STUDENT ATTENDANCE MONITORING SYSTEM USING FACE RECOGNITION

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ABSTRACT - There is no reason that a critical educational practise like attendance should be viewed in the old, tedious manner in this age of rapidly evolving new technologies. In the conventional method, it is difficult to manage large groups of students in a classroom. Since it takes time and has a high risk of error when entering data into a system, it is not recommended. Real-Time Face Recognition is a practical method for dealing with a large number of students' attendance on a daily basis. Many algorithms and techniques have been developed to improve face recognition performance, but our proposed model employs the Haarcascade classifier to determine the to determine the positive and negative characteristics of the face, as well as the LBPH (Local binary pattern histogram) algorithm for face recognition, all of which are implemented in Python and the OpenCV library. For user interface purposes, we use the tkinter GUI interface.

KEYWORDS-Local Binary Pattern Histogram(LBPH), Face Detection, Face Recognition, Haarcascade Classifier, Python, Student Attendance.

I. INTRODUCTION

Face Recognition is a popular image processing technology because of its widespread usage. Face recognition may be used to identify people in an organisation for attendance purposes. The maintenance and evaluation of attendance records is critical in every organization's performance review. The aim of creating an attendance monitoring system is to automate the conventional method of taking attendance. With less human interaction, the Automated Attendance Management System conducts the everyday tasks of attendance marking and review. When the intensity is greater, the traditional form of attendance marking becomes very time consuming and complicated. Automation of Attendance System has an advantage over conventional methods in that it saves time and can also be used for monitoring. This also aids in the prevention of false participation. Other biometric techniques, such as those mentioned below, can also be used to computerise the attendance process:

1. Log Book entry
2. Fingerprint based System
3. IRIS Recognition
4. RFID based System
5. Face Recognition

Facial recognition is the most unique, efficient, precise, and cost-effective of all the techniques described above. There are several sub-problems in the scheme, which are discussed in detail below.

1. Take a photo and identify all of the people in it.
2. Concentrate on a single face to remember that it is still the same person, even though it is bent in a different direction or has bad lighting.
3. Take note of the face's distinguishing features that will help you differentiate it from other photographs. The nose, the depth of the eyes, the proportions of the face, the colour of the skin, and so on are examples of characteristics. The human brain is capable of easily recognizing faces. Computers may also be programmed to identify the individuality of faces, so we must programme or train the machine how to distinguish between faces based on their distinguishing characteristics. As seen below, facial recognition can be split into two categories:

1. Verification
2. Identification

Verification is a one-on-one matching process (match or no match). The tool may be used to lock and unlock systems, phones, and other electronic devices.

Identification is a technique for distinguishing an individual within a group of individuals, such as one out of N.

II. LITERATURE SURVEY

Hajar Filaliet. al. [1] compared four machine learning techniques that allow a machine to learn and execute tasks that are difficult to complete using more conventional algorithmic methods (Haar-AdaBoost, LBP-AdaBoost, GF-SVM, GFNN). "Haar-AdaBoost" and "LBP-AdaBoost," The first two methods use the Boosting algorithm to choose and obtain an optimal classifier for a cascade classification. The Gabor filter is used to remove the characteristics in the last two classification methods, "GF-SVM" and "GF-NN." As a result of this research, we discovered that the detection time varies depending on the system. The Haar-AdaBoost approach remains the best of the four methods in terms of output rate. As a result, HaarAdaBoost will be used.

[2] proposes a scheme that avoids the pitfalls of the conventional manual attendance system. This paper explains how real-time face detection and recognition can be used to track student attendance. The paper depicts an automated attendance device that consists of a camera mounted in the classroom to capture photographs, accompanied by multiple face detection.Students' Face Database Development, HOG features, Face Detection and Eye Detection, SVM Classifier, Comparison/Recognition, and Attendance Marking are just a few of the steps in this method. To achieve the desired results, Viola-Jones and HOG functionality, as well as an SVM classifier, are used.
The paper had some flaws, such as the device being light-sensitive. The proposed system could overcome this flaw by employing algorithms that aren't affected by lighting, as well as advanced high-resolution cameras.

E.Varadharaja and colleagues al [7] suggested a face recognition-based method for automatic attendance. There are four components to the device. The first is Background Subtraction, in which the background of the image is removed. The image is subtracted, leaving only the face in the image. Face detection and cropping is the second component. Only the faces are cropped and stored in the images. The third step involves using the Eigenvalue method to recognise images. Eigen vectors are determined using formulae in this system, and images are recognised. Between the stored and testing images, the Euclidean distance is determined. After that, attendance is registered. Face recognition is difficult with this approach, which requires only simple hardware installation. The eigen vector form used in this paper has a 60-70 percent accuracy. As a result, the suggested system will detect faces using Haar features rather than the eigen vector, which yields better results than the eigen vector solution.

Shireesha Chintalapati, M.V. Raghunadh, and colleagues [8] identified the various strategies for implementing a face recognition-based attendance monitoring system. There are two sections of the process. The first is the face detection method, and the second is the face recognition method. The Haar-features, integral graphic, Adaboost algorithm, and cascade function are the four key components of the Viola-Jones face detection algorithm, can be used to detect faces. LBP can be used to incorporate face recognition (local binary patterns). LBP aids in the conversion of images into machine-readable formats, such as binary. To make the calculation easier, Until facial detection and identification, the detected image should be transformed to greyscale. Face recognition records the image (student dataset) and then finds faces in the images, which are then stored for potential reference. Face recognition software captures photographs from the classroom and attempts to identify them by comparing them to previously identified faces.

III. PROBLEM DEFINITION

It becomes more difficult to mark attendance for each student when there are so many students in a organisation and it is a time-consuming one. The Existing system of any institute is manual entry for the students. This system faces the issue of wasting time and it becomes complicated when the strength is more. It is very tedious job to carry out the attendance in log books and to maintain the records. Face recognition is a difficult issue in computer vision. Some of the problems to deal with include lighting issues, posing issues, scale variability, low image capture accuracy, and partially occluded faces are all issues that need to be addressed. As a result, face recognition algorithms must be resistant to changes in the above parameters. Existing techniques don't work well when there's a change in lighting, background, or rotation. As a result, the drawbacks listed above must be addressed. The project's goal is to design and construct a system that is less vulnerable to light, rotates invariantly, scales invariantly, and is robust enough to be used in real-world scenarios.

IV. PROBLEM SOLUTION

The approach suggested in this project is to use facial recognition technology to monitor attendance. The computer captures camera video streams and senses faces in image format. The identified faces will be linked to the student database, and the attendance will be recorded in an Excel spreadsheet. Using these Excel boards, we will create a graph that displays the average attendance of the whole class/individual student.

V. METHODLOGY

The method proposed in this paper is to mark the attendance of a student using Face recognition technique. The proposed system architecture is shown in figure.

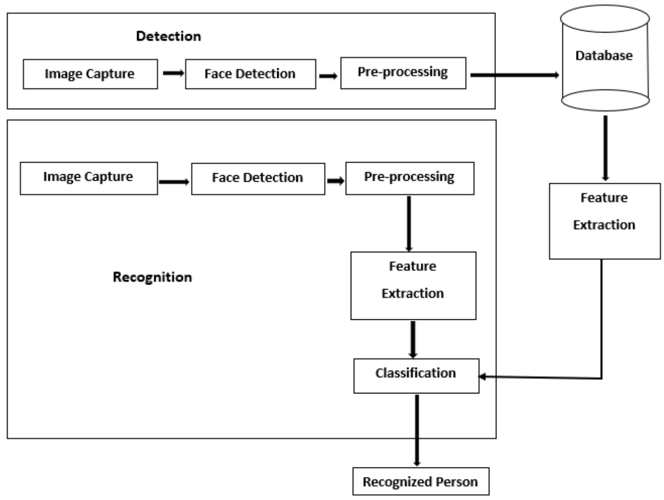


Fig. 1 Proposed system Architecture

A. Face detection using Haar-cascade Classifier:

Viola and Jones invented the Haar- cascade system, which trains machine learning to detect objects in an image. It can be used to detect faces in this context. The fundamental idea behind the Haar-based face detector is that the region with the eyes should be darker than the forehead and checks when looking at most frontal images, and the region with the mouth should be darker than the cheeks, and so on. It normally goes through about 20 levels of measurements like this to decide whether or not it's a face, so it has to do so in every possible place in the picture and with every possible size of the face, resulting in thousands of checks per image. A Haar-like characteristic is a rectangle separated into two, three, or four rectangles. Each rectangle is either black or white in colour. Figure 5 depicts the various features that can be used. A Haar cascade must be conditioned with a variety of positive and negative images. The aim is to work out which feature combination defines a face. A positive

image includes the object that must be remembered, while a negative image does not contain the object.
In the sense of face recognition, a positive image has a face, while a negative image does not. Grayscale images are needed for this machine learning. To determine the feature is reflected, the strength of grey will be used. By subtracting the number of the dark pixels in a given area from the sum of the light pixels, these properties can be discovered.

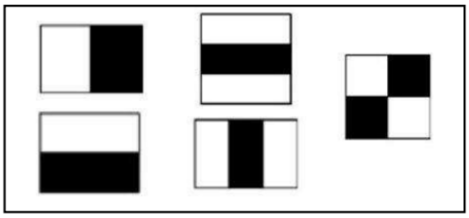


Fig. 2 Types of Haar Features

Fig. 3 Haar Features applied on an Image

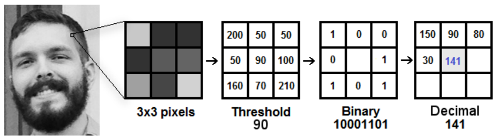
B. Training the Algorithm: we are training the Algorithm with the help of facial images of the students. we also need an unique identification number for each image which helps in recognition. All the images of the student should have a unique identification number.

C. Face Recognition using Local Binary Pattern Histogram (LBPH):

The LBPH's first procedural step is to create an intermediate image that highlights the facial features of the original image and best reflects it. The algorithm accomplishes this by using the idea of a sliding window, which is dependent on the parameters radius and neighbours.
This technique is depicted in the diagram below:

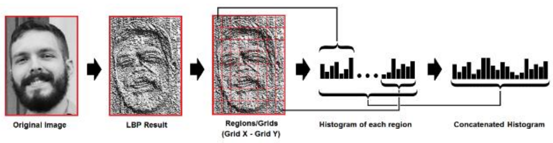
To make it easier to understand, let's break it down into small approaches that rely on the diagram above:
Assume we have a grayscale picture of a face.

- We can get a 3x3 pixel window of a portion of this image.



- It can also be interpreted as a 3x3 matrix with each pixel's intensity (0255).
- After that, we need to use the matrix's central value as the threshold.
- This value will be used to determine the new values derived from the eight neighbours.
- We create a new binary value for each neighbour of the central value (threshold). For values that were equal to or higher than the threshold, we used a 1, and for values that were smaller, we used a 0.
- The matrix can now only contain binary values (ignoring the central value). Each binary value from each location in the matrix must be concatenated line by line into a new binary value (e.g. 10001101). It's worth noting that different writers concatenate the binary values in different forms (for example, clockwise), but the final result is the same.
- The binary value is then converted to a decimal value and assigned to the central value of the matrix, which is a pixel from the original image. number of radius and neighbours.

Extracting the Histograms: Using the **Grid X** and **Grid Y** parameters, we can now divide the map into multiple grids using the diagram generated in the previous step, as seen in the following image:



We can extract the histogram of each area as follows using the image above:

- Since we're working with a grayscale picture, each histogram (from each grid) will only have 256 positions

(0255) to reflect the occurrences of each pixel strength.

- Then, to make a new, larger histogram, we must concatenate each histogram. In the case of 8x8 grids, the final histogram would have 8x8x256=16.384 locations. The characteristics of the original image are represented by the final histogram.

That's pretty much it for the LBPH algorithm.

- **Performing the face recognition**: The algorithm has already been trained at this stage. Every image from the training dataset is represented by a different histogram. As a result, given an input image, we repeat the steps for this new image, resulting in a histogram that represents the image.
- So, all we have to do to find the image that fits the input image is compare two histograms and return the image with the nearest histogram.
- We can use a number of methods to compare histograms (calculate the distance between two histograms), such as Euclidean distance, chi-square, absolute value, and so on. We may be using the Euclidean distance (which is well-known) in this case, which is calculated using the formula:

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

- As a result, the ID from the image with the nearest histogram is returned by the algorithm. The algorithm should also return the distance calculated, which can be used as a "confidence" indicator. Note: Don't be fooled by the term "confidence"; lower confidences mean a narrower distance between the two histograms, which is stronger.
- We can then use a threshold and the 'trust' to see if the algorithm correctly identified the picture. If the trust is less than the given threshold, we can conclude that the algorithm has successfully recognised it.

VI. EXPERIMENTAL RESULTS

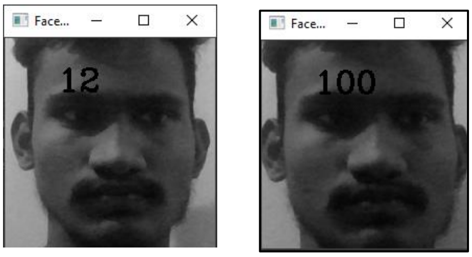


Fig. Dataset creation

In this proposed system, we have a authentication system for a faculty. After Authentication, the faculty need to register the student with their details and unique ID. During registration process, the faculty captures 100 image samples of a student. In this we are converting the coloured image to grayscale to avoid complexity and to get the desired results. Image samples are collected using webcam. For capturing the image samples, we resized the frame such that it captures the face region effectively.

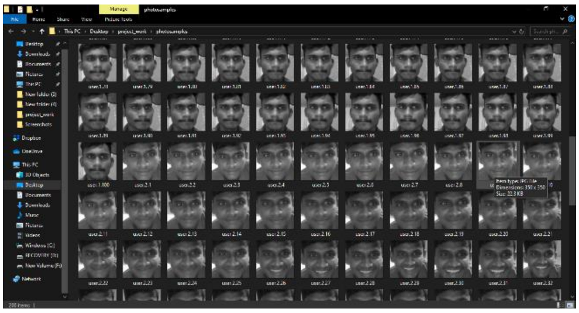


Fig. Image samples Database

After collecting 100 image samples of a person, the image samples are stored in a separate folder which further helps in training the model.

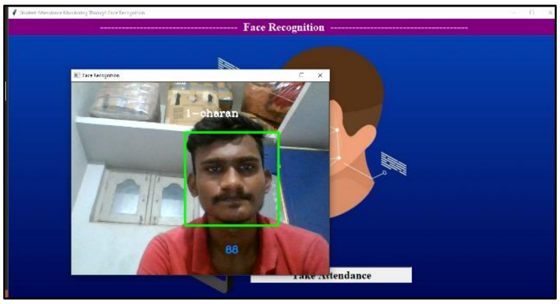


Fig. Recognizing the student

When face is matched with the list of faces available in the database, it recognizes the person successfully and displays the ID and Name of the person.

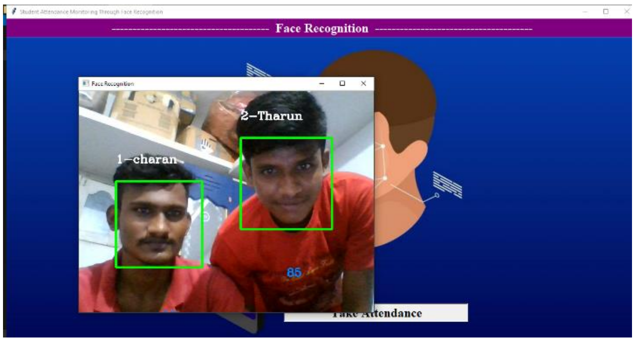


Fig. Multiple Face Recognition

The system is also capable of distinguishing between different faces.

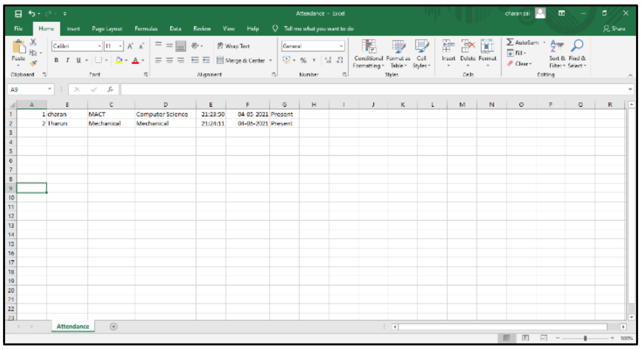


Fig. Excel Sheet Entry

After recognizing the faces successfully, the system updates the attendance in Excel sheet with student details including date and time.

Fig. Attendance Details

After Recognition, the system updates the attendance which we can import and export it into Excel sheet.

VII. CONCLUSION

The aim of implementing this system in place is to save time and money by reducing manpower. This method demonstrates a deeper understanding of the algorithm and a rigorous approach to accurately recognising users. The end result shows the system's ability to deal with improvements in face posing and projecting, as well as changes in room. According to facial recognition through machine learning, face detection addresses the problem of change in environment when the original image is transformed into a HOG representation that captures the key features of the image independent of image brightness. Local facial landmarks are taken into account for further processing in the face recognition system. The caught face is then encoded, yielding 128 measurements, and the best face identification is accomplished by removing the person's name from the encoding. The outcome is then used to build an excel spreadsheet. Currently the System has attained an accuracy upto 91%.

VIII. FUTURE SCOPE

- The robustness of the proposed work may necessitate taking a large number of descriptive photographs of the students and storing them in the cloud. To detect fraud, the device can be programmed and used in ATM machines.
- Additionally, the device can be used during elections to identify voters by recognizing their faces.
- The system can provide better results and accuracy when employed with high resolution cameras.
- It was noticed in this project that faces can only be identified when the person's face is clearly apparent, and that faces cannot be detected when the person is standing in any other direction. As a result, further research is required to use deep learning algorithms to detect people's faces clearly in all directions.
- We would like to create an application that would allow the user to update image samples of the student

in the training dataset as part of future work. This will allow users to create their own user groups rather than being limited to a pre-defined collection on the server. We'd also like to look into better face detection and face recognition algorithms in order to increase the number of students who are identified and recognized.

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