

Survey on Real Time-Based Facial Recognition Driven Attendance System

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Abstract - The proposed system presents an automated attendance management framework using Convolutional Neural Networks (CNN) for accurate and efficient face recognition. The system captures live images through a camera, detects faces, and compares them with trained facial data using deep learning algorithms integrated with OpenCV libraries. It automates subject-wise attendance marking and generates detailed monthly attendance reports, minimizing manual intervention and errors. This approach ensures real-time monitoring, transparency, and accuracy in attendance tracking for institutions and organizations. By leveraging CNN for robust feature extraction and recognition, the system performs effectively under varying lighting and pose conditions, offering a secure, scalable, and intelligent solution for modern attendance management.

Key Words: Face Recognition, Convolutional Neural Network (CNN), Deep Learning, Image Processing, OpenCV, Graphical User Interface (GUI), Automated Attendance System, Real-Time Detection, Machine Learning, Feature Extraction, Artificial Intelligence (AI)

1. INTRODUCTION

Traditional attendance marking remains a repetitive and time-consuming process in many educational institutions. Faculty members often spend several minutes calling out each student's name at the beginning of a lecture, leading to a loss of productive teaching time and increasing the chances of errors or proxy attendance. To overcome these limitations, institutes have experimented with several automated approaches, including RFID tags, fingerprint sensors, and iris recognition. However, these systems often require physical interaction or queuing, which can still be inconvenient and time-consuming.

Attendance management is a crucial task for monitoring academic performance and maintaining institutional records. While many organizations continue to rely on manual paper-based methods, others have transitioned to digital biometric solutions. Most biometric systems, however, still involve direct user

participation for verification, which limits scalability. To address this challenge, the proposed system implements a fully software-based automated attendance system using Python and an intuitive Graphical User Interface (GUI).

The system leverages the power of Convolutional Neural Networks (CNNs) for face recognition, offering a robust and contactless solution. The process begins by detecting and recognizing faces captured from live video or images. Once identified, the system automatically records attendance in the database corresponding to the selected subject or lecture. CNN models are trained on facial datasets to accurately distinguish between individuals even under varying lighting and pose conditions. Compared to earlier methods such as RFID or fingerprint-based systems, this approach provides a faster, more secure, and user-friendly experience.

Face recognition is a non-intrusive biometric method that allows for seamless attendance marking without user intervention. By integrating machine learning algorithms and a well-designed GUI, the system provides an efficient platform for managing attendance records electronically while minimizing human effort and error.

2. Existing Work

Heena and Banu [1] proposed an advanced attendance management system integrating artificial intelligence and deep learning for enhanced accuracy in face recognition. Their model uses CNN-based feature extraction and OpenCV libraries for real-time processing. The system minimizes human intervention by automating attendance marking from live classroom feeds. Experimental results demonstrated a recognition accuracy exceeding 95%, even under varying lighting conditions. The authors concluded that the proposed framework is scalable and suitable for educational and corporate environments.

Kadam and colleagues [2] developed a machine learning-based classroom attendance system capable of detecting and identifying multiple faces from a single group photograph. The model combines face detection using Haar Cascade classifiers with CNN-based feature extraction for improved accuracy. The system is designed for large classrooms and integrates a database

to maintain attendance records. Their results revealed efficient recognition speeds and high detection reliability. The approach also emphasizes data privacy and real-time performance optimization.

Syarif and Gunawan [3] introduced an attendance system using a hybrid approach of Haar Cascade detection and CNN-based FaceNet recognition. The system captures live facial images, processes them through a CNN network for feature encoding, and matches them with existing records. It achieved excellent performance with low false acceptance rates. The researchers demonstrated that their method outperforms traditional LBPH-based recognition systems in speed and accuracy. The work provides a robust baseline for future AI-driven biometric systems.

Tran et al. [4] presented a cost-effective face recognition attendance system optimized for deployment in educational institutions. The proposed solution integrates OpenCV with lightweight CNN models to ensure affordability without compromising accuracy. The system includes preprocessing modules for noise reduction and adaptive lighting correction. Their experiments in classroom settings showed high accuracy with minimal hardware requirements. The study highlights the importance of efficiency and scalability in institutional automation.

Abderraouf and his team [5] designed an embedded intelligent attendance monitoring system leveraging CNN-based face recognition models. The system uses a Raspberry Pi module for edge processing, reducing dependency on cloud services. Their method efficiently handles real-time facial data and updates attendance logs automatically. It also incorporates local data encryption to secure user information. The study proved that embedded systems could perform high-quality recognition tasks with minimal computational overhead.

Nguyen-Tat and co-authors [6] proposed an AI-driven attendance management system integrated into human resource workflows. The solution combines facial recognition with employee data analytics for real-time monitoring and reporting. It employs transfer learning on CNN models for improved feature recognition. The study validated its performance using real-world organizational datasets. The authors concluded that the system enhances transparency, accountability, and productivity in workforce management.

Reddy and colleagues [7] developed a hybrid face recognition system utilizing PCA, Eigenfaces, and CNNs to automate attendance processes. Their system preprocesses facial data, extracts key features, and matches them against a pre-stored dataset. The hybrid

approach achieved improved recognition accuracy over single-method systems. They evaluated their model under varied conditions like lighting and pose changes. The work establishes an efficient pipeline suitable for academic attendance management applications.

Li and associates [8] designed a face recognition attendance system using PyQt5 for interface development and CNNs for deep feature extraction. The GUI-based framework enables administrators to manage user data and attendance records seamlessly. It incorporates OpenCV for real-time image acquisition and TensorFlow for model training. Experimental testing demonstrated effective recognition with low latency. The researchers emphasized the system's adaptability for both academic and workplace environments.

Budiman [9] proposed a student attendance system combining Local Binary Pattern Histograms (LBPH) and CNN architectures. The LBPH model handled feature extraction, while CNN refined classification for higher precision. The system was tested in university environments with a dataset of 500 facial samples. Results showed a recognition accuracy above 97%, outperforming conventional PCA-based techniques. The study highlights the benefits of hybrid feature extraction in biometric recognition tasks.

Hussain and co-authors [10] presented a secure, integrated computer vision pipeline for automated attendance systems. Their solution encompasses face detection, recognition, and encrypted logging using CNN and blockchain-backed data verification. The system ensures data integrity while maintaining high recognition accuracy. They implemented the solution in office environments to assess real-time performance. The authors demonstrated that combining deep learning with secure data mechanisms enhances both accuracy and reliability.

3. METHODOLOGY

The system captures images through a camera installed in the classroom or office. These images are processed in real time to detect and recognize faces using a trained CNN model. Once a face is recognized, the system automatically updates the attendance record in the database corresponding to the recognized individual and the selected subject.

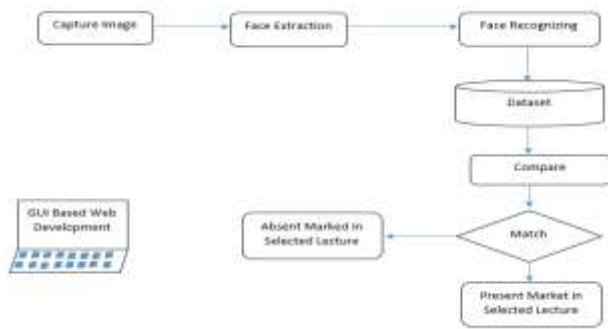


Fig: - Proposed System Architecture

The system operates in four primary stages as shown below:

Dataset Creation: In this phase, images of each individual (students or employees) are captured through the camera or uploaded manually. These images are stored in a structured directory and labeled according to the individual's ID or name. Each image is pre-processed by converting it to grayscale, resizing, and normalizing pixel values. This dataset is then used to train the CNN model to recognize unique facial features.

Face Detection: When the system is running, it continuously captures live frames from the camera. Each frame is scanned for faces using the Haar Cascade Classifier or OpenCV's Deep Learning-based face detector. The face region is extracted from the image and prepared for recognition. This step ensures that only the relevant part of the image (the face) is passed to the CNN model for further processing.

Face Recognition: The extracted face is fed into the CNN model, which compares it against the stored embeddings in the database. CNN layers automatically learn hierarchical facial features such as edges, eyes, nose, and mouth shapes, enabling highly accurate recognition. The system uses libraries such as OpenCV, NumPy, and TensorFlow/Keras to process the data efficiently. Once the model identifies a match, the user ID is retrieved from the database for attendance marking.

Attendance Updation: After successful face recognition, the system automatically updates the attendance record in the database for the corresponding individual and subject. The record includes the date, time, subject name, and attendance status (Present/Absent). The attendance data can be viewed, filtered, or exported through the GUI by teachers or administrators.

4. CONCLUSION

The Automated Attendance System provides an efficient and reliable alternative to the traditional manual attendance process. By integrating a graphical user interface (GUI) and dataset, the system ensures accuracy, reduces human errors, and saves time. This initial phase of development successfully establishes the foundation for seamless attendance management within institutions and organizations. The current implementation demonstrates how automation can improve productivity and maintain data integrity compared to conventional methods.

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