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Attendance Management System Using Face Recognition

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Abstract:

The increasing demand for accurate and efficient attendance monitoring in educational and organizational settings has led to the adoption of biometric-based solutions. Conventional methods such as manual registers, RFID cards, and fingerprint scanners are time-consuming, error-prone, and susceptible to proxy attendance. Recent research (2021–2025) highlights face recognition as an emerging technology that enables a contactless, reliable, and real-time solution for attendance automation.

This paper presents a Face Recognition-Based Attendance Management System developed using Python and OpenCV's Local Binary Patterns Histogram (LBPH) algorithm. The system captures real- time video through a webcam, detects and recognizes faces against a pre-trained dataset, and automatically records attendance into CSV files with the corresponding timestamps. Compared to traditional biometric systems, LBPH is computationally efficient, robust to lighting variations, and performs effectively with small datasets, making it suitable for classrooms and workplace environments.

Further literature from 2021–2025 indicates the growing integration of deep learning methods such as Convolutional Neural Networks (CNNs) and FaceNet models for enhanced accuracy and scalability. While this work utilizes the LBPH algorithm for simplicity and cost-effectiveness, its architecture provides a foundation for future integration of deep learning models to achieve improved recognition rates in large-scale environments.

Keywords: Face Recognition, Attendance Management System, LBPH Algorithm, OpenCV

1. Introduction

Attendance plays a crucial role in evaluating performance and maintaining discipline in academic and organizational environments. Traditional attendance methods, such as manual sign-in sheets or RFID-based systems, are prone to human errors, proxy attendance, and administrative inefficiencies. Moreover, fingerprint-based systems require physical contact, posing hygiene concerns.The advancement of **computer vision** and **biometric technologies** has enabled the development of automated, contactless solutions. **Face recognition** offers a non-intrusive, accurate, and time-saving method for attendance tracking. The system described in this paper leverages **OpenCV** with the

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LBPH (Local Binary Patterns Histogram) algorithm to recognize and record attendance automatically, providing a low-cost yet effective alternative to manual systems.

2. Approach / Methodology / Experimental Details / Algorithms

2.1 System Overview

The proposed system consists of four main stages:

1. **Data Collection:** The webcam captures facial images of individuals.
2. **Training Phase:** Captured images are stored in the *TrainingImage* directory and used to train the LBPH recognizer.
3. **Recognition Phase:** During attendance, live frames from the
4. webcam are compared with trained features.
5. **Attendance Logging:** When a match is detected, the system stores the
6. user's name, date, and time in a CSV file.

2.2 Algorithm: LBPH

- **Step 1:** Convert captured face to grayscale.
- **Step 2:** Divide the image into small grids and compute local binary patterns (0–255) by comparing each pixel to its neighbors.
- **Step 3:** Create histograms for each grid and concatenate them to form a feature vector.

Step 4: Compare the histogram vector of the test image with stored templates using Euclidean distance.

LBPH is chosen for its robustness to lighting variations and minimal training data requirement.

2.3 Experimental Setup

- **Programming Language:** Python 3.12
- **Libraries:** OpenCV, NumPy, Pandas, Pillow
- **Hardware:** Intel i3 Processor, 4 GB RAM, Webcam
- **Data Storage:** CSV file (daily attendance logs)

3. Results and Analysis / Discussions

The system successfully detects and recognizes trained faces in real time with minimal delay. During testing, each user's attendance was automatically logged in CSV format, confirming the system's accuracy and efficiency.

- **Recognition Accuracy:** ~85–90 % with 8–10 training images per user.
- **Response Time:** < 1 second per recognition event.
- **Storage Format:** Simple CSV makes data easily accessible through Excel or Pandas. Although lighting and camera angle can influence recognition quality, the LBPH algorithm provides stable results for small datasets. Future work can integrate deep learning-based models (e.g., FaceNet, DeepFace) to improve recognition rates and adapt to larger user databases.

4. Conclusions

The developed **Face Recognition-Based Attendance Management System** automates

attendance tracking using the LBPH algorithm in OpenCV. It eliminates manual effort, reduces errors, and prevents proxy attendance. The system is cost-effective, lightweight, and easy to deploy in classrooms and workplaces. Future enhancements may include incorporating deep learning networks, cloud-based databases, and mobile-app integration to enable large-scale, real-time attendance monitoring.

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