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# Online Attendance Using Face Detection For Virtual Classroom Using Local Binary Pattern Histogram (Lbph)

Gazala Kazi,
gazalkazi39@gmail.com

Asst. Professor Supriya Nagarkar
Department of Computer Science, TMV Pune-37

## Abstract

The face is the most important component of the human body for identifying a person. Face recognition systems can be created using facial characteristics as biometrics. The OpenCV based face recognition approach has been proposed in this study. Using OpenCV algorithms, this process stores the input images and converts them to grayscale images with their ID and names. The system will use the Local Binary Pattern Histogram (LBPH) approach to train grayscale images and save the data with their information. The system will recognize the input image and compare with the database and mark the attendance of the students and generate excel sheets.

**Keywords:** Haar cascade Classifier, Local Binary Pattern Histogram (LBPH) algorithm, OpenCV, Spreadsheet.

## Introduction:

Attendance marking is critical for preserving student performance, and especially in this pandemic situation, courses are delivered online, making it harder to maintain student performance. Facial recognition attendance is important because we may use face recognition software and biometric techniques to track student attendance. Automated attendance system is the advancement that has taken place in the field of automation replacing traditional marking attendance systems. [1] Face Recognition is a biometric way of identifying a person by matching live capture or digital picture data to a student's saved record. This system includes detection of human faces through a high definition camera where detection of images is done using a well-known algorithm called Local Binary Pattern Histogram Algorithm [10].This technology is used to track attendance in the Attendance System. Recognition of people's faces. This technology is used to track attendance in the Attendance System. Attendance is an important element of the daily evaluation in the classroom. The teacher typically checks it, but it's possible that the teacher missed someone or that some pupils answered many times[2]. Face recognition-based attendance system is a solution to the problem of recognizing faces for the purpose of collecting attendance, based on high-definition monitor video and other information technology. Face recognition is the ability of a computer system to detect and recognize human faces in photographs quickly and accurately.

## Overview:

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Face recognition is a biometric approach that determines whether the image of a student's face matches any of the face images contained in a database. Although facial recognition is not the most accurate of the biometric approaches, it offers certain advantages over the others. Using a conventional method of calling out names [5]takes approximately 5-10 minutes for marking attendance of the entire class. It becomes complicated when strength is more. Face recognition is simple, effective, and does not require any help. This system may give rise to the problem of fraudulent access. Iris [8] is the biometric that can be used for Attendance Systems. A web cam is used for capturing the images of students. The faces in the captured images are detected and compared with the images in the database and the attendance is marked.

**IMAGE PROCESSING**

The facial recognition process is divided into two stages: processing, which takes place before detection and involves face detection and alignment, and recognition, which takes place later and involves feature extraction and matching procedures.

1. FACE DETECTION: The major goal of this stage is to determine whether or not human faces appear in a given image and where they appear. Patches containing each face in the input image are the intended outputs of this stage to create a more reliable and easy-to-design facial recognition system. The scales and direction of these patches are rationalized by face alignment.

2. FEATURE EXTRACTION: Following the face detection process, human face patches are extracted from the image. Following this, the face patch is converted to a vector with fixed coordinates or a series of landmark points.

3. FACE RECOGNITION: Following the portrayal of faces, the final stage is to recognize them. We'll need to create a face database for automatic recognition. For each student, various images are captured, and their features are retrieved and saved in the database. After that, when an input image is fed, face detection and feature extraction are conducted, and their features are compared and stored in the database for each face class.

**Algorithm**

There are various algorithms used for facial recognition.

1.Local Binary Pattern Histogram: For the training portion of this method, grayscale images are required.

A. PARAMETERS: Local Binary Pattern Histogram (LBPH) uses the following parameters:

i. Radius: The radius of the circular local binary pattern, which represents the radius around the center pixel, is usually set to 1.

ii. Neighbors: The number of points in the area around the center pixel, which is usually eight. The computational cost will increase when the number of samples are increased.

iii. Grid X: Grid X represents the number of cells in the horizontal direction. The grid becomes finer as the number of cells increases, resulting in a rise in the dimensional feature vector.

iv. Grid Y: Grid Y represents the number of cells in the vertical direction. The grid becomes finer as the number of cells increases, resulting in a rise in the dimensional feature vector.

B. ALGORITHM TRAINING: The dataset of facial images of students to be identified, along with their unique ID, is necessary for training purposes so that the presented approach can use the available information to perceive an input image and provide an output. The same ID is required for the same images.

C. THE ALGORITHM'S EXECUTION: In the first stage, an intermediate image with better face attributes is formed, which corresponds to the original image. Sliding window theory is utilized to do this based on the parameters provided. A grayscale representation of a person's face is created. A 3x3 pixel window (also known as a 3x3 matrix) is used, which contains the intensity of each pixel (0-255). After that, we look at the matrix's central value, which we use as a threshold. The new values collected from the 8 neighbours are defined by this value. Each neighbour of the core value receives a new binary value. The result will be 1 if the value is equal to or greater than the threshold value, otherwise it will be 0.The matrix will only include binary values, and concatenation will be performed at each location to generate new values. The binary value is then converted to a decimal value, which is then used as the matrix's center value. It's a single pixel from the original image. When the procedure is finished, we are left with a new image that has the same qualities as the original.

D. EXTRACTION OF HISTOGRAM:

The image obtained in the previous stage is split into numerous grids using the Grid X and Grid Y parameters. The histogram can be extracted from the image as follows:

1. Because the image is grayscale, each histogram will only have 256 points (0-255) to represent the existence of each pixel intensity.

2. Following that, each histogram is formed, followed by the creation of a new, larger histogram. Let's say there are 8x8 grids, which means the final histogram will have 16.384 positions in total. In the end, the histogram represents the characteristics of the actual image.

E. THE FACE RECOGNITION: The algorithm has been properly trained. The two histograms are compared to discover the image that is identical to the input image, and the image corresponding to the closest histogram is returned. The distance between the two histograms is calculated using a variety of methods. We'll utilize the Euclidean distance, which is calculated using the formula:

Equation 1:

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

As a result, the ID of the image with the closest histogram is returned by this procedure. It should return the estimated distance as a 'confidence' value. The threshold and 'confidence' can then be used to determine whether the image is successfully recognized automatically. The threshold and 'confidence' can then be used to automatically determine whether or not the image has been accurately recognized. If the confidence value is less than the specified threshold, the image has been correctly detected by the algorithm.

ADVANTAGES OF USING LOCAL BINARY PATTERN HISTOGRAM (LBPH) ALGORITHM:

1. One of the simplest algorithms for face recognition.

2. The local features of the images can be characterized by this algorithm.

3. Using this algorithm, considerable results can be obtained.

4. OpenCV library is used to implement Local Binary Pattern Histogram (LBPH) algorithm.

- Block Diagram Of Face Detection Process

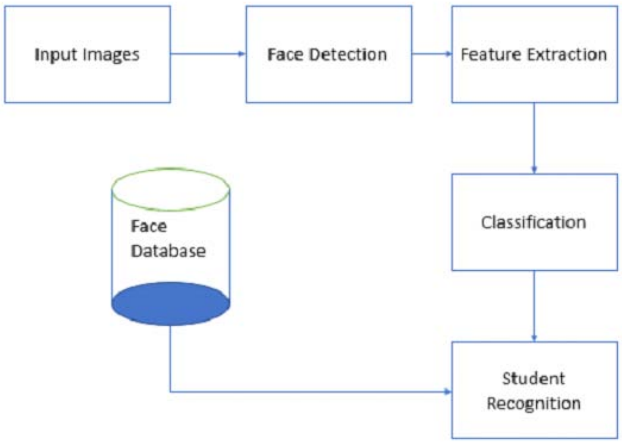


Fig 3.. Block Diagram Of Face Detection

DATABASE CREATION: The construction of a database of faces to be utilized in the Attendance System is the initial phase. Different students are taken into account, and a camera is utilized to detect faces and capture the frontal face. For different accuracy levels, the number of frames to consider can be changed. These photos, along with the Registration ID, are then placed in the database.

TRAINING OF FACES: After being captured by a camera, the photos are kept in grey scale. Because the coaching determines the resolution, the Local Binary Pattern Histogram (LBPH) recognizer is used to teach these faces. As a result, the recognized face resolutions are radically different. The center of the image is chosen, and the surrounding pixels are thresholder against it. It is denoted as 1 if the intensity of the center section is greater or equal to that of its neighbour, and 0 if it is not. As a result, binary patterns known as LBP codes will emerge.

FACE DETECTION:

The trained faces' data is saved in .py format. The Haar cascade frontal face module is used to detect the faces.

FACE RECOGNITION:

The trained faces' data is saved, and the identified faces are recognized by comparing them to the students' IDs. To ensure the system's correctness, faces are recorded in real time. This system is precisely dependent on the camera’s condition

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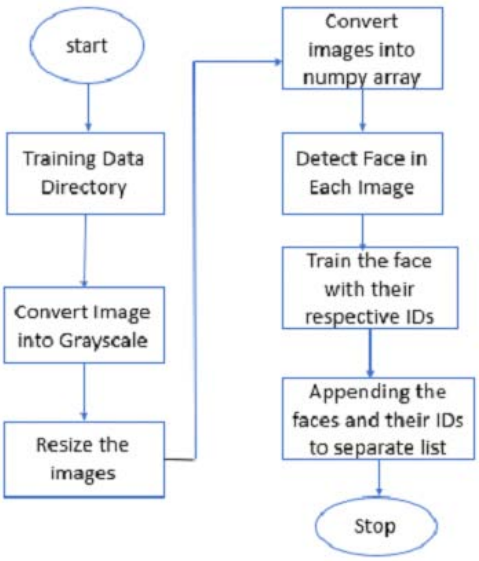


Fig1.Flow-chart used of Methodology used for Training Process

The traversal of the training data directory is the first step in the training process. The images in the training date are all turned to grayscale. A portion of the image is chosen as the center, and its neighbours are set against it. If the center part's intensity is more than or equal to that of its neighbour, use 1; otherwise, use 0. Following that, the photos are downsized. The photos are then transformed into a numpy array, which is the numpy library's primary data structure. Each individual face in the image is recognized. Separate lists for each face are created, and the faces, along with their associated IDs, are appended to them. The faces are then programmed with their unique IDs.

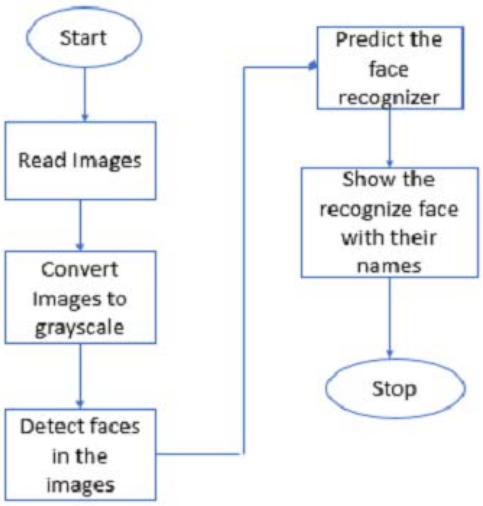


Fig2..Flow-chart used of Methodology used for Face Detection And Recognition

The camera on the phone reads the input image. The image is transformed to grey scale after it has been read. The Haar Cascade frontal face module is used to detect the faces in the image. The faces in the image are predicted using the Local Binary Pattern Histogram (LBPH) algorithm. Following the prediction of the photos, the recognized faces are displayed in a green box with their names.

**SOFTWARE DESCRIPTION**

1.OpenCV: OpenCV (Open-Source Computer Vision Library) is a machine learning-oriented open-source computer vision software library. OpenCV was created with the goal of assisting computer vision applications and encouraging the use of machine perception in commercially viable goods. OpenCV is a BSD-licensed tool that allows for simple code usage and customization. More than 2500 complex algorithms are included in the collection, including a large number of both traditional and cutting-edge computer vision and machine learning techniques. These algorithms can be used to detect and recognize faces, identify objects, extract three-dimensional models of objects, create three-dimensional point clouds from stereo cameras, stitch images together to create a high-resolution image of an entire scene, find similar images in an image database, removing red eyes from flash photos, tracking eye movements, recognizing scenery and placing marks to overlay it with heightened realism, and so on.

2.Microsoft Excel: Microsoft Excel is a spreadsheet programmed that is part of the Microsoft Office suite. Spreadsheets are tables of values that are organized in rows and columns and may be numerically modified using both basic and advanced arithmetic functions and operations. Excel adds programming capability via Microsoft's Visual Basic for Applications (VBA), the ability to retrieve data from external sources via Microsoft's Dynamic Data Exchange (DDE), and sophisticated graphing and charting capabilities to its regular spreadsheet functions. Excel is a spreadsheet tool that may be used to organize, store, and change data. Previously, electronic spreadsheet systems were based on paper spreadsheets that were used for accounting. The basic layout of electronic spreadsheets is similar to that of paper spreadsheets. Tables, which are a collection of small rectangular boxes or cells that are standardized into rows and columns, can be used to hold related data.

## Conclusion

The most effective OpenCV face recognition algorithm for Attendance Management is described in this study. The Local Binary Pattern Histogram (LBPH) algorithm was used to create the system. Local Binary Pattern Histogram (LBPH)outperforms other algorithms by a ratio of 2-5 and has the least amount of noise interference. The Smart Attendance System's implementation demonstrates that the appropriate recognition rate and the threshold value are in agreement. As a result, Local Binary Pattern Histogram (LBPH) is the most reliable and capable face recognition algorithm in OpenCV for identifying students at educational institutions and accurately noting their attendance by avoiding proxies.

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