



# ATTENDANCE MONITORING USING FACE RECOGNITION

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**Abstract:** Attendance tracking is a crucial aspect of daily operations in educational institutions, organizations, and offices. Traditionally, this task involves manual methods like calling out names or roll numbers, which can be time-consuming and prone to errors. The aim of this project is to revolutionize attendance management by implementing a Face Recognition-based system, automating the process and enhancing efficiency. This innovative system, installed in classrooms or designated areas, utilizes facial recognition technology to identify and mark attendance. Students' information, including their names, roll numbers, class, section, and photographs, is stored and trained within the system. OpenCV is employed to extract facial images for training purposes. The system operates by capturing images of individuals approaching the device before the start of the class. These images are then processed through several stages: facial detection using a Haarcascade classifier, facial recognition utilizing the LBPH (Local Binary Pattern Histogram) Algorithm, comparison of histogram data with the established dataset, and automatic attendance marking. An Excel sheet is generated and updated regularly with attendance information, ensuring accurate record-keeping.

Overall, this project offers a modernized approach to attendance management, leveraging advanced technology to streamline processes and improve time management in educational and organizational settings.

## I.INTRODUCTION

Attendance-taking in educational institutions can be time-consuming and prone to errors, particularly when relying on manual methods such as calling out each student's name. Not only does this consume valuable class time, but it also opens the door to proxy attendance, where someone else marks attendance on behalf of others.

To address these challenges, many schools and colleges have explored alternative methods such as RFID, iris recognition, and fingerprint recognition. However, these approaches often involve queues and can be intrusive, potentially exacerbating time constraints.

Face recognition technology emerges as a promising solution due to its non-intrusive nature and relative immunity to variations in facial expressions. Face recognition systems typically operate in two modes: verification, which involves comparing a face image to a single template, and identification, which matches a face against multiple templates.

Our goal is to develop an attendance system leveraging face recognition techniques. Instead of manual input or queue-based methods, our system uses live streaming video within the classroom to detect student faces. When a detected face matches one in the database, attendance is automatically marked. This approach saves time compared to traditional methods and capitalizes on the growing popularity of face recognition technology.

Face recognition is a vital application of image processing, especially in identifying individuals for attendance purposes. Automating attendance management reduces human intervention and streamlines daily operations. While existing face recognition techniques struggle with challenges like scaling, pose variations, and illumination changes, our proposed system aims to overcome these limitations by integrating various techniques such as image contrasts, integral images, color features, and cascading classifiers.

The system's accuracy is tested across different scenarios, including varying lighting conditions, facial expressions, and the presence of occlusions like beards and glasses. By focusing on specific areas such as classroom attendance, we assess the system's performance using metrics like the percentage of recognized faces compared to the total number of faces tested for the same person.

## II. LITERATUREREVIEW

- [1] S. Bhattacharya made a system that uses a video as input and using Viola-Jones algorithm the facial expressions are extracted. This algorithm used the parameters like brightness, sharpness and resolution of the captured image.
- [2] Mayank Srivastava built a system that works in three steps, at first the detected image is extracted. Then the eigen values and eigenvectors of the trained image is computed. At last the stored images as YML file are compared to recognize the face.
- [3] Kennedy Ok okpujie used a camera module as input. The camera is used to detect face by using Viola-Jones algorithm. Fisher face algorithm is used to create a template of captured images.
- [4] Samridhi Dev proposed an attendance system in her research paper which uses Haar classifiers, KNN, CNN, and Gabor filters. Attendance reports will be stored in a excel file after face recognition.
- [5] Nandhini R. made a system which captures a video and converts it into frames. The face is detected using the CNN algorithm. These detected faces in the database are then matched with the input to recognize the face.

## III. PROBLEMSTATEMENT

Relying on manual processes to maintain and log attendance in a class proves to be ineffective. The allure of skipping classes or arranging proxies for absentees has become a trend among today's students. Manually recording attendance in logbooks presents challenges and is susceptible to manipulation.

Therefore, there is a pressing requirement to create a student attendance system that operates in real-time, ensuring that the identification process occurs within specified time limits to avoid any omissions. The features extracted from facial images, which serve as the basis for student identity, must remain consistent despite changes in background, lighting conditions, pose, and facial expressions. The performance evaluation of this system will prioritize both high accuracy and rapid computation time as key metrics.

## IV. METHODOLOGY

### Workflow of Machine Learning Model Building

#### LOCAL BINARY PATTRARNS HISTOGRAM:

The gray scale pictures is needed in this method for dealing with the training part.

#### 1) Parameters:

LBPH uses the following parameters:

- i. **Radius:** The radius parameter defines the radius around the central pixel for which the pixel values are compared. It determines the size of the neighborhood considered for computing the local binary patterns. A larger radius captures more spatial information but may also introduce noise.
- ii. **Neighbours:** The neighbors parameter specifies the number of sample points to be considered around the central pixel. It determines the number of comparisons made to generate the binary pattern. More neighbors result in a more detailed representation but also increase computational complexity.
- iii. **Grid X and Grid Y:** As the parameter Grid X increases, the number of cells along the horizontal direction in the image grid expands. This finer grid division leads to a more detailed analysis of local image regions. Consequently, the feature vector's dimensionality grows as more cells are introduced, capturing a richer representation of the image's texture and structure. When the parameter Grid Y is augmented, the number of cells along the vertical direction in the image grid escalates. This refinement of the grid configuration leads to a more intricate subdivision of the image. Consequently, as the number of cells increases, the dimensional complexity of the feature vector also expands, facilitating a more comprehensive encoding of the image's characteristics and nuances.

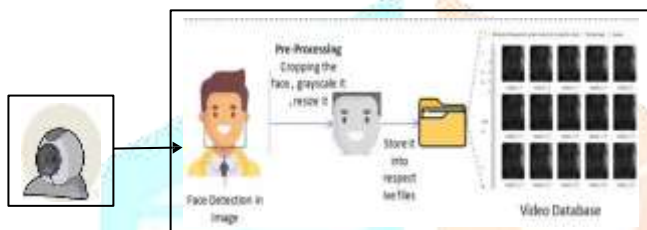
#### 2) Algorithm Training:

During the algorithm training phase, a dataset comprising facial images of individuals to be recognized is utilized. Each image in this dataset

is associated with a unique identifier, enabling the system to learn and differentiate between different individuals. This training process enables the algorithm to effectively interpret input images and generate corresponding outputs. Images depicting the same individual are labeled with the same unique identifier to ensure consistent recognition.

### 3) Computation of the Algorithm:

In the algorithmic computation stage, we begin by enhancing the facial features of the original image to create an intermediate image. This enhancement is achieved through a sliding window approach, employing parameters provided for guidance. Initially, the facial image undergoes grayscale conversion. Subsequently, we traverse the image using a 3x3 window, essentially a matrix encompassing the intensity values of each pixel (ranging from 0 to 255). Within this window, the central pixel's intensity acts as a threshold for determining the values of



its eight neighboring pixels. Each neighbor is assigned a binary value based on whether its intensity surpasses the threshold (assigned 1) or not (assigned 0). These binary values are then concatenated to obtain new values for each position. Following this step, the binary sequence is converted into a decimal value, which replaces the central pixel's intensity, effectively reconstructing the original image. Upon completion of this process, we obtain an intermediate image exhibiting enhanced facial characteristics compared to the initial input.

### 4) Extraction of Histogram:

In the preceding step, the image obtained utilizes the parameters Grid X and Grid Y to partition the image into multiple grids. From the image, the histogram can be extracted as follows:

- i. The histogram counts the occurrences of different patterns within the cell. Typically, there are 256 possible patterns in an 8-bit image (0-255), so the histogram usually has 256 bins. Each bin in the histogram corresponds to a particular pattern, and its value represents the frequency of occurrence of that pattern within the cell.
- ii. After histograms are computed for all cells in the image, they are concatenated to form a single feature vector representing the entire image. The concatenated feature vector encodes the distribution of Local Binary Patterns across the entire image, capturing the texture information necessary for face recognition.

### 6) The Face Recognition:

The training of the algorithm is done. To locate an image identical to the input image, it compares the histograms of the two images and returns the image with the closest histogram match. Various methods are employed to compute the distance between the histograms. Here we use the Euclidean distance based on the formula:

$$D = \sqrt{\sum_{i=1}^n (\text{hist1}_i - \text{hist2}_i)^2}$$

Hence this method yields the ID of the image with the closest histogram, alongside a measure of confidence calculated as the distance. This "confidence" value, along with a predefined threshold, enables automatic evaluation of image recognition accuracy. If the confidence falls below the specified threshold, it indicates successful recognition by the algorithm.

### DATA ACQUISITION

The initial phase of the Attendance System involves establishing a database of faces. Various individuals are included, with a camera employed to detect and capture frontal face images. The number of frames captured can be adjusted to enhance accuracy. These images, along with corresponding Registration IDs, are then stored in the database.

### IMAGE PROCESSING

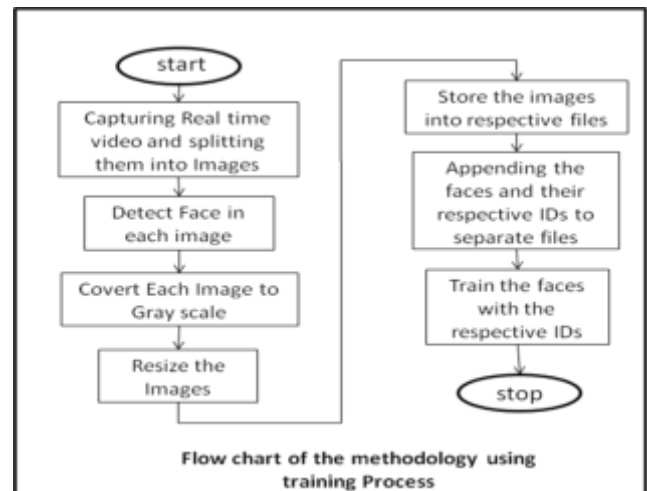
The facial recognition process can be split into two major stages: processing which occurs before face detection and alignment and after that face recognition is done using feature extraction using Euclidean distance and matching steps:

- A. **Face Detection:** This initial phase aims to determine if human faces are present in an image and to identify their locations. The output includes patches containing each detected face. To enhance the robustness and design flexibility of the system, face alignment is conducted to standardize the scales and orientations of these patches.
- B. **Feature Extraction:** Following face detection, human face patches are extracted from images. These patches are then converted into vectors with fixed coordinates or a set of landmark points. In this project, LBPH (Local Binary Patterns Histograms) was utilized for feature extraction.
- C. **Face Recognition:** The final step involves identifying the faces. For automatic recognition, a face database is constructed. Multiple images are captured for each individual, and their features are extracted and stored in the database. When an image is provided as input, face detection and then feature extraction are performed on the image. The features of the input image are then compared to each face class stored in the database to determine identity.

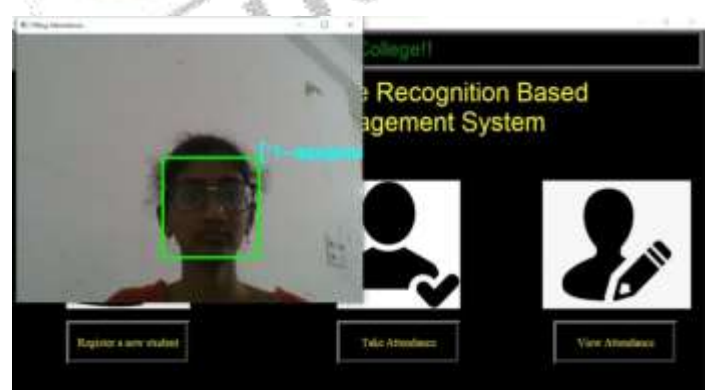
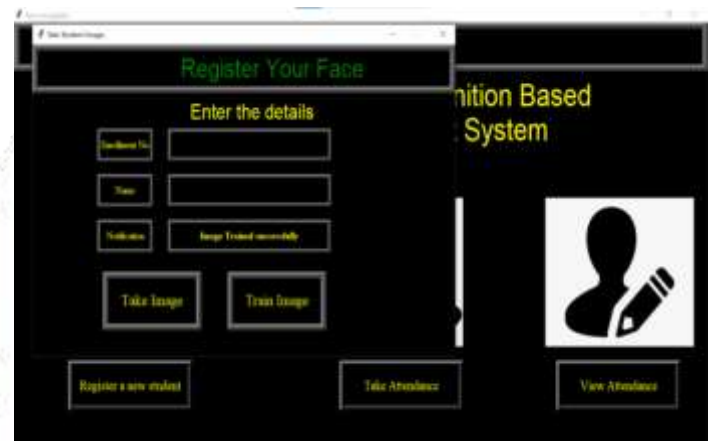
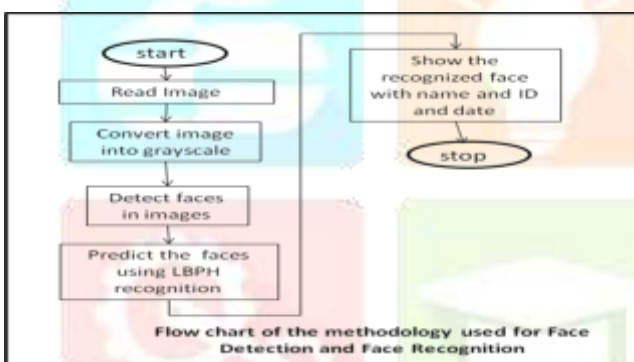
## DATA ANALYSIS

### 1) Model Training :

The training process commences by scanning through the training data directory. Each image in the training dataset is converted to grayscale. A specific portion of the image is chosen as the center, and its neighboring pixels are compared against it using a thresholding mechanism. If the intensity of the central portion is equal to or greater than its neighbors, it's denoted as 1; otherwise, it's denoted as 0. Following this step, the images are resized. Subsequently, the images are converted into a numpy array, which serves as the central data structure of the numpy library. Facial detection is performed on each image, resulting in the creation of 14 separate lists, each containing detected faces along with their respective IDs. These faces are then used to train the system, associating them with their corresponding IDs.



### 2) Model Implementation :



## V.RESULTS



## VI. CONCLUSION

we can build an effective attendance management system using face recognition in deep learning. The system can be designed to capture images or videos, detect faces, and recognize individuals using a pre-trained deep learning model. The recognized individuals can then be marked as present in the attendance log.

## VII.FUTURE WORK

We're envisioning a future where we implement multi-face recognition technology through closed-circuit cameras (CC cameras) to revolutionize attendance tracking. This system would streamline the process, saving valuable time, and eliminating the possibility of proxy attendance and data corruption.

By integrating face recognition directly into CC cameras, the system would automatically capture video during class sessions, adhering to scheduled timings. This footage would then be securely stored on a server, ensuring its integrity and preventing any tampering or modifications.

With this innovative approach, we can enhance efficiency and accountability in attendance management, providing a robust solution for educational institutions to ensure accurate and reliable attendance records.

## VIII.REFERENCES

- [1] "Automated Attendance System using Face Recognition"  
URL:<https://www.ijert.org/research/automated-attendance-system-using-face-recognition-IJERTV8IS030069.pdf>  
This paper discusses the implementation of an automated attendance system using face recognition technology. It covers the system architecture, algorithm used, and experimental results.
- [2] "Face Recognition Based Attendance System"  
URL:<https://www.ijraset.com/files/serve.php?FID=21438> .This article presents a face recognition-based attendance system designed for educational institutions. It includes details about the system design, implementation, and performance evaluation.
- [3] "Attendance System Using Face Recognition: A Review"  
URL:<https://www.ijedr.org/papers/IJEDR1804175.pdf> .This paper provides a review of different approaches and techniques used in attendance systems based on face recognition. It discusses the advantages, challenges, and future directions in this field.
- [4] "Development of an Attendance Monitoring System Using Face Recognition"  
URL:[https://www.researchgate.net/publication/308743997\\_Development\\_of\\_an\\_Attendance\\_Monitoring\\_System\\_Using\\_Face\\_Recognition](https://www.researchgate.net/publication/308743997_Development_of_an_Attendance_Monitoring_System_Using_Face_Recognition). This research paper outlines the development process of an attendance monitoring system using face recognition. It covers the system architecture, methodology, and experimental results.

- [5] "Smart Attendance System Using Face Recognition"

URL:<https://www.ijitee.org/wp-content/uploads/papers/v9i12/L69331191219.pdf>

This article describes the design and implementation of a smart attendance system based on face recognition technology. It includes details about the system components, algorithm used, and performance evaluation.