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Implementation of Attendance System Using Face Recognition and Machine Learning

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Abstract: The prototype of an automated Online Biometric-enabled Class Attendance Register System is shown in this study (OBCARS). In higher education courses, the technology is being planned and developed to address the problem of lost and/or shredded attendance record paper sheets. The system also aims to provide a dependable and effective class attendance tracking system that avoids students imitating attendance markers and simplifies the calculation of students' attendance records. Biometric appreciation includes both pragmatic biometric behavior in contrast to previously poised data for a focus and an open-mindedness of computation. Because of differences in biological traits and actions both within and among persons, estimated identical is required. It uses a student's attendance in class to determine their attendance. The student's face will be identified by the technology and save the response to the database automatically.

Keywords **- Face Recognition, Machine Learning, Attendance, Biometric, Python, PCA, OpenCV, training, testing, Haar Cascade.**

1. INTRODUCTION

Face recognition is one of the few biometric technologies that is accurate and non-intrusive at the same time. Face recognition has piqued the interest of academics in domains ranging from security to image processing to computer vision since the early 1970s. Face recognition has also proven beneficial in the analysis of multimedia data. Previously, attendance was taken manually in the classroom using attendance registers provided to staff members. However, it is a time-consuming technique. Furthermore, verifying each student individually to see if they are present is impossible in a large classroom. The suggested system demonstrates how to use Java to collect a student's attendance automatically using facial recognition, how to store the faces in a database, and how to retrieve the absence list. Detecting whether a person's face image matches one of the database's face images. Due to the changes that many components, such as facial expression, ageing, and even lighting, can cause on the image, this difficulty is difficult to address automatically. Despite the fact that facial recognition is not the most reliable biometric technology, it does have some advantages over the others. Among the applications are security and access control, forensic medicine, police controls, and attendance management systems, to name a few. Some of the strategies for keeping track of attendance are as follows:

1) Fingerprint based System
2) Iris Recognition
3) RFID based System
4) Face Recognition

Among the above techniques, Face Recognition is one of the biometric technique which is natural, easy to use and does not require aid from the test subject. It is a series of several related problems which are solved step by step:

1) To take a picture and identify all of the people in it.
2) Focus on one face at a time, remembering that even if a face is twisted in an unusual direction or illuminated poorly, it is still the same person.
3) Identify numerous distinctive elements of the face that can assist in recognizing it from the faces of others. These traits could include the size of the eyes, nose, face length, skin tone, and so on.

2. LITERATURE SURVEY

One of the most important aspects of school is keeping track of student attendance [4]. One of the factors of student graduation is the student's attendance record. Attendance records that precisely recorded [1], [2] are required in practically every educational profession. As a result of the availability of various information and communication technology capabilities, procedures have evolved from manual to semiautomatic or automatic. The range of extant sensor technologies allows for diverse combinations of processes to be produced by researchers and developers in a variety of ways, including the use of a camera [26]. Higher education uses a variety of methods to track student attendance, including manual, semi-automatic, and even technological systems [28]. At current time, various methods of recording student attendance are available and being developed; each system, of course, has advantages and disadvantages [27]. RFID [6], social media [7], barcodes, Bluetooth [8], fingerprints [9], and Near Field Communication (NFC) [10]

are examples of technology used in this attendance system. This attendance system application was developed by a number of researchers and application developers. Attendance systems can be constructed in a variety of ways using various sensor technologies. One of the options used to track student attendance during class meetings is the use of facial recognition technology [2], [11]. Face capture using cameras and object protection systems that make up human faces are used in this technology [12]. After that, the system discusses each face's object, and each item is forecasted using a list of confirmed faces from the student's face library. The model of face recognition used in student participation systems in higher institutions is discussed in this paper. One possibility for colleges to use attendance systems on each campus is to apply facial recognition technology to the college attendance system. The term "computer vision" refers to the processing of digital images [13]. So that computers can see and understand objects in the same way as humans do [14]. As a result, the machine is capable of recognizing an object, making decisions, taking action, and counting the number of items [15]. Computer Vision [16] allows computers to learn from existing data and to learn on its own, allowing machines to see objects in the same way that people do [2]. Humans utilize computers in a variety of activities that need them to watch and pay attention to objects, until the machine is advanced enough to include student attendance systems in the learning process with their lecturers. Machine learning has recently become one of the growing technologies [18] because to the presence and development of an accelerated Graphics Processing Unit (GPU). The use of fixed and moving graphics for various procedures required by people and their developers, in particular. Deep systematic learning [19], [20] is one of the technologies used. Deep learning's broad coverage is expanding, making it prominent in information processing via natural language processing, as well as capability extraction and visualization procedures. Deep Learning technology, especially its application to Computer Vision, has a strong ability to manage procedures linked to face identification. Convolutional Neural Networks (CNN) [21], [22] are one of the capabilities utilized for classifying objects in an image. The inclusion of numerous options, such as the success of the regional proposal approach and the RCNN [23], is helping to recognize objects in the form of images. [25] Through the real-time test of the algorithm, it fully meets the requirements of the attendance time in the class.

3. PROBLEM STATEMENT

To develop a windows based prototype model for biometric attendance system using face recognition using python programming language.

3.1 GOALS & OBJECTIVES

1) To implement biometric attendance system using face recognition.
2) To design a database and identify the person from pre-defined database.
3) To mark the attendance by comparing unique features of the face.

3.2 MOTIVATION

Image processing, which is concerned with extracting useful information from a digital image, has played a crucial role in recent technological advancements. It is focused on two goals. Human comprehension of graphic data is improving. Image data processing, comprising storage, transmission, and representation, for autonomous machine perception. Individuals have begun to use picture-taking devices in ways they never have before, thanks to the emergence of smart phones and closed-circuit television.

4. PROPOSED SYSTEM

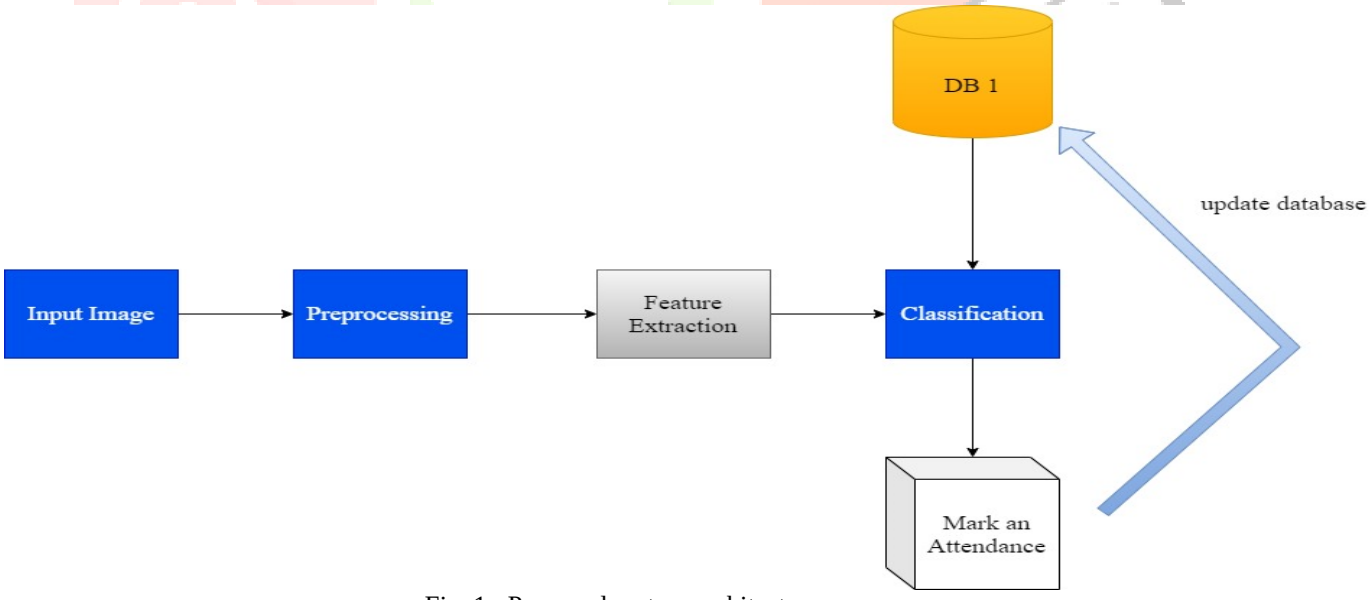

Fig. 1: Proposed system architecture

A biometric attendance system with facial recognition is presented as a solution. In recent decades, there has been a lot of research into face recognition. It's a type of object detection that calculates the size of potential faces in a photograph. It is the process of delivering input in the form of images containing faces to train a classifier to recognize a face in an image. The primary goal is to reduce the amount of false positives and hence improve accuracy.

5. ALGORITHM

The primary purpose of principle component analysis (PCA) is to reduce the dimensionality of a data set composed of several variables that are strongly or weakly related to one another while keeping as much variance as possible. The same can be done by transforming the variables into a new set of variables called principal components (or simply PCs), which are orthogonal and ordered in such a way that the amount of variance kept in the original variables decreases as we travel down the order. As a

result, the first principle component keeps the highest variance from the original components. The major components are orthogonal because they are the eigenvectors of a covariance matrix.
Steps of this proposed algorithm is as follows:

A. Initialization process

1) Obtain the initial set of face photos, which is referred to as the training set.

B. Recognition process

1) Calculate the Eigen faces using only the highest eigenvalues from the training set. These M images define the face space. The Eigen faces can be updated or recalculated as new faces are encountered.
2) Calculate each known person's distribution in this M-dimensional space by projecting his or her face images onto this face-space.
3) By projecting the input image onto each of the faces, calculate a set of weights based on the input image.
4) Check to see if the image is close enough to an empty space to determine if it is a face at all (known or unknown).
5) If it's a face, decide if the pattern belongs to a recognized or unknown person.

6. FLOWCHART

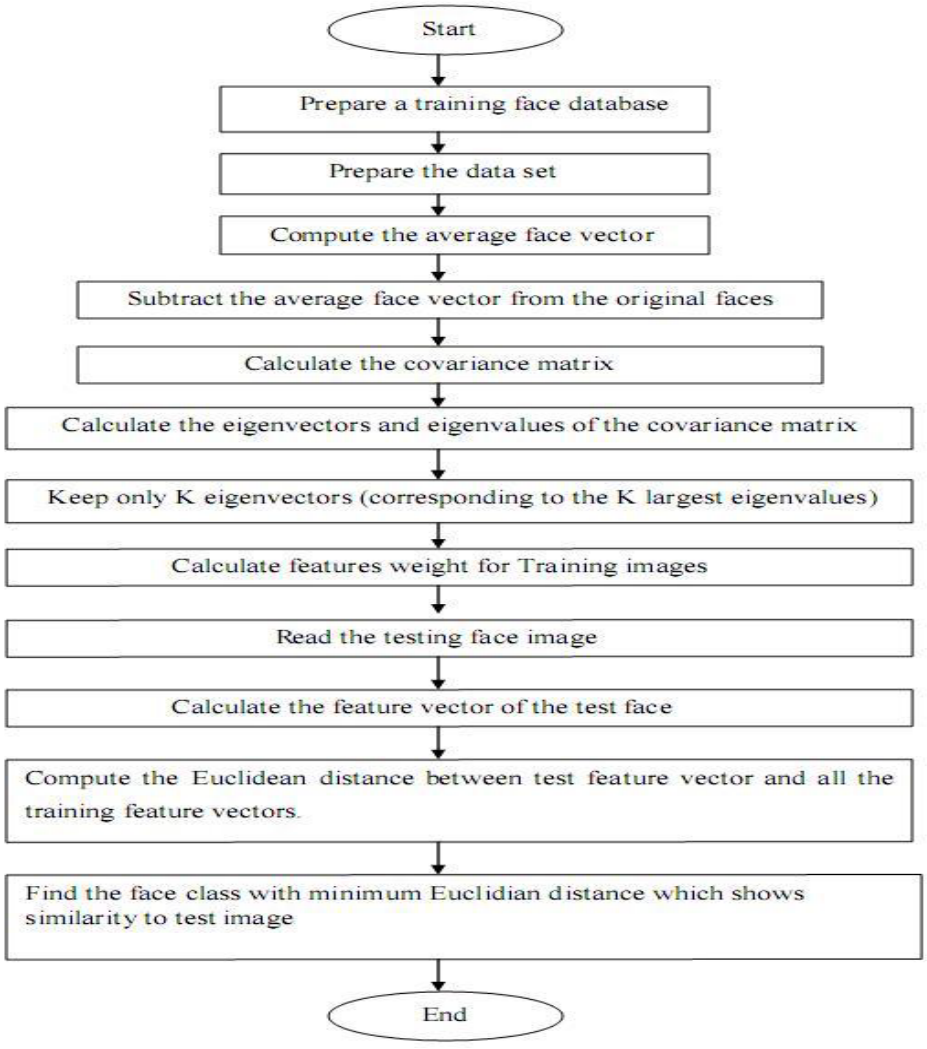

Fig. 2: Algorithm flow

7. MATHEMATICAL MODEL

Let,

S be Closed system defined as, S = Ip, Op, Ss, Su, Fi, A
To select the input from the system and perform various actions from the set of actions A so that Su state can be attained.
S=Ip, Op, Ss, Su, Fi, A
Where,
IP1=input image
Set of actions=A=F1, F2, F3, F4
Where,
F1= Image Capture
F2= Pre-Processing
F3= Segmentation
F4= Face Recognition

S=Set of users
Ss=rest state, capturing image, processing image, detection of face
Su- success state is successful analysis
Fi- failure state
Objects:
1) Input1: Ip1 = Username, Password
2) Input2: Ip2= Image
1) Output1: Op1 = Data Processing
2) Output2: Op2 = Face Recognition
3) Output3: Op3 =Mark Attendance

8. EXPECTED RESULTS

1) Face should get recognized.
2) Attendance should be marked in the database.
3) If attendance is less than threshold value then a message stating “You are in a defaulter list” should be sent.
4) If attendance is more than threshold value then a message stating “You are not in a defaulter list” should be sent.

9. ACTUAL RESULTS

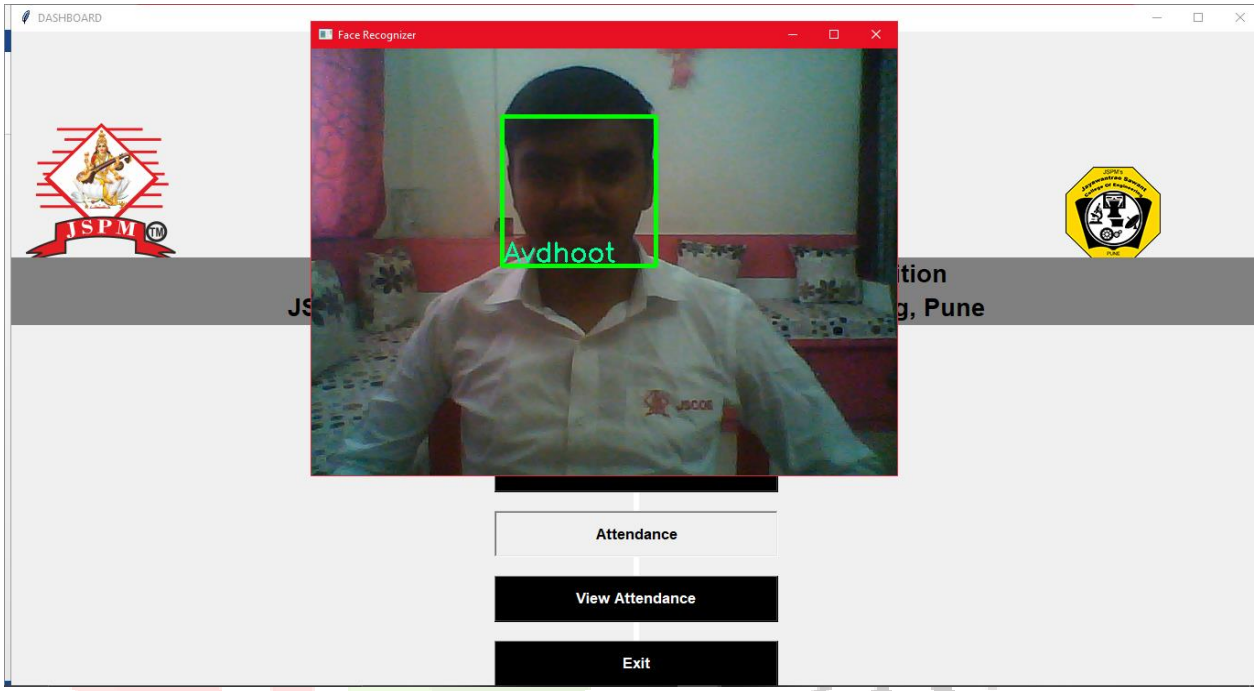

Fig. 3: Person recognition

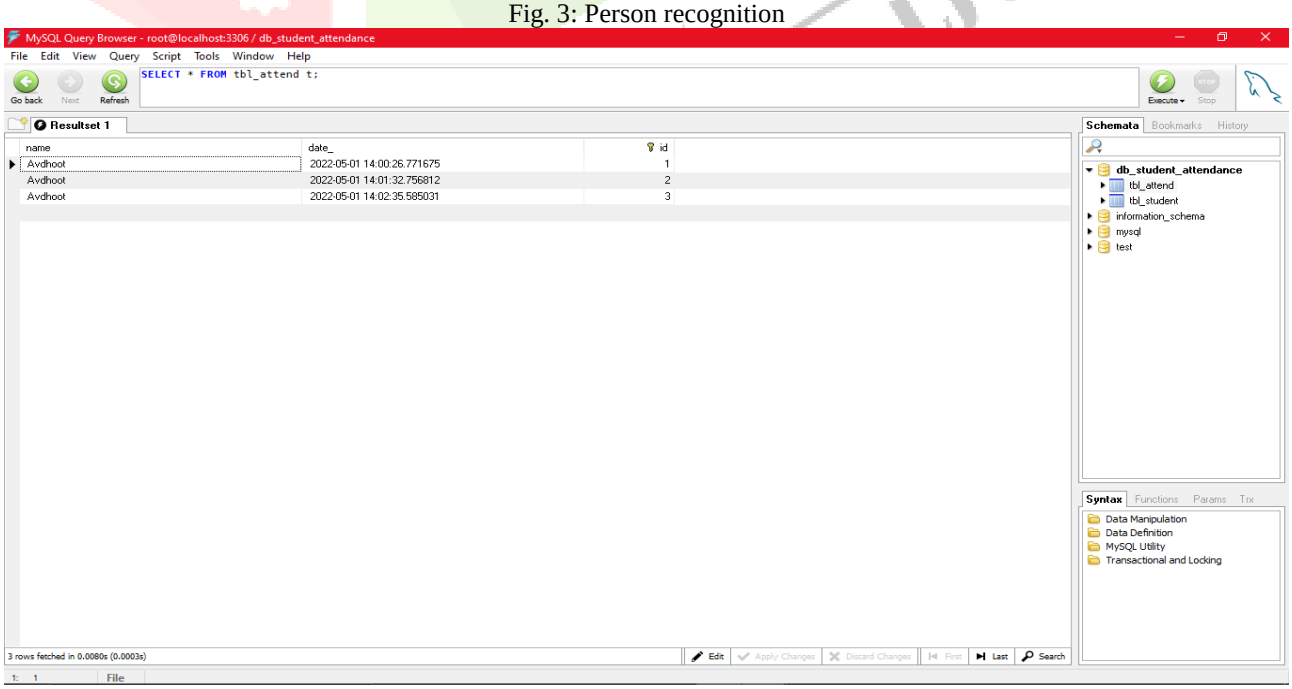

Fig 4: Attendance Marked in database

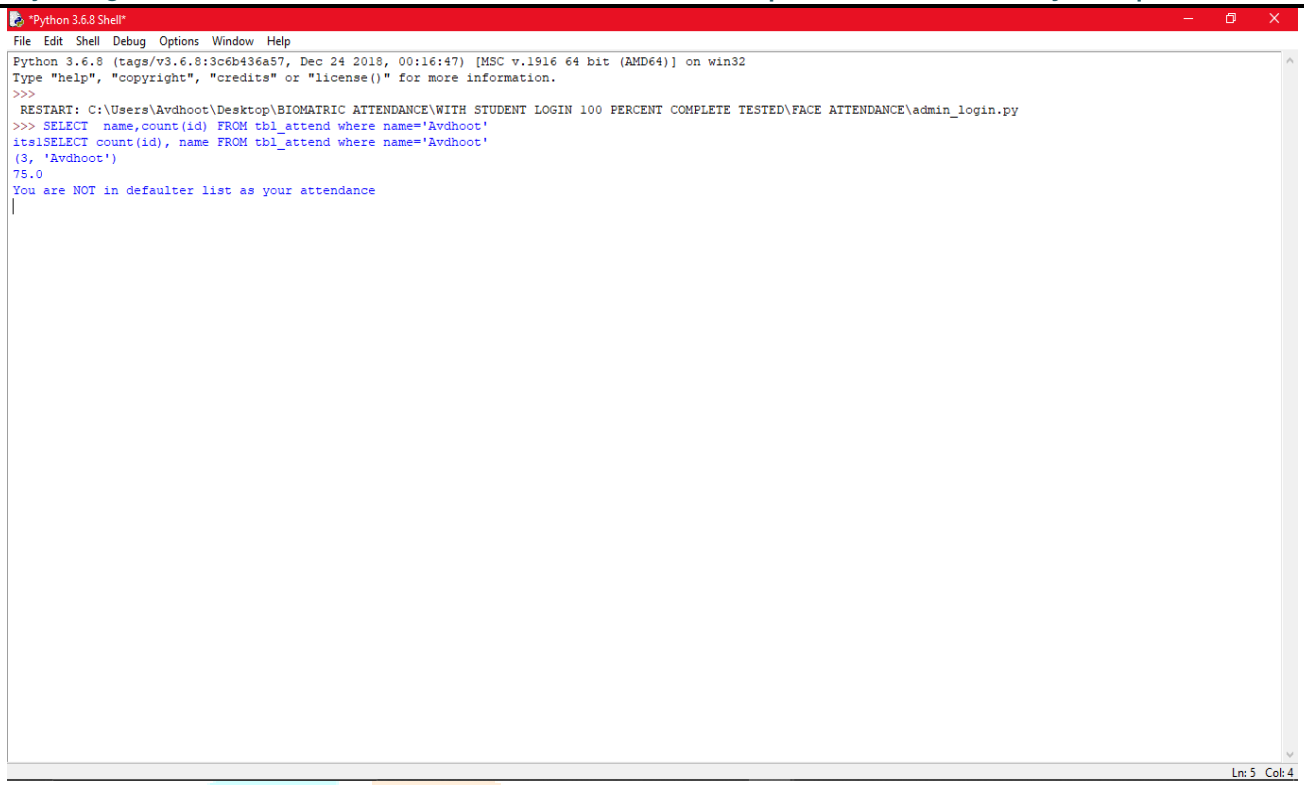

Fig 5: Attendance percentage

10. PROS

1) It is simple to keep track of attendance with this approach.
2) The amount of paper effort required by this proposed approach is considerably reduced.
3) Because this system is automated, there is no need to manually enter data into it.
4) Unlike fingerprint-based systems, no additional hardware is required.
5) This technology is both inexpensive and portable.

11. APPLICATIONS

1) Government organizations and various enterprises can make use of this system to mark the attendance of their employee.
2) This system can also be integrated in the CCTV of schools and colleges to keep track of the attendance.
3) Can also be used in various video conferencing applications such as Google meet, Zoom meeting.

12. CONCLUSION

In this system, first we take the input of face image whose attendance is to be marked. Then we use various pre-processing techniques such as Numpy, Matplotlib and Pandas. To implement this system we use PCA (Principle Component Analysis) algorithm to get higher efficiency from the model. We use feature extraction technique to extract some unique facial features of the face. After that we use a classification technique called Haar Cascade to classify the face images. In this way we are able to implement this system and mark the attendance. The application of image processing techniques in the classroom is demonstrated in this attendance system. This technique has the potential to improve a school's reputation as well as its attendance system.

13. FUTURE WORK

This attendance system can be implemented in school and college CCTV cameras. We can integrate this system in various video conferencing applications for further enhancing the application capabilities.

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