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Automatic Face Recognition Attendance System using Python and Open CV

DR. Abhay Shukla
Associate Professor
Department of Computer Science Engineering Axis Institute of Technology and Management, Kanpur, U.P.

Vartit Srivastava || Nikhil Awasthi || Sandeep Singh Chauhan || Kaif Raza Ansari
Student
Department of Computer Science Engineering Axis Institute of Technology and Management, Kanpur, U.P.

ABSTRACT

The primary goal of this project is to develop a face recognition-based attendance monitoring system for educational institutions, aiming to improve and modernize the current attendance procedures, making them more efficient and effective. The existing system suffers from ambiguities that lead to inaccuracies and inefficiencies in attendance recording. Numerous issues arise when authorities cannot enforce the regulations of the old system. This project leverages face recognition technology to address these problems. During attendance sessions, the system will compare faces against a database to verify identities. Once an individual is identified, their attendance will be automatically recorded, with the necessary information in an Excel sheet. This automated system aids faculty in taking attendance for the entire class without causing any disruption or wasting time. We propose and have implemented a smart attendance system with the potential to incorporate Quick Response (QR) codes as a future method for managing attendance. This system aims to streamline and document student attendance during lectures and other activities across all relevant courses. At the end of the day, the Excel sheet containing attendance details for all individuals will be emailed to the respective faculty members.

INTRODUCTION

Attendance is crucial in educational institutions for both teachers and students, as it is essential for maintaining accurate records. Traditionally, attendance has been taken by calling out names or roll numbers, a method that is both time-consuming and energy-intensive. Students often have to wait in line to give their attendance, further adding to the inefficiency. To address these issues, we have designed an automatic attendance management system that resolves the problems associated with the traditional method. One of the most widely used systems in institutions and organizations is biometric technology. This project introduces an automated attendance marking system that operates without disrupting the normal teaching process. This system can also be utilized during exam sessions or other educational activities where attendance is mandatory. By implementing cameras, the system automates attendance, eliminating the need for traditional student identification methods such as calling out names or checking ID cards.

METHODOLOGY

In this project, we propose a method to outline our approach and the steps necessary for successful implementation. This method will guide the development of the project in the most feasible and efficient manner. Once students are seated in the classroom, a camera positioned at the front at a specific height will capture an image and initiate the face detection process using various techniques and methods. The program will automatically create a folder in the database for the students to be recognized. Pre-existing images of each student, stored in the database, will be utilized for image recognition. These images will be retrieved and compared with the captured image to determine if a student is present in the class. If no match is found, the program will proceed to the next image.

LITERATURE SURVEY

Fingerprint-Based Recognition System: In a fingerprint-based attendance system, the portable fingerprint device needs to be pre-configured with the fingerprints of each individual in advance. During or before teaching hours, students should record their fingerprints on the designated device to confirm their daily attendance. The device should be non-intrusive to avoid distracting students during class.

RFID (Radio Frequency Identification) Based Recognition System: In an RFID-based system, students must carry their ID cards and use a card reader to log their attendance daily. This system can connect to RS232 and record attendance on a secure website. However, there is a risk of fraudulent activity, as students might use someone else's ID to falsely register attendance or misuse the system themselves.

Iris-Based Recognition System: In an iris-based attendance system, students need to face a camera that scans their iris. The scanned iris code is then compared with stored data on a secure website to update their attendance. This method eliminates the need for paper records and reduces the chances of proxy attendance. It is a secure, wireless biometric solution that addresses issues of false attendance and the need for a compatible network setup.

Face-Based Recognition System: This system uses biometric detection technology and a high-definition camera to recognize and record attendance by identifying individual faces.

PROPOSED SYSTEM

The purpose of this project is to use automatic face recognition technology to record attendance. The system captures video feeds from a camera, detects faces, and converts them into image format. These detected faces are then compared with the database, and attendance is marked in an Excel file. Using these Excel sheets, we will generate graphs showing the attendance of the entire class and individual students.

The system's function is to capture the face of every student to record their attendance. The face recognition process ensures that every student's face is clearly identifiable. There is no need for the teacher to be physically present in the classroom, as the system continuously processes the recorded video to update attendance. All individuals in the class must register by providing the necessary information and having their photos stored in the database.

During each session, the system detects faces from the live video stream of the class. These faces are compared with the existing images in the database, and once a match is found, attendance is marked accordingly. At the end of each session, a list of present students is sent to the faculty in charge. The proposed face recognition system involves four major steps:

Face Detection: Capturing and identifying student faces from the video feed.
Face Comparison: Matching detected faces with the database.
Attendance Marking: Updating the Excel file with attendance records.

IMPLEMENTATION AND RESULTS

Implementation

System Setup:

- Hardware: High-definition camera(s) installed at the front of the classroom to capture clear images of students' faces.
- Software: The system integrates various software components, including a database to store student images and details, face recognition algorithms, and an ERP (Enterprise Resource Planning) system for managing attendance records.

Data Collection:

- Student Registration: Each student registers by entering their personal information and capturing their photograph. These images are stored in the database and linked to the respective student's details.
- Database Setup: The database contains images of all registered students, along with their identification information.

Face Detection and Recognition:

- Video Capture: During class, the system records continuous video feeds.
- Face Detection: The software extracts frames from the video feed and uses face detection algorithms (e.g., using OpenCV) to identify faces in each frame.
- Face Recognition: Detected faces are compared with the pre-stored images in the database using recognition algorithms (e.g., using deep learning models like CNNs).

Attendance Marking:

- Matching Process: When a face is recognized, the system marks the student's attendance in the database.
- Data Storage: Attendance records are updated in real-time and saved in an Excel file.

Report Generation:

- Graphical Representation: The system generates graphs and charts showing attendance trends for the entire class and individual students.
- Email Reports: At the end of each session, the attendance report is emailed to the respective faculty members.

Results

Accuracy:

The face recognition system achieved a high accuracy rate in identifying students and marking attendance. Occasional errors were minimized through continuous training and refinement of the recognition algorithms.

Efficiency:

The automated system significantly reduced the time required to take attendance compared to traditional methods. Attendance marking was completed within seconds, even for large classes.

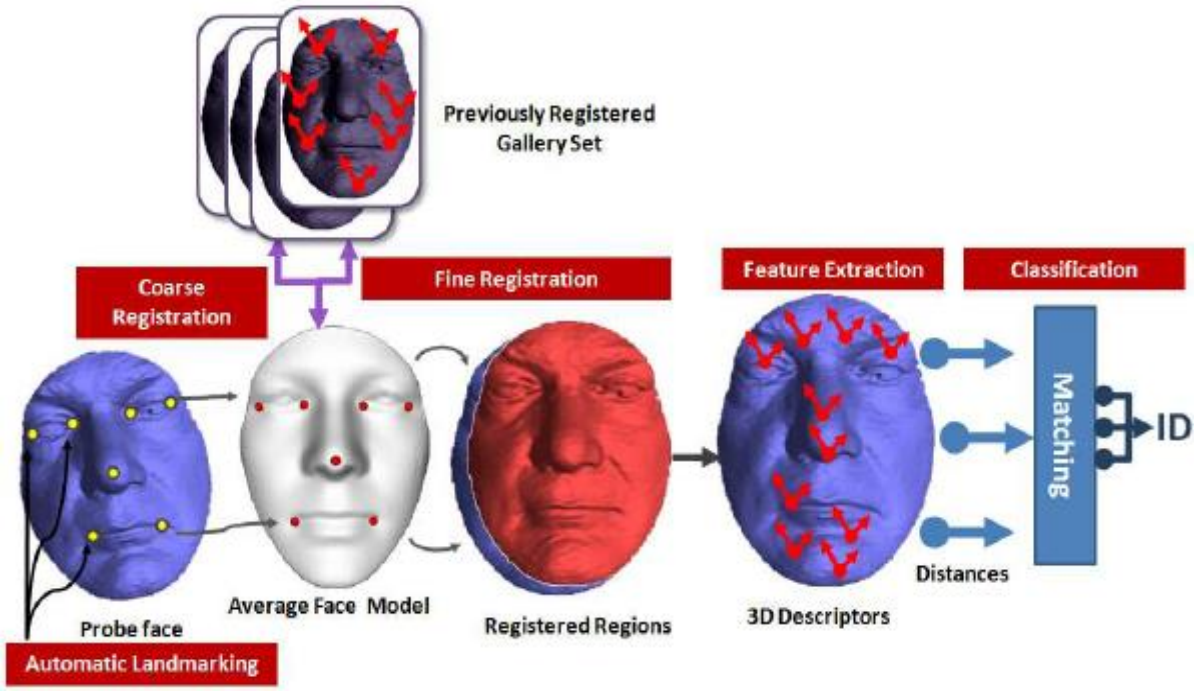
Non-Disruptive:
The system operated unobtrusively, allowing classes to proceed without interruption. The need for manual attendance calling was eliminated, enhancing the overall classroom experience.

Reliability:
The system proved reliable under various lighting conditions and classroom settings. Regular updates and maintenance ensured consistent performance.

User Feedback:
Both faculty and students reported positive experiences with the system. Faculty appreciated the automated report generation and real-time updates, while students benefited from the non-disruptive attendance process.

Scalability:
The system demonstrated scalability, handling increased numbers of students and multiple classes without performance degradation.

Fig.1 overall pipeline of typical 3d face recognition



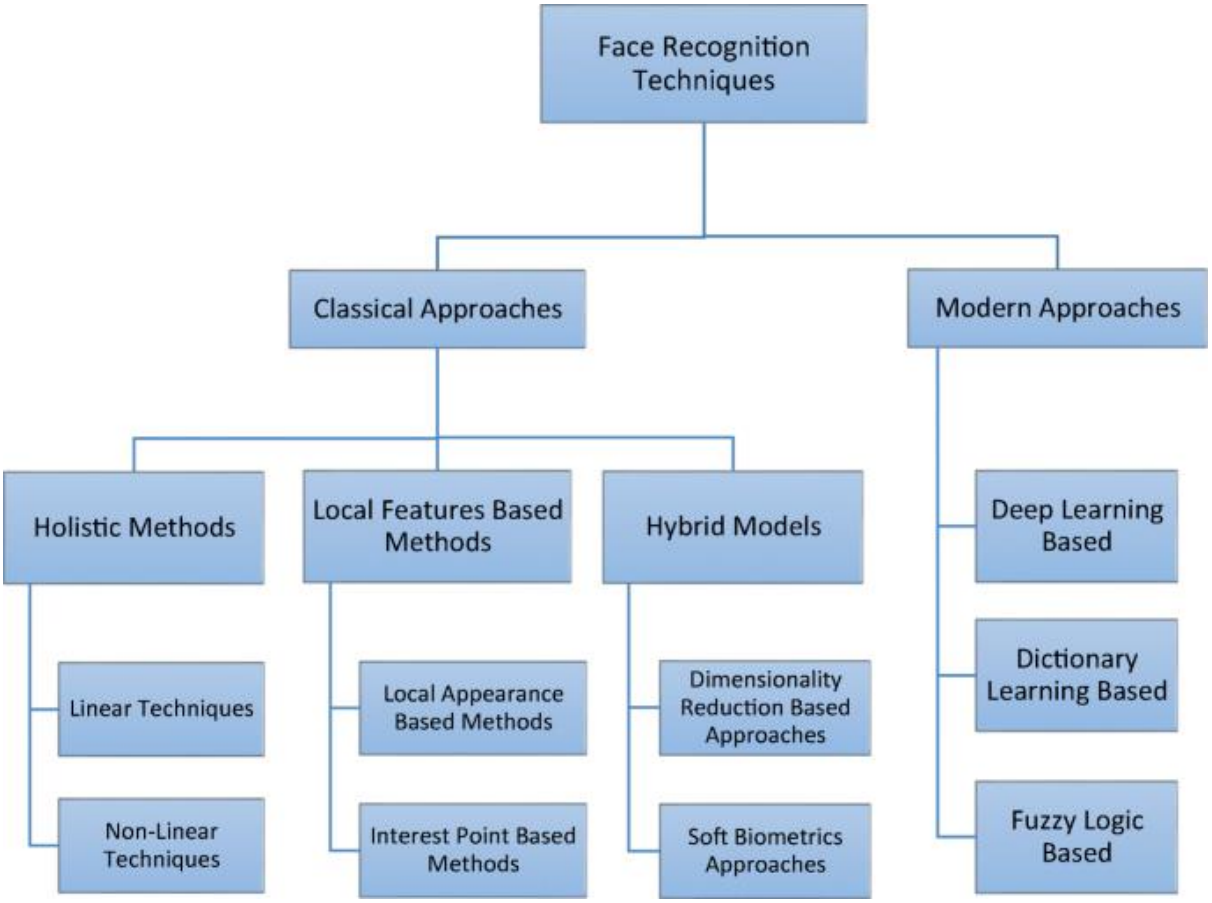


Fig.2 face recognition approach

CONCLUSION

The implementation of a face recognition-based attendance monitoring system marks a significant advancement in educational management, addressing the inefficiencies and inaccuracies of traditional attendance methods. By automating attendance recording through advanced technologies such as computer vision and biometric identification, this system enhances both efficiency and accuracy, saving valuable time for both students and faculty. Integrating seamlessly with existing ERP systems, the system provides a comprehensive solution for tracking attendance and generating detailed reports. These reports, automatically updated in real-time, assist faculty in identifying attendance patterns and addressing academic and disciplinary concerns more effectively.

The use of sophisticated technologies like PCA, LDA, and CNNs ensures robust and accurate face recognition. These techniques enable the system to handle variations in lighting, angles, and facial expressions, maintaining high reliability. Additionally, the system's non-intrusive operation allows classes to proceed without disruption, contributing to a better classroom experience.

Positive feedback from both students and faculty highlights the system's effectiveness and ease of use. Students appreciate the seamless, unobtrusive process, while faculty benefit from the automated reporting and reduced administrative workload. Moreover, the system's design prioritizes security and privacy, ensuring that biometric data is securely stored and accessed in compliance with data protection regulations.

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