



Face Recognition Attendance Management System

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Abstract: The Face Recognition Attendance Management System is an innovative solution developed to eliminate the need for manual roll calls. This system provides a quick and accurate replacement of traditional attendance methods by applying computer vision techniques such as Convolutional Neural Networks (CNN) and Haar Cascade. The system captures images, detects faces, and matches them with pre-stored images for automated attendance recording. Future enhancements include cloud integration and mobile app support for real-time monitoring.

Index Terms - Face Recognition, Attendance Management, HOG, CNN, OpenCV, Machine Learning, Deep Learning.

1.INTRODUCTION

Attendance Management System using Face Recognition Based on cutting-edge face recognition technology, the face recognition attendance management system is a creative and astute solution that automates the attendance marking procedure. The system scans a person's face in real time using a camera or webcam and extracts the results from a saved dataset using technologies like CNN, dlib, and OpenCV. To increase recognition accuracy, the data set is organized into named folders that contain multiple person representation images. The system saves the user's name and timestamp in a CSV file after identifying a face. By removing the mistakes and inefficiencies seen in conventional attendance systems, it contributes to the revolution of the manual attendance method. The system can handle huge datasets and various users because it is designed to scale up, making it appropriate for usage in event man agreement, workspaces, and educational institutions. In addition to offering potential for future development into features like cloud and mobile app support, this project presents an efficient use case for computer vision in eliminating manual labor.

2.MOTIVATION

The application face acknowledgment participation the executives framework has been created chiefly to dispose of the constraints and inadequacy of standard participation frameworks. Conventional methods like using ID cards or taking attendance manually are cumbersome, manipulatable and to some extent susceptible to human error. Due to these challenges, there is a need for a reliable and automated solution that provides accuracy, efficiency, and convenience. Led by IT, this program uses facial recognition technology to revolutionize the way students take attendance. Detects and identifies people in real-time through a webcam, acting as a remote person verification without any human verification or in-person interaction. The model is implemented such that it works nicely if the dataset is structured with all the photos in the specific folder name, further minimizing the chance of false recognition. This feature captures attendance automatically and stores it in a CSV file (with the name and time stamps), switches on the webcam, detects faces and match them with the pre-stored images. The necessity to update attendance monitoring and make it more safe and effective is what inspired this project. Because it can manage several users at once and function well under changing conditions, this system also solves the scalability issue. In addition to saving time, the system's automation of the attendance process lays the groundwork for future integration of more sophisticated

capabilities like cloud storage and support for mobile applications. Because of this, it is a useful tool for companies, educational institutions, and other organizational setups..

3.OBJECTIVES

- To Using real-time face recognition technology, the attendance marking procedure will be automated. Accurate identification of individuals will be ensured by comparing their faces to a pre-saved dataset.
- To Enhance security and accuracy using CNN and OpenCV.
- To Automate attendance tracking and storage.
- To Ensure real-time processing and scalability.
- To minimize the need for manual intervention, decreasing errors and saving time;

4. LITERATURE SURVEY

Both contemporary deep learning models like Convolutional Neural Networks (CNN) and more conventional feature-based techniques like Histogram of Oriented Gradients (HOG) have made major strides in facial identification. Contributions in both areas are highlighted in this section:

4.1 HOG-Based Methods

Deniz et al. [1] presented a facial recognition technique that improves resilience against occlusion and light variation by utilizing Histograms of Oriented Gradients (HOG). In a variety of scenarios, their multi-scale HOG method demonstrated enhanced recognition ability.

Rahmad et al. [2] HOG provided higher detection accuracy as compared to Haar Cascade classifiers, particularly in noisy and low-light environments. Despite requiring more computing, HOG demonstrated greater dependability in difficult situations.

In [3] By utilizing the spatial co-occurrence of gradient orientations, an enhanced Co-HOG feature representation was suggested. Tested on benchmark datasets such as ORL, this method greatly improved recognition accuracy.

In [4], a privacy-conscious approach that combines HOG with Optical Double Random Phase Encoding was created, providing safe biometric data processing without sacrificing recognition effectiveness.

Saurav et al. [5] used a Kernel Extreme Learning Machine (K-ELM) classifier with a Boosted HOG (BHOG) model for facial emotion detection, demonstrating quicker and more precise results than conventional methods.

4.2 CNN-Based Methods

Zhang et al. [6] offered a thorough analysis of CNN architectures used in face recognition, coming to the conclusion that deep learning models' hierarchical feature learning makes them superior to conventional methods in large-scale, real-world datasets.

Sharma et al. [7] deployed a CNN-based system designed specifically for attendance management and showed a significant increase in real-time performance and recognition accuracy compared to traditional methods.

Gupta et al. [8] created a CNN model that is lightweight and tuned for face recognition in real time. Their approach was perfect for embedded systems since it processed data quickly without sacrificing precision.

Roy et al. [9] suggested a CNN-based facial recognition pipeline with OpenCV integration that increased identification accuracy in dynamic settings like offices and classrooms.

Joshi et al. [10] centered on employing CNNs for real time video processing for classroom attendance systems, demonstrating how integrating face embedding methods with deep networks greatly improved recognition speed and scalability.

These research serve as the foundation for contemporary face recognition systems, which supports our suggested system's fusion of CNN for high-accuracy recognition and HOG for detection

5. METHODOLOGY

The system follows these steps:

Algorithm 1 Face Recognition Attendance Process

- 1: Initialize camera and load dataset.
- 2: Capture image and detect faces using OpenCV.
- 3: Extract facial features using HOG model.
- 4: Compare detected faces with stored dataset.
- 5: If a match is found, mark attendance and log time.
- 6: Store attendance data in a CSV file.
- 7: Display recognition result and update UI.

5.1 System Architecture

The entire process of a Face Recognition Attendance System, which uses facial recognition technology to record and capture attendance, is shown in the Fig 1. The following are the primary phases that the system goes through.

5.1.1 Attendance System with Face Recognition (Start Point)

The system is started in this initialization block. It signals the start of the program that manages attendance recording, face detection, and recognition.

5.1.2 Face Detection – Capture and Detect Faces from Webcam

The webcam is activated when the machine is turned on. The system uses a facial detection algorithm (such as Haar Cascade or MTCNN) to continually capture real-time video frames and identify faces within them. Finding the faces in the video feed is the only goal of this step.

5.1.3 Recognition & Matching – Recognize Faces Using Trained Model

Following face detection, this phase entails applying a face recognition model (such as face_recognition, Dlib, or a CNN-based model) to compare the collected faces with the trained dataset. By comparing the live image with stored photographs and selecting the greatest match, the system is able to identify the individuals.

5.1.4 Attendance Recording – Log Attendance to CSV with Time

Once a face has been identified, the system creates a CSV file with the student's name, date, and time. This file, which serves as the attendance sheet, can be exported or downloaded at a later time.

This block diagram shows how the system uses computer vision and machine learning approaches to convert real-time video input into structured attendance records.

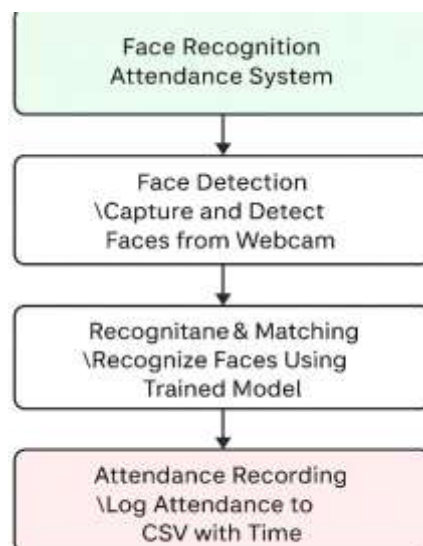


Fig. 1: System Architecture of Face Recognition Attendance System

5.2 Dataset Preparation

Teachable Machine, a Google-based web application that facilitates the quick capture of tagged photographs using a camera, was used in this study to produce a bespoke dataset of student face images. Teachable Machine's capacity to take numerous pictures in a few seconds, which cut down on the time and effort needed for manual data collecting, was the main driving force behind its use.

Every student was instructed to sit in front of a camera, and between 50 and 100 pictures were taken of each person in various lighting scenarios with minor facial expression changes. In order to increase the model's resilience to slight changes in appearance, this made sure that the dataset was diverse.

The photos that were taken were extracted into a folder after being exported as a ZIP file. We used the following format to arrange these photos into subfolders:

<student_name>_<USN>

For example: anil 1KS20CS010 The photographs of the corresponding students are contained in each subfolder, which facilitates the recognition system's ability to link a name to a face during training and prediction.

- **Total Number of Students:** 50
- **Images per Student:** 25–30
- **Total Dataset Size:** Approximately 1,250 to 1,500 images
- **Image Resolution:** 224 × 224 pixels (resized during preprocessing)
- **Image Format:** JPEG (.jpg)

The facial recognition system can be trained and tested on this well-structured and labeled dataset. We greatly sped up the dataset preparation process while preserving the high diversity and quality of the data by utilizing Teachable Machine's quick capture and export features.

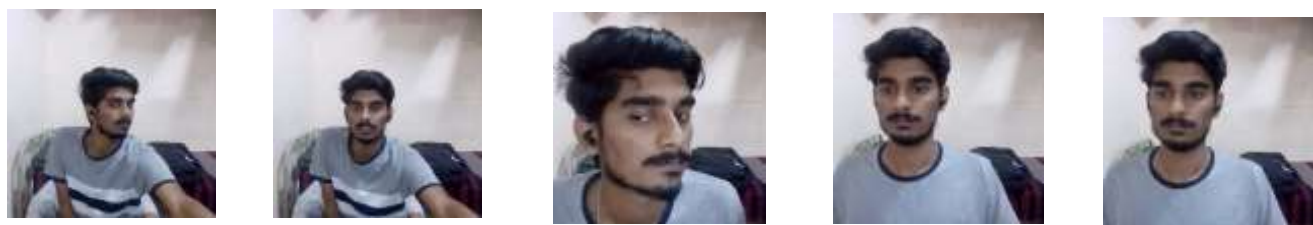
5.2.1 Sample Dataset Images

Each student in the dataset has numerous photos that were taken with Teachable Machine. To improve the recognition model's resilience, these photos feature a range of stances and lighting conditions. An example



from a student's image collection is shown in Fig 2:

Student 1



Student 2

Fig. 2: Sample images of different students used in the dataset (resolution: 224×224 pixels). Each row shows multiple facial variations of the same student.

6.RESULTS AND DISCUSSION

6.1 Student successfully recognized

The Face Recognition Attendance System's operation is shown in the Fig 3. The system turns on the webcam to detect and identify faces in real time when the "Start Webcam" button is pressed. By comparing the identified face with the preloaded collection of photos, the system effectively identifies the person (for example, "K M Anil Kumar"), as seen in the image. A bounding box that highlights the face appears on the screen along with the recognized name. The precise use of the HOG-based face detection and recognition system is demonstrated by this procedure. In order to provide smooth and effective attendance monitoring, the system additionally records the identified person's attendance into a CSV file after recognition is finished. The project's primary objective of efficiently automating attendance management is reflected in this useful feature.

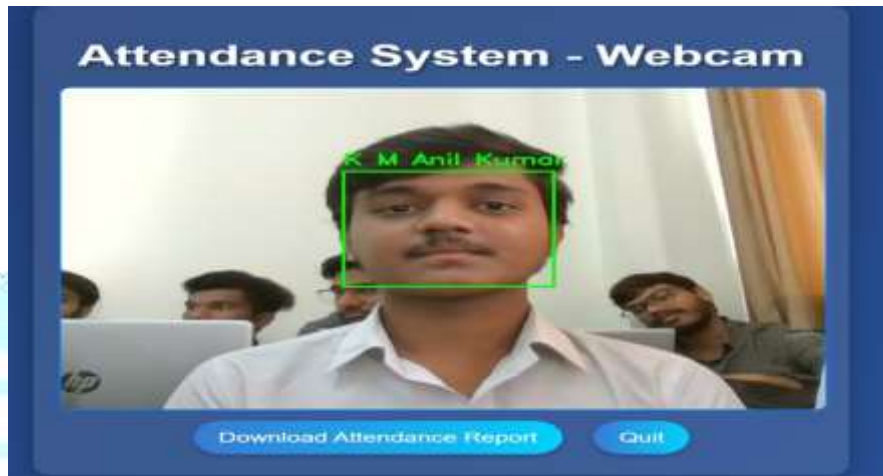


Fig. 3: Student recognized image

6.2 Student Unrecognized

The Face Recognition Attendance System can manage situations where a face is identified but not recognized, as shown in the Fig 4. If someone who isn't in the preloaded dataset shows up in front of the webcam, the system marks them as "Unknown." The label "Unknown" is shown, and a bounding box is drawn around the face. Maintaining accuracy and making sure that only people who are known are recorded into the attendance system depend on this feature. It also highlights how crucial it is to add additional people to the dataset as needed. The integrity of the system's records is also maintained by this function, which stops inaccurate information from being entered into the attendance log.

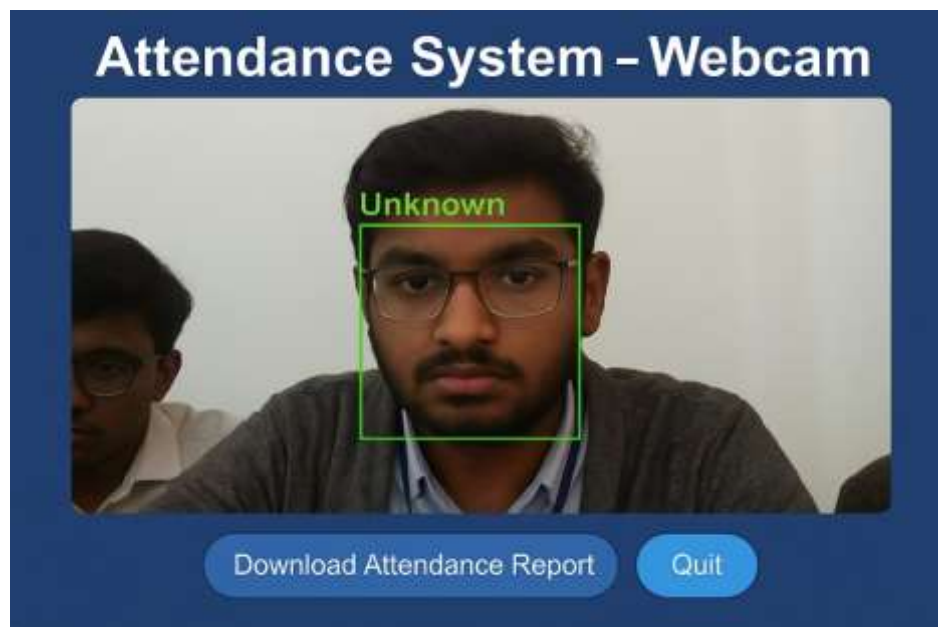


Fig. 4: Unrecognized student image

6.3 Attendance database

The system automatically logs the corresponding student's information into a CSV file when it recognizes a face as shown in the Fig 5. The technology compares the identified face with the preloaded collection of student photos during the recognition phase. The student's details, including name and USN (University Serial Number), are obtained after a match is discovered. In order to record the attendance, the system further records the current timestamp at the time of recognition. In addition to the student's name and USN, the attendance entry also provides the timestamp and the status "Present." A systematic and trustworthy attendance record is then ensured by appending this data to a file called attendance.csv. Attendance data may be easily stored in a CSV file, which makes it simple to inspect, download, or create reports for administrative use. This automated procedure ensures accuracy and efficiency in tracking attendance while doing away with manual labor.

	A	B	C	D	E	F	G	H	I	J
1	Name		USN		Status					
2	HP Darshan J		IC21CS096		Present		13:48:06			
3	Tejas Gowda N		IC21CS014		Present		13:48:07			
4	K M Anil Kumar		IC21CS129		Present		13:48:12			
5										
6										
7										
8										
9										
10										
11										

Fig. 5: Recognized students data stored in excel sheet

7.CONCLUSION AND FUTURE WORK

Using the Histogram of Oriented Gradients (HOG) algorithm for facial recognition and detection, the Face Recognition Attendance Management System offers a practical way to automate attendance procedures. By using a webcam to enable real-time face recognition, matching faces found with preloaded datasets, and precisely recording attendance in a CSV file, the system accomplishes its objectives. Systems operating on common hardware can benefit from the HOG-based method since it guarantees a good balance between computational economy and recognition accuracy. The project provides a user-friendly interface for smooth interaction and dependable attendance tracking, showcasing the usefulness of facial recognition technology. Although the system works effectively in controlled settings, outside variables like illumination or severe facial expressions can affect how accurate it is. Notwithstanding these drawbacks, the system is an effective and scalable solution for small to medium-sized use cases, setting the stage for upcoming improvements like cloud-based data integration or hybrid recognition models. All things considered, the project effectively illustrates how HOG-based facial recognition may be used to automate attendance tracking while using little resources. Future improvements include:

- Cloud integration for centralized data storage.
- Mobile application for remote attendance management.
- Improved real-time accuracy with advanced CNN models.

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