system is performed through QR code scanning. But it is failed due to more performance of procurators.so due to this any of can enter into the class other than students and staff by using their mobile.

The problem with already existing face recognition system is it will recognize around six images of same person at time. So due to this it contains more storage and it takes more time to recognize. [14]

The attendance taking process becomes simple if the identity is recorded immediately after a person enters the class. As per the proposed model, his/her image will be recorded using camera at the entrance and the attendance shall be recorded upon recognizing the face. When the student's face is recognized it will post-process so, that students can view their attendance status instantly.[15]

The PCA algorithm uses Eigen vectors of the covariance matrix that corresponds to the largest Eigenvalues.

The steps in saving the information to database is in Fig. 1 and the recognition steps are in Fig 2

The different phases involved in the process are

- *Pre-process Image*

The system will capture a single image of every individual's faces. This image will be converted into gray scale and stored in the database along with the student name and Roll number.

- *Face detection*

As soon as a student enters the class and shown his/her face in front of the camera, the camera will place a frame over the face and convert the face into gray scale and submits to the next phase.

- *Feature Extraction*

The binary value of the previous phase will be used for feature extraction. Fisher face method is used for extracting the feature.

- *Face Recognition*

The face recognition is done by comparing the values obtained to the values stored in the database. In the event that the qualities are a match, at that point the face is perceived and the name related with that face is shown

The eigenfaces and fisher faces a holistic approach to face recognition. These algorithms take high-dimensional image space, the high-dimension is bad, so low-dimensional subspace is used

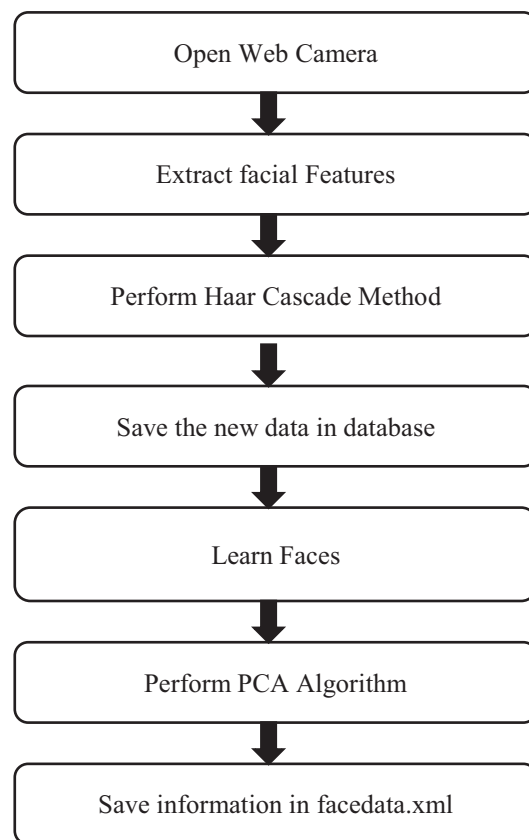


Fig. 1: Registration Phase

The Fisher Faces method worked great at least for the constrained scenario we've assumed in our model. In order to save the discriminative data, the Linear Discriminant Analysis is used. The steps involved in this process are:

1. Construct the scatter matrix S_a , S_b , S_c , S_d and find out the matrix within class scatter S_w as the sum of S_a , S_b , S_c , S_d
2. Calculate the Eigen vector and generalized Eigen values

3. Normalize the fisherface and calculate the weights of training image into normalized fisherface.

The face recognition model is shown in Figure 3

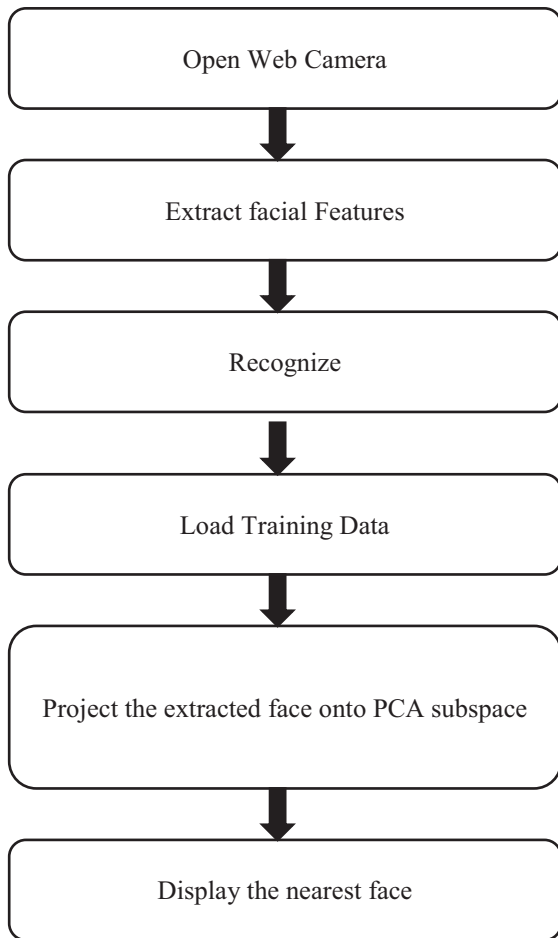


Fig. 2: Steps in recognition

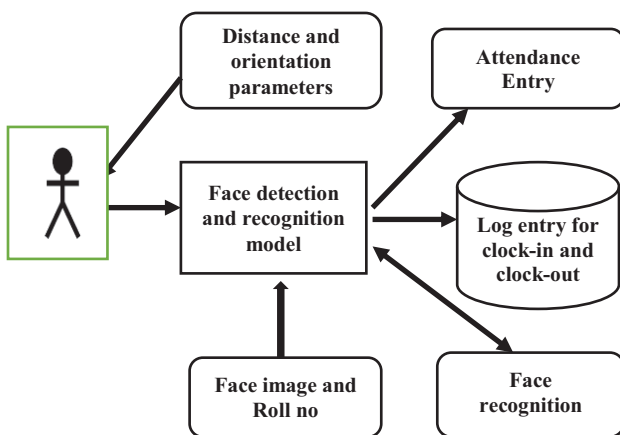


Fig. 3: Face detection model

The same algorithm can be used with more number of training images. In that case, it can't be ensured that ideal light settings is in every picture of an individual. This may lead to poor recognition. To overcome this, the same image can be looked using high dimensional vector. But this solution may require more processing time. Hence the proposed algorithm focuses on local features of the face with low dimensions.

The Binary pattern strategy has its underlying foundations in 2D text analysis. The fundamental thought of Local Binary Patterns is to sum up the nearby structure in a picture by contrasting every pixel and its neighbor. Consider, a pixel as a center and calculate the threshold of its neighbors. In the event that the intensity of the center pixel is more prominent equivalent than its neighbor, then mark it as 1 and 0 if not. This will give a binary value like 10001101. In this way, with 8 pixels as neighbors, it will give 2^8 values, called Local Binary which is also referred as LBP codes.

The single image has to be of medium - high resolution and taken in well-lit environment for better processing by the computer, and to prevent unknown areas during the processing.

IV. EXPERIMENTAL RESULTS

The screenshot of the face recognition is in Figure 4.

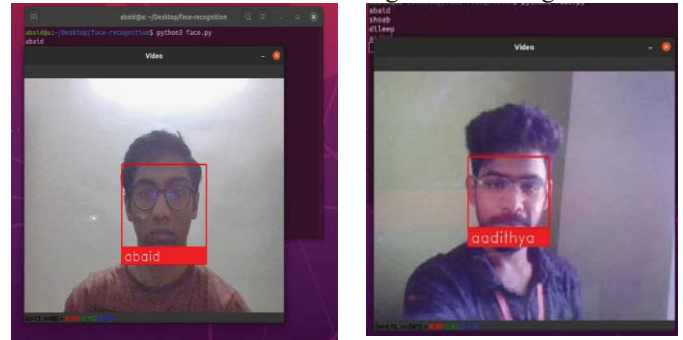


Figure 4.a Recognized image 1

Figure 4.b Recognized image 2

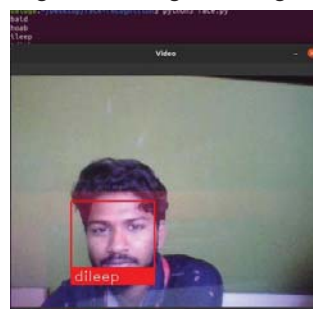


Figure 4.c Recognized image 3

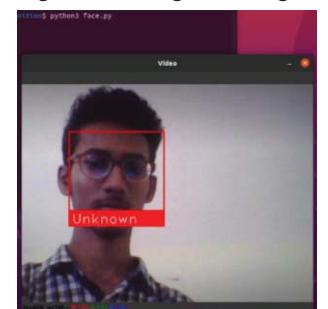


Figure 4.d Un-recognized image

Fig. 4: Face recognition screenshot

The action and observations are in Table 1

Table 1: Actions and observation

Step	Action	Observation
Video_Capture	Connects with the installed camera and starts playing.	Camera started.
load-image_file	Loads the HaarClassifier Cascade files for frontal face	Gets ready for Extraction.
face_locations	Initiates the Face extracting Frame work.	Features extracted
face_encoding	Start the PCA Algorithm	Updates the facedata.xml
process_face	It compares the input face with the saved faces.	Nearest face recognized

The system was tested with a batch of 70 students. When tested, it was observed that there was no false acceptance. i.e., No students were marked present by mistake in algorithm. But there were few false rejections during the test. The 70 students were divided into 7 small batches {B₁, B₂...B₇} of 10 students. The success rate of over 97% was obtained overall. The success vs. failure is shown in Table 2

Table 2: Success Vs Failure Value

Batch	Success %	Failure %
B ₁	100	0
B ₂	100	0
B ₃	90	10
B ₄	100	0
B ₅	100	0
B ₆	90	10
B ₇	100	0

The time taken for the recognition by the proposed method is much less than manual attendance. The percentage of success is in Figure 5.

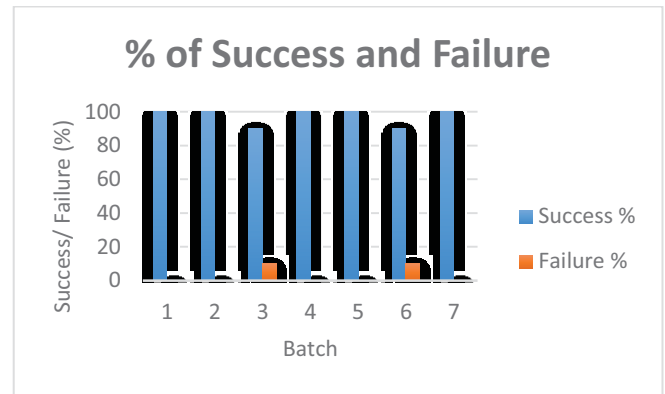


Fig 5: Success % Vs Failure %

V. CONCLUSION

This prototype has successfully captured the attendance of the students for regular class hour. The performance was mainly acceptable because there was no false acceptance. Efficiency of the algorithm can be further improved by using biometric for achieving more accuracy.

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