IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 3, April 2023
Impact Factor: 7.301

Face Recognition Smart Attendance System using Machine Learning Techniques

Shruti Tiwari, Sanskar Bandi and Jay Dubey
Dr. Praveen Gupta, Prof. Vandana Kate, Prof. Nidhi Nigam
Department of Computer Science and Information Technology
Acropolis Institute of Technology and Research, Indore, MP, India

Abstract: *Face recognition plays a crucial part in the practical arena and is one of the most operative image-processing applications. For authentication purposes, specifically in the context of student attendance, face recognition is a pressing issue. Face recognition is a method aimed at identifying students using face biostatistics based on high-definition monitoring and other computer technologies in an attendance system. The development of this system aims to digitize the traditional method of calling names and keeping pen-and-paper records to take attendance. The current methods for taking attendance are time-consuming and arduous. The manual recording makes it simple to alter attendance records. Both the existing biometric systems and the conventional method for taking attendance are susceptible to proxies. As a result, it is suggested that this paper address all of these issues. A live video stream is used to mark attendance with this system. OpenCV is used to extract the frames from the video. Face detection and face recognition, for which dlib is utilized, are the primary implementation steps in this type of system. After this, a comparison of the identified faces with the database of students' faces should make a relationship between them possible. Attendance reports will be created and saved in Google format following face recognition. The system is tested under a variety of conditions, including lighting, head movements, and the student's changing distance from the cameras. The overall complexity and accuracy are determined after extensive testing. When it came to taking attendance in a classroom without spending any time or doing any manual work, the proposed system proved to be a reliable and effective tool. The developed system is less expensive and requires less installation..*

Keywords: Attendance system, Automated attendance, Image Processing, Face detection, Feature matching, Face recognition

I. INTRODUCTION

To keep track of students' attendance, every organization needs a reliable system. Every organization does this differently; some use biometrics systems like fingerprints, RFID card readers, and Iris systems to record attendance, while others use a sheet of paper and call students' names during lecture time. Time-consuming is the traditional method of manually calling students' names. "In the RFID card system, each student assigns a card with their corresponding identity but there is a chance of card loss or an unauthorized person may misuse the card for fake attendance. While in other biometrics such as fingerprint, iris, or voice recognition, all have their own flaws and also they are not 100% accurate".[1][4]

The first step in face recognition is the detection of faces, and the second step is matching the images of those faces with the database that already exists. There are new approaches to face recognition and detection. Face recognition can be either appearance-based, which takes into account the features of the entire face, or feature-based, which takes into account the geometric features of the face, such as the eyes, nose, eyebrows, and cheeks. "Face recognition is a part of biometric identification that extracts the facial features of a face, and then stores it as a unique face print to uniquely recognize a person. Face verification is a 1:1 matching process, it compares face images against the template face images and whereas is a 1:N problem that compares a query face image, matching with an identity stored in a database (typically employed to authenticate users through ID verification services, works by pinpointing and measuring facial

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 3, April 2023
Impact Factor: 7.301

features from a given image.) and at end confirming with showing information of that person otherwise show an error. Here the face of an individual will be considered for marking attendance".[3]

Biometric security falls in the class of facial recognition. In any case, currently, most facial acknowledgment methods can work fine provided that the quantity of individuals in a single edge is not very many and under controlled brightening, with the legitimate place of countenances, and clear pictures. Voice recognition, fingerprint recognition, and iris recognition are all instances of biometric software. Though Face Recognition is less accurate than iris and fingerprint recognition as a biometric technology, it is widely used due to its contactless process because everyone in Covid wants contactless work. In this day and age, keeping a record of attendance is a laborious task for any organization (like schools, colleges, coaching, and even businesses). Because marking the attendance of students or employees requires manual labor, the process is time-consuming and sometimes chaotic. The manual intervention also introduces human error, which reduces the work's efficiency and output.

II. PROBLEM FORMULATION

Understudies' participation is taken physically by utilizing a participation sheet, which is a tedious occasion. In addition, it is extremely challenging to verify each student, regardless of whether they are responding, in a large classroom with distributed branches. This paper proposes an automated Smart Class Attendance System based on face detection and face recognition methods. The time-consuming manual labor required for this process results in the output of the work.

III. LITERATURE REVIEW

Now it is the time to articulate the previous research work with ideas and methods proposed by various researchers with critical analysis. The primary purpose of this paper review is to find the solutions provided by other authors and consider the imperfection of the system proposed by them, giving the best solutions.

3.1 "A Counterpart Approach to Attendance and Feedback System using Machine Learning Techniques

In this paper, the idea of two technologies namely Student Attendance and Feedback system has been implemented with a machine learning approach. This system automatically detects the student's performance and maintains the student's records like attendance and their feedback on the subjects like Science, English, etc. Therefore the attendance of the student can be made available by recognizing the face. On recognizing, the attendance details and details about the marks of the student are obtained as feedback." [3]

3.2 "Automated Attendance System Using Face Recognition

Automated Attendance System using Face Recognition proposes that the system is grounded on face detection and recognition algorithms, which are used to automatically detects the student's face when he/she enters the class and the system is capable of marks the attendance by recognizing him. Viola-Jones Algorithm has been used for face detection which detects human faces using cascade classifier and PCA algorithm for feature selection and SVM for classification. When it is compared to traditional attendance marking this system saves time and also helps to monitor the students." [5]

3.3 "Student Attendance System Using Iris Detection

In this proposed system the student is requested to stand to Face Recognition Based Attendance System Nandhini R, Duraimurugan N, S.P.Chokkalingam FACE RECOGNITION BASED ATTENDANCE SYSTEM 575 Published By: Blue Eyes Intelligence Engineering Retrieval Number: C11230283S19/19©BEIESP & Sciences Publication in front of the camera to detect and recognize the iris, for the system to mark attendance for the student. Some algorithms like Gray Scale Conversion, Six Segment Rectangular Filter, and Skin Pixel Detection are being used to detect the iris. It helps in preventing proxy issues and it maintains the attendance of the student in an effective manner, but in one of the time-consuming processes for a student or a staff to wait until the completion of the previous members." [6]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 3, April 2023
Impact Factor: 7.301

3.4 Face Recognition-based Lecture Attendance System

This paper suggests that the system automatically recognizes attendance based on continuous observation. Estimating and improving attendance performance is aided by constant observation. Positions and face images of the students in the classroom are recorded for attendance purposes. The system estimates each student's seating position and location for attendance marking through continuous observation and recording. The method for determining the various weights of each focused seat based on its location is the primary focus of the work. The viability of the image is likewise being talked about to empower quicker acknowledgment of the picture.

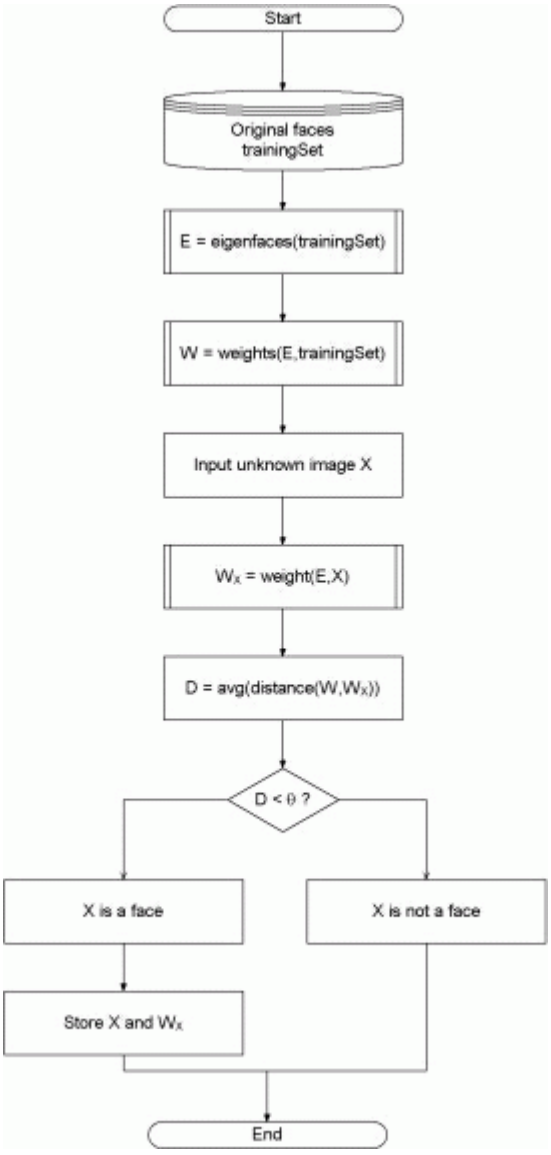

Fig 1. The high-level functioning principle of the eigenface-based facial recognition algorithm [21]

In [7] Jomon Joseph, K. P. Zacharia proposed a framework utilizing picture handling, PCA, Eigenfaces, and Microcontroller, because of MatLab. Their system only works with front-face images, so a good method that works with the system's orientation is needed. Ajinkya Patil and his colleagues in [8] proposed a face recognition method for marking attendance that makes use of the Viola-Jones algorithm. Haar cascades are used to find faces in images, and the Eigen face method is used to recognize faces. Another way to make the attendance system easy and secure is to use artificial neural networks [9]. They used PCA to extract face images, and neural networks were used for testing and training. Their system works in different orientations. MuthuKalyani suggested a 3D face recognition method for an attendance management system. VeeraMuthu, K. A [10] has proposed that they mark each student's attendance based

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 3, April 2023
Impact Factor: 7.301

on their monthly progress. An alternative algorithm that can improve the recognition of oriented faces is required. The effective Attendance Management system was developed with the assistance of the PCA algorithm [11]. Although they have achieved an accuracy of up to 83 percent, the system's performance deteriorates when light conditions change even slightly. An Eigen face approach alongside a PCA calculation for checking face acknowledgment participation frameworks have been presented by creators in [12], they notice an examination of various face acknowledgment calculations in their paper. In general, it was a successful strategy for recording attendance.

IV. METHODOLOGY

Smart Class Attendance is an AI-powered face recognition solution that uses Computer Vision and Machine Learning algorithms to mark the attendance of the employees or students of the organization.

All class members must sign up by entering the required information, after which their images will be automatically captured and saved in the dataset with an OTP. Faces will be identified from the classroom's live-streaming video during each session. The images in the dataset will be compared to the faces that were found. Attendance will be recorded for each student if a match is found. Here we are utilizing identify MultiScale module from OpenCV. This is necessary to draw a rectangle around an image's faces. ScaleFactor, minNeighbors, and minSize are the three factors to consider. In each image scale, the scaleFactor is used to indicate how much an image must be reduced. minNeighbors determines the number of neighbors every competitor square shape should have. Higher values typically detect more high-quality images while detecting fewer faces. The minimum size of an object is set by minSize.

After the face recognition process, the recognized faces will be marked as present in the Google sheet and the rest will be marked as absent.

4.1 Data Acquisition

1. **Image acquisition:** Image is acquired using a high-definition camera which is placed in the classroom. This picture is given as a contribution to the framework.
2. **Dataset Creation:** The dataset of students is created earlierin the recognition method. The dataset was created only to train this system. We have created a dataset of 5 students which involves theirnames, roll numbers, branches, and images of students in diverse poses and variations. For better accuracy minimum of 5 images of each student should be captured. Whenever we register students' data and images in our system to create a dataset, deep learning applies to each face to compute 128-d facial features and store them in the student face data file to recall that face in the recognition process. This process applies to each image taken during registration.
3. **Storing:** We have used JSON to store the student's data. JavaScript Object Notation (JSON): To represent structured data based on JavaScript object syntax, a standard text-based format is introduced. JSON is utilized for sending information in web applications. It is a perfect solution for storing temporary data that are consumed by the entity that creates the data. JSON can store data in String, Number, Object, Array, Boolean, and Null forms which means it has a limitation of storing data in functions, dates, and undefined data forms. If you are trying to store or exchange data in functions or dates then JSON is not the right choice for you.

4.2 Face Recognition Process

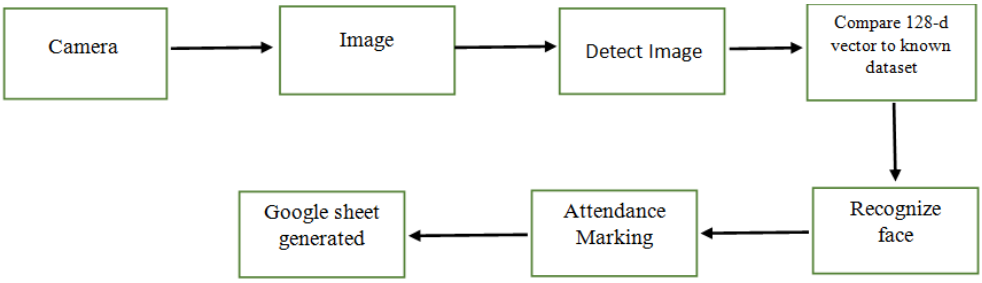

Fig 2: Block Diagram

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 3, April 2023
Impact Factor: 7.301

1. **Face Detection and Extraction:** Face detection is crucial because the system's camera takes an image, a face detection algorithm is used to identify the human faces in that image, and several image processing algorithms are introduced to identify faces in images and their locations.
2. **Face Positioning:** The human face has 68 distinct points. To put it another way, there are 68 face landmarks. This step's primary purpose is to position the image and locate facial landmarks. The face landmarks are automatically identified and positioned using a Python script without distorting the image.
3. **Face Encoding:** The next step is to extract the distinctive facial feature that identifies each image once the faces have been identified in the given image. For each image that is input, the 128 key facial points are extracted with high accuracy whenever face localization is achieved. These 128-d facial points are then stored in the data file for face recognition.
4. **Face matching:** The face recognition process concludes here. Deep metric learning, which is highly accurate and capable of producing real-value feature vectors, is one of the best learning methods we used. The faces are ratified by our system, which creates the 128-d embedding (ratification) for each face. The Euclidean distance between all of the faces in the dataset and the faces in the image is calculated using the internally compare faces function. Attendance marking will begin if the current image meets the 60% threshold with the existing dataset.

4.3 Attendance Marking

Python generates roll numbers for current students and returns them when data is returned after the face is identified with the image in the JSON file. The system generates an attendance table that includes the name, roll number, date, day, and time with the corresponding subject id. And then passes the data to python to store the table into a Google sheet automatically. Each sheet is saved according to the subjects already entered by the administrator, for example when the system generates a Google sheet by sending the compiled sheet in an array to python, python first checks whether there exits any Google sheet of that date, if yes then it creates separate worksheet by subject id so that attendance is differentiated for different subjects.

V. RESULT AND DISCUSSIONS

A graphical user interface (GUI) lets users use the system. The primary choices that users will have here are marking attendance, faculty registration, and student registration. The student registration form requires the students to provide all required information. Following the click of the register button.
The result is divided into four main parts:

A. Database Creation

A database is created by entering the basic details of students and teachers along with capturing their images. The system is capturing a single image as the dlib library is being used which minimizes the need for several images for training.

B. Feature Extraction

The features of images are extracted using the dlib library. The features of images are extracted and later on used while comparing with the detected image.

C. Face Detection & Comparison

The face is detected using a face time HD webcam. After detecting the face, the image is captured and compared with that of images stored in the database. Assuming that the examination result emerges to be valid, that implies the understudy's subtleties are as of now present in the data set, generally the webcam has recognized another face.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 3, April 2023
Impact Factor: 7.301

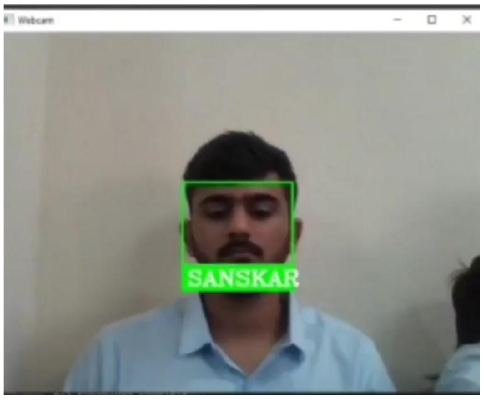

Fig 3: Detection and Comparison

D. Updation of Google sheet

In the fourth and end part, after detecting and comparing the images, an updation of attendance takes place. If the comparison result is successful, the attendance is marked as present, and at the end, the Google sheet is updated with the correctly recognized students.

	A	B	C	D	E	F	G
1	Name	Roll Number	Day	Date	Time	Subject ID	
2	Sanskar Bandi	51	Thursday	30/03/2023	15:38	CSIT503	
3	Shruti Tiwari	53	Wednesday	29/03/2023	12:14	CSIT402	
4	Jay Dubey	27	Tuesday	28/03/2023	16:32	CSIT301	

Fig 4: Google Sheet

VI. CONCLUSION

This paper deals with the technique and process involved to prepare Smart Class Attendance System deployed with face recognition technique. Using a camera and a face id, it digitally records attendance without human intervention. Images are stored in a database and image storage is minimized with the help of the dlib library. The dlib library is used to extract image features. Images are compared against the database's image.

VII. ACKNOWLEDGMENT

I would like to express my gratitude to my primary supervisor, Prof. Vandana Kate who guided me throughout this project. I would also like to show my deep appreciation to my supervisors who helped me finalize my project.

REFERENCES

[1]. Kar, Nirmalya, et al. "Study of implementing automated attendance system using face recognition technique." International Journal of computer and communication engineering 1.2 (2012): 100

[2]. Selvi, K. Senthamil, P. Chitrakala, and A. Antony Jenitha. "Face recognition based attendance marking system." Corresponding Author: S. Rajkumar*, Email: rajkumarsrajkumar@ Gmail.com (2014).

[3]. N. Sudhakar Reddy, M.V.Sumanth, S.Suresh Babu," A Counterpart Approach to Attendance and Feedback System using Machine Learning Techniques" Journal of Emerging Technologies and Innovative Research(JETIR), Volume5, Issue 12, Dec 2018.

[4]. Mehta, Preeti, and Pankaj Tomar. "An Efficient Attendance Management System based on Face Recognition using Matlab and Raspberry Pi 2." International Journal of Engineering Technology Science and Research IJETSR 3.5 (2016): 71-78.

[5]. Akshara Jadhav, Akshay Jadhav, Tushar Ladhe, Krishna Yeolekar, "Automated Attendance System Using Face Recognition", International Research Journal of Engineering and Technology (IRJET), Volume 4, Issue 1, Jan 2017.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 3, April 2023
Impact Factor: 7.301

[6]. Prajakta Lad, Sonali More, Simran Parkhe, Priyanka Nikam, Dipalee Chaudhari, " Student Attendance System Using Iris Detection", IJARIIE-ISSN(O)-2395-4396, Vol-3 Issue-2 2017.
[7]. Joseph, Jomon, and K. P. Zacharia. "Automatic attendance management system using face recognition." International Journal of Science and Research (IJSR) 2.11 (2013): 327- 330.
[8]. Patil, Ajinkya, and Mrudang Shukla. "Implementation of classroom attendance system based on face recognition in class." International Journal of Advances in Engineering & Technology 7.3 (2014): 974.
[9]. Kanti, Jyotshana, and Shubha Sharm. "Automated Attendance using Face Recognition based on PCA with Artificial Neural Network." International journal of science and research IJSR (2012).
[10]. MuthuKalyani, K., and A. VeeraMuthu. "Smart application for AMS using face recognition." Computer Science & Engineering 3.5 (2013): 13.
[11]. Deshmukh, Badal J., and Sudhir M. Kharad. "Efficient Attendance Management: A Face Recognition Approach." (2014).
[12]. Wagh, Priyanka, et al. "Attendance system based on face recognition using eigenface and PCA algorithms." 2015 International Conference on Green Computing and Internet of Things (ICGCIoT). IEEE, 2015.
[13]. Bhattacharya, Shubhobrata, et al. "Smart Attendance Monitoring System (SAMS): A Face Recognition Based Attendance System for Classroom Environment." 2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT). IEEE, 2018.
[14]. Samet, Refik, and Muhammed Tanriverdi. "Face recognition-based mobile automatic classroom attendance management system." 2017 International Conference on Cyberworlds (CW). IEEE, 2017.
[15]. Li, Xiang-Yu, and Zhen-Xian Lin. "Face recognition based on HOG and fast PCA algorithm." The Euro-China Conference on Intelligent Data Analysis and Applications. Springer, Cham, 2017.
[16]. Arsenovic, Marko, et al. "FaceTime—Deep learning based face recognition attendance system." 2017 IEEE 15th International Symposium on Intelligent Systems and Informatics (SISY). IEEE, 2017.
[17]. Rekha, N., and M. Z. Kurian. "Face detection in real-time based on HOG." International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) 3.4 (2014): 1345-1352.
[18]. Kwolek, Bogdan. "Face detection using convolutional neural networks and Gabor filters." International Conference on Artificial Neural Networks. Springer, Berlin, Heidelberg, 2005.
[19]. Ashwini, C., et al. "An Efficient Attendance System Using Local Binary Pattern and Local Directional Pattern." Journal of Network Communications and Emerging Technologies (JNCET) www. jncet. org 8.4 (2018).
[20]. Karnalim, Oscar, et al. "Face-face at classroom environment: Dataset and exploration." 2018 Eighth International Conference on Image Processing Theory, Tools and Applications (IPTA). IEEE, 2018.
[21]. Dimitri, "Eigenface-based facial recognition", available online at http://openbio.sourceforge.net/resources/eigenfaces/eigenfaces-html/facesOptions.html, February 13, 2003.