Face Recognition based Attendance System

Atharva Moholkar, Pranav Rao
Department of Information Technology
Vishwakarma Institute of Information
Technology, Pune

***Abstract*— This article presents the creation of a system that utilises face recognition technology for attendance marking purposes in various settings. While face recognition has lower accuracy compared to other biometric methods like fingerprint or iris recognition, its non-invasive and contactless approach makes it a popular choice. This system aims to address the inefficiencies of traditional manual attendance systems that are time-consuming and prone to errors such as proxy attendance. It consists of four phases: database creation, face detection, face recognition, and attendance updating. The database is established using images of the students in the class. Face detection and recognition are carried out using the Facial Recognition classifier and the Local Binary Pattern Histogram algorithm, respectively. The system detects and recognizes faces from live streaming video feeds of the classroom, and attendance records are automatically sent to the respective faculty members at the end of each session via email.**

Keywords—Face Recognition; Face Detection; classifier; attendance system; Recognition Libraries

I. INTRODUCTION

The normal approach to marking attendance is often seen as a tiresome and time-consuming task in schools and colleges. The process of manually calling out the names of students can take up to 5 minutes of the entire session, putting an additional burden on faculties. Furthermore, there is a possibility of proxy attendance, adding to the inefficiencies of this approach. As a result, many educational institutions have turned to other methods of attendance tracking, such as Radio Frequency Identification (RFID), iris recognition, and fingerprint recognition. However, these methods can be queue-based, which may consume more time and be intrusive.
In contrast, face recognition provides an easily acquirable and non-intrusive solution that can detect faces regardless of various facial expressions. Face recognition systems can be divided into two categories: verification and face identification. Verification is a 1:1 matching process that compares a face image against at template face image, while identification is a 1:N matching process that compares a query face image to multiple template Images.
The aim of this system is to develop an attendance system that uses face recognition technology. The face of each individual will be used to mark attendance, as face recognition has become increasingly popular and widely used. In this paper, we propose a system that detects the faces of students from a live streaming video of the classroom and marks attendance if the faces are recognised.

II. LITERATURE SURVEY

The authors presented an automated attendance system that utilises both face recognition and Radio Frequency Identification (RFID) technology to detect and count authorised students as they enter and exit the classroom. The system keeps an accurate record of registered students and their attendance for each course, providing necessary information as needed.

In their paper [4], the authors designed and implemented an attendance system based on iris biometrics. Attendees were asked to register their unique iris template, which was used to automatically capture their attendance by recognising their iris and searching for a match in the database. The system was web-based and user-friendly.

In [5], the authors proposed an attendance system based on facial recognition, which uses algorithms such as Viola-Jones and Histogram of Oriented Gradients (HOG) features, along with Support Vector Machine (SVM) classifier. They considered various real-time scenarios and used Peak Signal to Noise Ratio (PSNR) values for quantitative analysis. The system was implemented in MATLAB GUI.

Authors in [6] conducted a study to determine the best facial recognition algorithm (Eigenface and Fisherface) provided by Open CV 2.4.8. They compared the Receiver Operating Characteristics (ROC) curve and implemented the system using the Eigenface algorithm, which achieved an accuracy rate of 70% to 90%.

In [7]In [7], the authors proposed a method for student attendance using face recognition, which combined Discrete Wavelet Transforms (DWT) and Discrete Cosine Transform (DCT) to extract facial features. They then used the Radial Basis Function (RBF) for classifying facial objects.

III. PROPOSED SYSTEM

The proposed system requires all students to register by providing their details and submitting their images, which will be stored in the system's dataset. During each class session, the system will use live streaming video to detect faces and compare them with the images in the dataset. If a match is found, attendance will be marked for the corresponding student. At the end of each session, the system will generate a list of absentees and email it to the responsible faculty member.

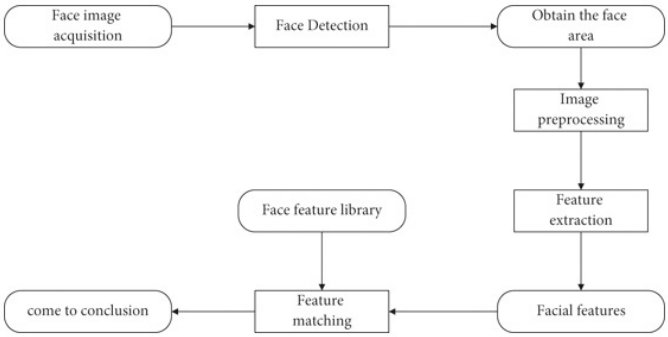

Fig.1. System Architecture

This process is divided into four stages,

1. Making a Dataset

ImThe process of creating an automated attendance system can be broken down into four key stages. The first stage involves creating a dataset of student images using a web camera. Multiple images of each student are captured from various angles and gestures. These images are then pre-processed by cropping them to obtain the Region of Interest (ROI), which will be used in the recognition process. The cropped images are resized to a specific pixel position, converted from RGB to grayscale, and saved as the names of the respective students in a designated folder.

2. Detection of Face

In the second stage, the system utilises the face_recognition Python library to perform face detection. This cutting-edge AI model is designed to scan and recognise human faces. The library is built on the foundations of deep learning and dlib's advanced face recognition technology. With the help of this technology, the system can accurately detect and recognise faces in the dataset, making it an essential component in the overall attendance system. The face_recognition python library has gained popularity in recent years due to its high accuracy in detecting and recognising human faces. This library uses deep learning algorithms to analyse and compare facial features, making it highly efficient in detecting even small variations in facial expressions and features.Overall, the face_recognition library is a powerful tool for face detection and recognition, providing high accuracy and flexibility for a wide range of applications.

3. Recognition of Face

Face recognitionFace recognition is a complex process that involves several steps. One of the crucial steps is the detection of facial features, such as the eyes, nose, mouth, and chin, from the image of a given person. This is done using advanced computer vision techniques, such as the face_recognition Python library, which is built using dlib's state-of-the-art face recognition algorithms. The library uses deep learning models to scan and recognise human faces from images, videos, and live streaming feeds. Once the facial features are detected, the library extracts relevant information, such as the location and outline of each feature, to create a facial descriptor or template. The facial template is a unique representation of the person's facial features that can be used for comparison and identification. The template is then compared with the templates of other faces stored in the system to determine if there is a match. If a match is found, the system returns the name and other relevant information of the person associated with the matched template.

4. Attendance Updation

The last step of the attendance system involves marking the attendance of the students based on their recognised faces. Once the face recognition process is complete, the system will mark the recognised faces as present in the attendance record. The faces that were not recognised will be marked as absent in the attendance sheet. The attendance record will be stored in an Excel sheet that can be accessed by the respective faculties.

At the end of each month, the system will generate a monthly attendance sheet for each faculty that contains the attendance record of all the students who attended their classes. This will provide the faculties with an overview of the attendance of each student and enable them to take appropriate actions for students who are consistently absent. Additionally, the system will automatically generate a list of absentees for each session and mail it to the respective faculty, ensuring that they are aware of the students who missed their classes.

IV. RESULTS AND DISCUSSIONS

The proposed system is designed to provide a user-friendly Graphical User Interface (GUI) for users to interact with the system. The GUI provides three main options for the users, namely student registration, faculty registration, and mark attendance. To register as a student, users need to enter all the required details in the student registration form. After clicking the register button, the system automatically activates the webcam and detects faces in the frame. A window appears on the screen displaying the live camera feed and captures photos until 60 samples are collected or until CRTL+Q is pressed. The captured images are pre-processed and stored in the training images folder.

On the other hand, faculties are required to register with their respective course codes and email IDs in the faculty registration form. This registration is essential because the list of absentees will be sent to the respective faculty members.

This ensures that the relevant faculties are informed of the attendance status of their students. By providing separate registration forms for students and faculties, the system aims to streamline the registration process and ensure that the necessary information is collected accurately and efficiently.

During each session, the faculty is required to enter their corresponding course code into the system. Once the course code is submitted, the camera will start functioning automatically.

Upon completion of the attendance marking process, the faculty can close the window by pressing CTRL+Q. The attendance data is then updated in the system's excel sheet, and the list of absentees is automatically generated and mailed to the respective faculty. This process ensures that the attendance records are accurate and up-to-date, and helps to minimise the possibility of errors or omissions in attendance marking.

Moreover, the system has the capability to generate monthly attendance reports for both students and faculties. These reports can be downloaded in the form of an excel sheet and can be used for further analysis and record-keeping purposes.

To ensure the security and privacy of the data, the system employs various encryption techniques. The passwords of the users are stored in hashed format to prevent unauthorised access. Additionally, the system is equipped with a login system to restrict access to authorised users only.

V. CONCLUSION

This system is designed to create a reliable and efficient method for taking attendance in class using facial recognition technology. By using face ID, the proposed system can accurately and efficiently mark attendance. The system utilizes a webcam to detect faces in the classroom and then performs facial recognition on the captured images. Once a face is recognized, the system marks the attendance of the corresponding student and updates the attendance record accordingly. This eliminates the need for manual attendance taking and reduces the possibility of errors. Overall, the use of facial recognition technology in attendance taking has the potential to save time and increase accuracy.

Moreover, the system reduces the workload on faculty members who would otherwise have to manually mark attendance and maintain attendance records. With the use of automated face recognition. Overall, this proposed system provides a reliable and efficient solution for class attendance management, improving accuracy and saving time for both students and faculty members.

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