Face Recognition Based Attendance System

SHUBHI VERMA[1], NISHU CHOUDHARY[2], SANJANA BHATTIYA[3]
[1, 2, 3] *Shri Ram Group of Colleges, Muzaffarnagar*

***Abstract*—Face recognition attendance systems have gained prominence due to their non-intrusive and efficient nature. This paper explores the development and implementation of a face recognition attendance system using Python and machine learning technologies. We discuss the system architecture, algorithms, and tools utilized, alongside a detailed examination of the implementation process. We also ad-dress the challenges and propose solutions for improving system accuracy and robustness.**

***Index Terms*—Face Recognition; Face Detection; Haar-Cascade classifier; Local Binary Pattern Histogram; attendance system**

I. INTRODUCTION

Accurate and efficient attendance tracking is essential in educational institutions, workplaces, and other organizations. Traditional methods, such as manual roll calls and swipe cards, are often inefficient and susceptible to errors. With advancements in biometric technologies, face recognition has emerged as a viable solution due to its non-intrusive nature and high accuracy. This paper focuses on developing a face recognition attendance system using Python and machine learning techniques, providing a comprehensive overview from system design to implementation. The main aim of the project is to help our teacher's in taking attendance and save their time and efforts. It takes approx. 10 to 15 for every teacher to take attendance in every class which takes a lot of efforts and energy is also wasted as well as the class timing is also wasted So we have designed a face recognition system which saves a lot time and efforts..

II. LITERATURE REVIEW

Authors in [3] proposed a model of an automated attendance system. The model focuses on how face Recognition incorporated with Radio Frequency Identification (RFID) detect the authorized students and counts as they get in and get out form the classroom. The system keeps the authentic record of every registered student. The system also keeps the data of every student registered for a particular course in the attendance log and provides necessary Information according to the need.

In this paper [4], authors have designed and implemented an attendance system which uses iris biometrics. Initially, the attendees were asked to register their details along with their unique iris template. At the time of attendance, the system automatically took class attendance by capturing the eye image of each attendee, recognizing their iris, and searching for a match in the created database. The prototype was web based.

In [5], authors proposed an attendance system based on facial recognition. The algorithms like Viola-Jones and Histogram of Oriented Gradients (HOG) features along with Support Vector Machine (SVM) classifier were used to implement the system. Various real time scenarios such as scaling, illumination, occlusions and pose was considered by
the authors. Quantitative analysis was done on the basis of Peak Signal to Noise Ratio (PSNR) values and was implemented in MATLAB GUI.

Authors in [6] researches to get best facial recognition algorithm (Eigenface and Fisherface) provided by the Open CV 2.4.8 by comparing the Receiver Operating Characteristics (ROC) curve and then implemented it in the attendance system. Based on the experiments carried out in this paper, the ROC curve proved that, Eigenface achieves better result than Fisherface. System implemented using Eigenface algorithm achieved an accuracy rate of 70% to 90%. In [7], authors proposed a method for student attendance system in classroom using face recognition technique by combining Discrete Wavelet Transforms (DWT) and Discrete Cosine Transform (DCT). These algorithms were used to extract the features of student's face followed by applying Radial Basis

Function (RBF) for classifying the facial objects. This system achieved an accuracy rate of 82%.

III. WORKING OF SYSTEM

For the working of the face recognition system the students and the faculty members have to register themselves after the registeration the webcam is opened and it captures the student image using the algorithm. We have used two algorithms that are Haar Cascading algorithm and Local Binary Pattern Histogram Algorithm the webcam captures 100 images of the students at a time from different angels. The complete process can be divided into four stages:

1. Dataset Creation:

Images of students are captured using a webcam. Multiple images of each student are taken from different angles and with various gestures (approx. 100 images). These images then go through pre-processing, where they are cropped to focus on the Region of Interest (ROI) for use in the recognition process. Next, the cropped images are resized to a specific pixel dimension. These images are then converted from RGB to grayscale and saved in a folder under the respective student's name.

2. Face Detection:

Face detection is done using the Haar-Cascade Classifier in OpenCV. Before it can detect faces, the Haar Cascade algorithm needs to be trained, a process called feature extraction. The training data is in an XML file named haarcascade_frontalface_default. The Haar features, shown in Figure 2, are used for this feature extraction.

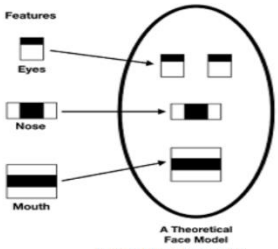


Fig.2. Haar Features

3. Face Recognition:

For face recognition, we use the Haar Cascade algorithm with OpenCV. It checks the images using all the stored images and compare the present image with the other and consider the matched image as positive image and the unmatched image as negative image. This algorithm processes 100 images at a time.

4. *Attendance Updation:*

After face recognition, the recognized faces will be marked as present in the backend, and the others will be marked as absent. The list of absentees will be shown in the student as well as the faculty dashboard. At the end of each month, faculty will receive an updated monthly attendance sheet.

IV. ALGORITHM AND TECHNIQUES

We have used two algorithms in the face recognition system:

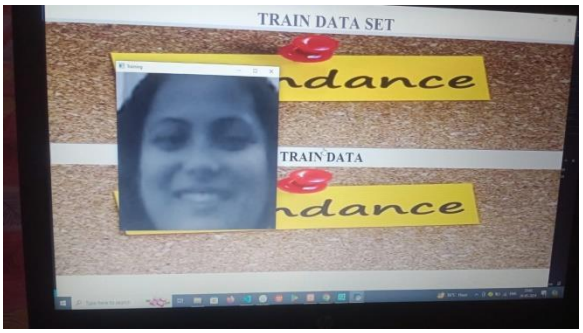
(a) Haar Cascading Algorithm

(b) Local Binary Patterns Histograms (LCPH) Algorithm

The Haar Cascading algorithm is used for the Face recognition process, The Haar Cascade algorithm is a popular method for face recognition, implemented using OpenCV. It checks the images using all the stored images and compares the present image with the other and considers the matched image as positive image and the unmatched image as negative image. This algorithm processes 100 images at a time.

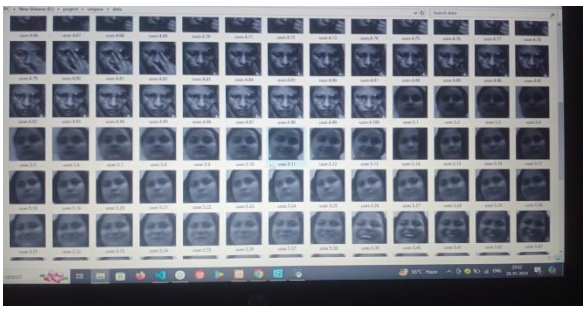
The Haar Cascade algorithm is known for its speed and efficiency, making it suitable for real-time face detection applications. However, it may not be as accurate as some more modern techniques, especially in complex or varied lighting conditions. The another algorithm which is used is Local Binary Patterns Histograms (LBPH)

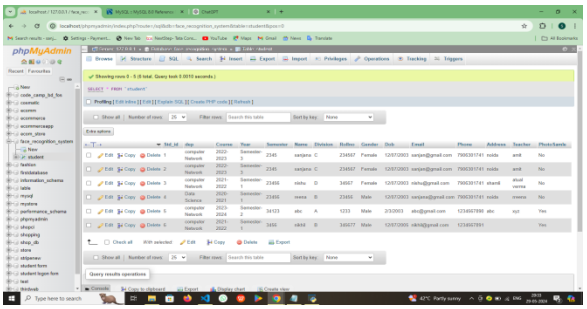
The Local Binary Patterns Histograms (LBPH) algorithm is widely used in face recognition systems due to its robustness and simplicity. Overall, LBPH is a powerful tool in face recognition systems, providing a good balance between accuracy, speed, and robustness to variations in lighting and expressions.



V. RESULTS AND DISCUSSION

For the recognition of the image we have used two algorithms that is the Haar Cascade algorithm and the Local Binary Patterns Histograms (LBPH) algorithm The Haar Cascade algorithm is used with Open CV. It checks the images using all the stored images and compares the present image with the other and considers the matched image as positive image and the unmatched image as negative image. This algorithm processes 100 images at a time. The users can interact with the system using a GUI. Here users will be mainly provided with three different options such as, student registration, faculty registration, and mark attendance. The students are supposed to enter all the required details in the student registration form. After clicking on register button, the web cam starts automatically and window is opened as shown in Fig.3. pops up and starts detecting the faces in the frame. Then it automatically starts clicking photos until 100 samples are collected. These images then will be preprocessed and stored in training images folder. The faculties are supposed to register with the respective course codes along with their email-id in the faculty registration form provided. This is important because the list of absentees will be ultimately mailed to the re spective faculties.





CONCLUSION

This system aims to create an efficient class attendance system which will save lots of time of our teachers using face recognition. It will mark attendance through face IDs, detecting and recognizing faces with a webcam. Once a face is recognized, the system will mark the student's attendance and update the records.

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