International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 06 | June - 2021 ISSN: 2582-3930

Facial Recognition Attendance System (FRAS) using Haar Cascade and LBPH Algorithm

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Abstract - This Attendance is a compulsory requirement of every organization. Maintaining attendance register daily is a difficult and time-consuming task. There are many automated methods for the same available like Biometric, RFID, eye detection, voice recognition, and many more. This paper provides an efficient and smart method for marking attendance. As it is known that primary identification for any human is its face, face recognition provides an accurate system which overcomes the ambiguities like fake attendance, high cost, and time consumption. This system uses face recognizer library for facial recognition and storing attendance.

Key Words: Attendance, Face Recognition, Face detection, Face LBPH algorithm, Harr Cascade, OpenCV

1.INTRODUCTION

The main objective of this project is to develop face recognition based automated employee attendance system using OpenCV. In order to achieve better performance, the test images and training images of this proposed approach are limited to frontal and upright facial images. The test images and training images need to be captured by using an equivalent device to make sure no quality difference. In addition, the employees need to register within the database to be recognized. The enrolment is often done on the spot through the user-friendly interface. The process of identification will be based on face recognition which is further divided into three steps: detection of face, extractions of the features and classification, and real time recognition. Detection of face is recognized as the essential step of our system. It is used to extract a face in a frame, which is based on the Viola-Jones object detection algorithm that uses AdaBoost classifier with Haar and LBP features. Local Binary Patterns (LBP) is utilized to extract the unique features of the face like eyes, nose, and mouth in the feature extraction phase. The facial image is correlated with the images available in the database for the classification. The system is implemented in Python using OpenCV library.

2. PROPOSED SYSTEM

The proposed employee attendance management system is made on Haar Cascade for face detection and the Local Binary Pattern Histogram algorithm for face recognition. Graphic User Interface for this system is created using python module Tkinter because It is easy to very interactive and easy to implement. The GUI is shown in Figure-2.

This system provides functionalities like taking images of employees alongside their details for the database, training the images within the database and on the camera and begin tracking people entering the office. When employees enter the office department, this system detects the faces who are entering the office from the camera and pre-processed for further processing. The stages within the proposed system are shown in Figure-1 The process of every stage is mentioned thoroughly in the next section.

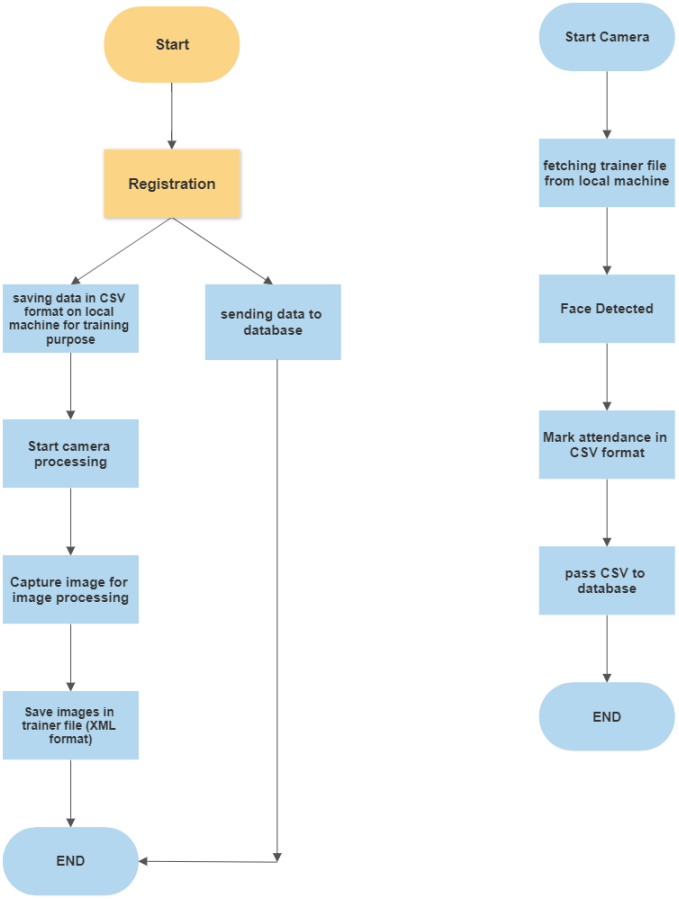

Fig. 1. System Flowchart

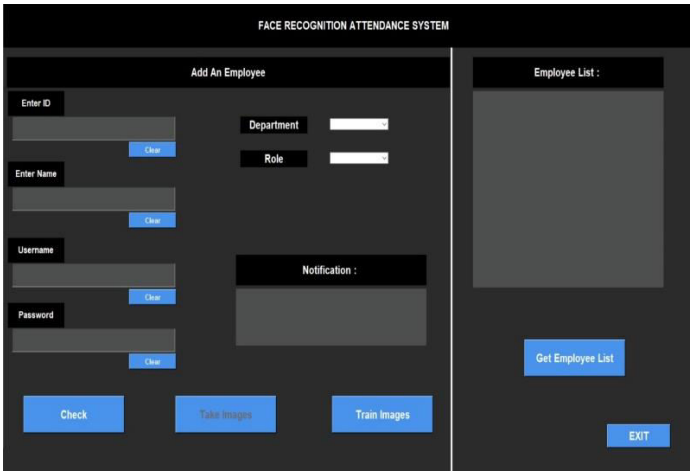

Fig. 2. System GUI

3. METHODOLOGY AND DATASET

We have created our own dataset containing 30 images for each person. There consists of 10 individuals with 30 images of each that have been taken for this project. Additional 5 individuals are taken for testing recognition of unknown persons. We have tested our system using a live real-time video in which employees and unknown persons stand in front of the camera.

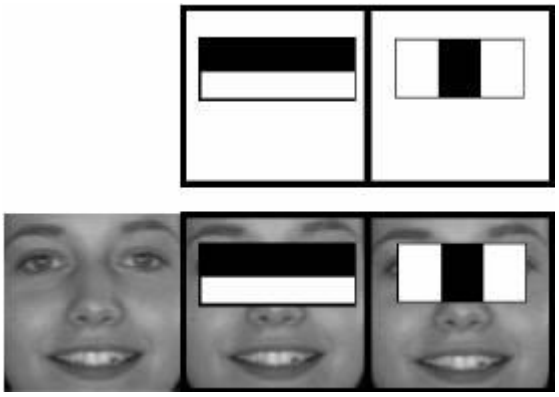

Fig. 3. Example for relevant Haar-like featires

A.Face Detection

Initially we convert the frame from color to grayscale mode. For detecting the faces we have used a haar cascade classifier where a cascade function is trained and detect features in other images. Tm make this possible, we use haar features like edge, line, and four-rectangle. For a variable size of an image, it takes a lot of computations and features and most of them will be unnecessary. But AdaBoost manages to select the best out of many as shown in Figure 3.Then Region Of Interest containing faces is extracted and sent to next stage.

B. Face Recognition

The process of face recognition is different from the detection of the face. In the process of detection of face, the system recognizes the face with an image and locates its position whereas in face recognition the system recognizes specific people. Face recognition basically compares the input face within an image and visually searches with all facial images in the data set, find and identify specific faces within large image collections. The LBPH algorithm is used as it find characteristics that best describe a face in image. They were many face recognition algorithms and the LPBH algorithm is better different environments and light conditions than other algorithms.

First, it converts the frame to matrices of 3X3 pixels as in Figure-4 . if a neighboring pixel in a matrix is greater than the median pixel of that matrix then set value 1 else 0 in that pixel position. Writing down the values of neighbor pixels in a line we get a binary number. We convert that binary number to decimal number and replace it with the median pixel value of the matrix.

Now the image is converted into LBP form, it extracts histograms from each grid and concatenate to form a new and larger histogram. Each histogram represents the facial image from the database. For the next image, it again performs the above steps and gets a new histogram for the image.

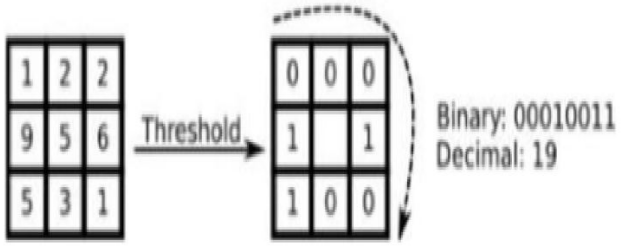

Fig. 4. 3X3 matrix LBP

C. Post Processing

For recognition of the person in the image it compares the new histogram (by applying Euclidean distance) with the histogram from the training dataset and chooses the histogram having lowest confidence which is least distance, since lower confidences are better and also extracts the ID corresponding to that histogram. If the confidence is less than 50 then information belonging to the extracted ID is shown on the camera frame as in Figure-6, the names are updated into database as in Fig. 8. Else ”Unknown” word is shown in the Figure-7. This helps in identifying any unknown person entering the department.

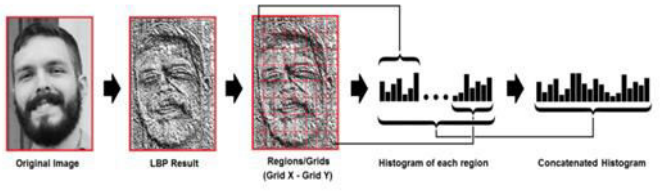

Fig. 5. Working of LBPH algorithm on an grayscale image

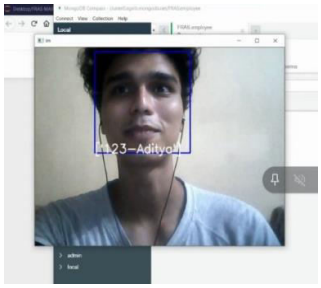

Fig. 6. Recognizing the faces with label

Fig. 7. Labelling unknown faces and known faces

4. RESULT AND ANALYSIS

We have considered 300 cm as the distance of an object for recognition. As we can see in Table 1, the Face recognition rate of employees is 89% and its false-positive rate is 11%. The system is recognizing people even when they are wearing glasses. Face Recognition of unknown persons is 60%. This happens mostly due to detecting random objects. Its false positive rate is 15%. The threshold value only affected the false positive rate of an unknown person. It is observed that only if confidence is greater than 50 and 95 then a person is considered to be an unknown person and that person's image is saved with unknown tag.

id	Name	Time	Date
3	[Prateek]	9:45:23	11/6/2021
212	[Soham]	9:45:28	11/6/2021
436	[Aditya]	9:45:30	11/6/2021

Fig. 8. Attendance marked in the sheet

TABLE 1 : PERFORMANCE OF THE SYSTEM

Performance	Result percentage
Employees Recognition Rate (Live video)	89%
false-positive rate	11%
Unknown people Recognition Rate (proposed model)	60%
Unknown people false-positive rate (proposed model)	15%

5. CONCLUSIONS

We have successfully implemented an automated employee attendance system. It helps in reducing time and efforts, especially for large number of employees on everyday basis. The whole system is implemented in Python programming language. We have used Haar Classifies and LBPH for face detection and recognition. Also, this record of attendance can further be used for cross-verification. We were able to make our system interface using Tkinter library of python. MongoDB database is used for marking attendance of the employees. We were able to successfully integrate all the files and able to answer our problem statement which is to make an employee attendance system for an office.

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