IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 10, May 2023

A Survey on Face Recognition Monitoring Attendance System

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Abstract: *Due to the time-consuming nature and security risks of traditional techniques, automated attendance management systems are becoming more and more common in educational institutions. Such systems frequently employ the biometric technique known as face recognition. The integration of ubiquitous components in portable devices is used to develop an attendance management system that uses facial recognition technology for managing students' attendance. The hybrid feature extraction method used by this system combines CNN-PCA to provide a more accurate feature extraction method, creating a dependable and potent system for real-time face recognition. The proposed model in this study uses Eigen face values, Principal Component Analysis (PCA), and Convolutional Neural Networks (CNN) as face detection and identification techniques. The link between the database of student faces and the faces that were recognized are then compared. With this idea, the issue of proxies and fraudulent attendance should be resolved while also managing student records and attendance.*

Keywords: Principal Component Analysis, Convolutional Neural Network, face recognition, Attendance management system

I. INTRODUCTION

The Faculty members must manually call out each student's name in order to record attendance in schools and universities, which takes a lot of time. Proxy attendance, where someone records attendance on another person's behalf, is also possible with this method.These issues have been resolved by the implementation of additional attendance recording techniques such as Radio Frequency Identification (RFID), iris identification, and fingerprint recognition. These systems, however, operate on a wait and might be bothersome.

Face recognition technology is a non-intrusive biometric feature that has gained popularity and is relatively oblivious to various facial expressions. Due to its potential to strengthen security measures and increase convenience across a variety of industries, facial recognition technology has grown in popularity in recent years. Law enforcement, access control, attendance tracking, and personal device authentication are just a few examples of applications that can be made for the capability to quickly and accurately identify people using facial features. The development of facial recognition technologies has been aided by the emergence of computer vision, machine learning, and artificial intelligence. Using cameras to take pictures of people's faces and then analyzing those pictures to extract distinctive facial traits is a typical technique for facial recognition. The individual is then identified by comparing these attributes to a database of previously saved photos. This process can be done through either a point-based approach or a holistic approach. In point-based facial recognition, input photographs of the face are converted into geometric feature vectors by first detecting specific locations on the face, such as the eyes, nose, and mouth, and then measuring the distances and angles between these points. The original point-based facial recognition study used the Geometrical Features and Template Matching system with the Bayesian Classifier [1]. Other point-based systems included the Multi-Layer Perceptron (MLP), Self-Organizing Map (SOM), and Nearest Neighbour systems [2]. This method can be useful but may not capture the whole picture of a person's face, resulting in potential inaccuracies in identification.

The holistic facial recognition approach tries to identify faces using global representations, describing them based on the whole image and not just the original features of the face. The simplest holistic technique displays the image as a 2D array of recognition and intensity values and assesses the direct relationship between each input face and each other

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face in the database. The Eigen faces system and bracket styles [3] were used in the first thorough study of facial recognition to detect faces using a distance from space face metric. Although it may need more processing, this method may be more accurate than point-based methods. Several studies have been conducted using different point-based and holistic face recognition systems. For instance, one study used the Geometrical Features and Template Matching system, while another study used the Cylinder Head Models (CHMs) methodology to detect faces using multiple cameras. Other studies used different point birth systems, such as Self-Organizing Maps (SOM), Independent Component Analysis (ICA), and PCA (Principal Component Analysis). The bracket system used in these studies varied, including Bayesian Classifier, Multi-Layer Perceptron (MLP), Euclidean Distance, and Distance Measure. Overall, face recognition systems using cameras are useful for storing large-scale face image databases and can be used in various applications, such as security systems, surveillance, and image database examinations. These systems are accurate, safe, and can detect faces with high delicacy. However, the accuracy and robustness of the system depend on the chosen point birth and bracket systems, as well as the data accession methodology used.

Face detection and face recognition are two procedures used by the face recognition system. Images of the students' faces are taken using the camera that is set up in the classroom, and the image quality is improved using image processing techniques including grayscale conversion and histogram equalisation. After face detection, there comes face recognition, which compares faces to databases using various methods as Eigen face, PCA, and LDA hybrid algorithm to record attendance. [4].

II. METHODOLOGY

2.1 Architecture

The armature of the automated attendance operation system is incredibly straightforward and user-friendly. In the system, there are two databases: one is for students, and the other is for attendance. To maintain track of each student's details for a certain class, use the student database. As its name suggests, the attendance database, on the other hand, is used to track and maintain a record of the students who attended a specific lecture. This system will have a high-definition camera outside the classroom placed for the purpose of recording attendance. Students will evaluate the entrance to the classroom by looking at their faces in the camera. An additional camera will be placed within the classroom so that every student may be observed via the camera's lens. Both cameras will utilize facial detection and identification technologies to assess the faces and store attendees.

2.2 Methodology

There must be a strategy for successfully navigating this task if the smart attendance operation system is to be developed. The following definitions are possible for the way:

- Registration
- Face Detection
- Face Recognition
- Class Camera Evidence
- Attendance Marking

Registration

The student is added to the pupil database at this stage. The database contains general data such as Roll Number, Class, Name and Section. Along with all the other information, the student database also includes images of the student's face as viewed through the camera window. Using the images that are all stored in the student database, facial recognition software may be used to identify each and every student that is attending a lecture.

Face Detection

We will use the 68 milestones that can be found on a person's face to identify faces. The Viola and Jones approach will be utilised to discover the face's bounding box, as well as to constrain the Original Model- grounded face shadowing and face corner identification. The AdaBoost algorithm for face discovery is another name for it. AdaBoost is a machine learning method that chooses the most useful attributes and eliminates those that are unnecessary to determine

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whether or not a certain window has a face. It makes use of weak features, which are only used when they outperform random estimates.

Face Recognition

In this model, facial recognition will be provided using Principal Component Analysis (PCA). The number of variables utilised in face recognition is decreased using a method known as PCA. Each image in the training set is represented by an Eigen faces eigenvector, which has linear weights. Faces are turned into Eigen faces using this method, a condensed arrangement of introduction rates that makes up the top corridor of the supporting arrangement of instructional images. Another image must be expected in the Eigen face subspace in order to enforce recognition. The existing is then put in order by comparing its current position inside the Eigen face space with that of the supplied people.

The main benefits of using PCA for facial recognition are its ease of use, speed, and lack of judgement based on variations in the human face. After appearing on camera outside the lecture, the pupils will have their faces honoured so they can enter the classroom. The student is permitted to enter the classroom, though, if his face is recorded in a different database. If not, the student will be prompted to sign up for a student database before being allowed entry to the classroom by the system.

Class Camera Evidence

Once a student's face has been successfully recognized and the student is permitted entry to the classroom, a second camera will be set up within the room to ensure that every student is visible in order to verify that the student is in the room for the lecture. This will make it easier to dismiss the delegates.

Attendance Marking

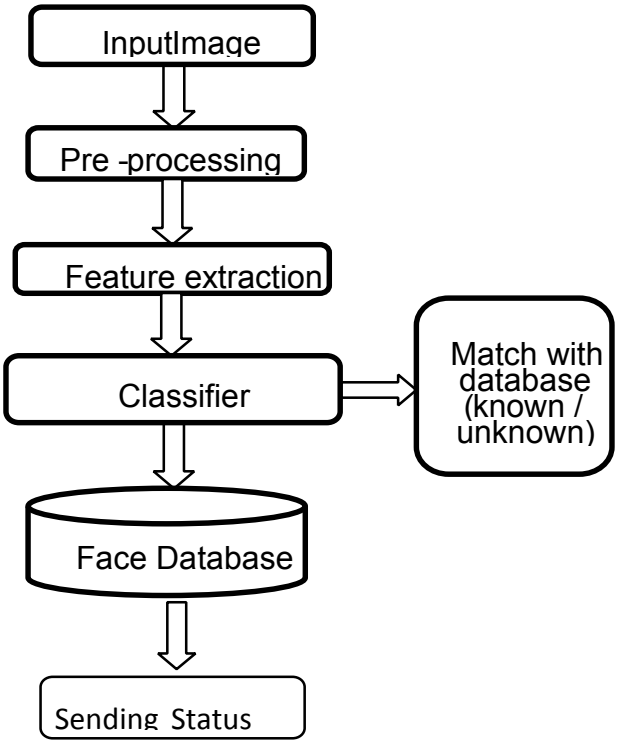
After the lectures are over, a list of the pupils in the room will be provided using the classroom camera. By doing so, the attendance database will be able to track attendance for that lecture.

Algorithm

Algorithm: Real-Time Smart Attendance Algorithm with Face Recognition

Inputs: Student faces at the door and inside the classroom are inputs.

Here is the working flowchart of the mode:-



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Outputs: Automatic marking of attendance.
Problem description: The goal is to recognize the faces of students and mark their attendance accordingly.
Step 1: Begin the process.
Step 2: Add student information to the database of students.
Step 3: Set up a camera outside the classroom to record students' faces.
Step 4: Use the camera to find faces.
Step 5: Compare the discovered faces to the pictures in the student database to identify them.
Step 6: If the student's face is in the database, provide permission for admission to the classroom. Alternatively, return to Step 2.
Step 7: Use a camera installed inside the classroom to check for the presence of recognized faces. If the faces are present, mark them present in the attendance sheet. If not, mark them absent.
Step 8: Enter the attendance data in the database.
Step 9: Put the procedure to rest.

III. LITERATURE REVIEW

The "Class Attendance Management System using Facial Recognition" was proposed by Gomes, Clyde, Chanchal, Sagar, Desai, Tanmay, and Jadhav, Dipti in 202.: The traditional technique of keeping track of attendance promotes proxy through friends, which reduces effectiveness.
Because of this, biometrics are our first option, but since they are unreliable, we resort to facial recognition technology, which is efficient and quick. Image capture, face detection, face comparison, and database updating are the four processes that the system goes through to operate.
The "Attendance Management System" was created in 2018 by Omar Abdul, Rhman Salim, Rashidah Funke Olanrewaju, and Wasiu Adebayo Balogun [7]. This research study addresses complete class attendance in the expanding virtual world using facial recognition, which takes a human subject's image and verifies it against the database already in place. The results are then entered into MySQL with a 99% accuracy rate.
R. S. Siswanto, A. S. Nugroho and M. Galinium,[8] proposed "*Implementation of face Recognition Algorithm for biometrics Based time Attendance System" in 2014* . Face recognition starts with taking out the features of face like breadth of mouth, width of pupil in eyes & checks it from already existing database. Many papers are published that contains facial feature extraction, face recognition implementations. The major focus over it is best face recognition upto 95% similar.
N, Dr &Tuladhar, Emerald & Shah, Avinash & Hegde, Anusha & Sai, Alekya [9] developed "*Attendance Monitoring System Based on face Recognition" in 2021.* Understanding the scenario, to make the different task of institutions & organizations fruitful, face recognition feature comes into use that takes out facial features & changes into numeral format. An automatic mail system sends mail to all the students or staff.
S. Poornima, N. Sripriya, B. Vijayalakshmi and P. Vishnupriya*[10] proposed "Attendance Monitoring System using Facial Recognition with Audio Output" in 2017.* The manual approach of keeping track of class attendance and keeping a journal is ineffective. Since, bunking classes or appointing proxies for absentees has become a popular pastime among today students. Manual Attendance entry in logbooks becomes a laborious chore that can be readily manipulated. As a result, the purpose of this work is to offer an automatic attendance system.
E. Varadharajan, R. Dharani, S. Jeevitha, B. Kavinmathi and S. Hemalatha [11] "*Automatic attendance management system using face Detection" in 2017.* The automatic attendance management systemwill replace the time-consuming and difficult-to-maintain manualsystem. Inthis study, we shall address attendance without the need of humans. This method involves installing a camera in the classroom that captures images, detects faces, compares them to a database, and then registers attendance. If a student's attendance is marked as absent, a notice notifying their parents of their child's absence is sent. A multitude of methods exist for comparing faces. The Eigen face of the procedure is the one. Eigen faces are a set of Eigen vectors used in computer vision to solve the face recognition problem.
Saravanan, Sharma &Shanmugasundaram, Karthikeyan & Ramasamy, Sathees [12] proposed "*CNN based efficient face recognition technique using D-lib "in 2016.* Despite breakthroughs in face recognition, it has received a lot more

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attention in the scientific and business sectors in recent decades. This research proposes a Deep Learning-based face recognition system that uses Convolutional Neural Networks (CNN) with D-lib face alignment.

Akash Singh, Shreya Bhatt, Abhishek Gupta[13] developed *"Automated Attendance System with Face Recognition" in 2021*. The face is a tangible manifestation of a person's uniqueness. As a result, we've created an automatic student attendance system based on face recognition. This technology has a wide range of applications in daily life, particularly in security and surveillance systems. Airport security systems utilise facial recognition to detect offenders.

Nandhini R, Duraimurugan N, S.P.Chokkalingam [14] developed "*Face Recognition Based Attendance System" in 2019*. Automatic face recognition technology has progressed significantly in today's ever-changing world. Smart Attendance with Real-Time Face Recognition is a convenient way to keep track of students' attendance on a regular basis. A facial recognition-based attendance system recognises a student's face for the purpose of collecting attendance using high-definition monitor video and other information technologies. A computer system will be able to swiftly and reliably detect and recognise human faces in images or videos captured by a security camera in my face recognition project.

Prof. M. S. Sawane, ShrutikaNakhale, Vishal Rathod, Nikita Ghadge[14] proposed *"Real-Time Smart Attendance System using Face Recognition Techniques" in 2021*. Automation is crucial in today's academic system for assessing performance quality. Most organisations' traditional practises, such as calling names or signing documents, are both time-consuming and insecure. As technology progresses, computer vision may be utilised to automate the manual attendance approach. It is critical to employ computer vision to recognise student facialfeatures in order to automate attendance without using paper and pen. Teachers, students, and parents may check attendance from anywhere at any time. Deep learning image processing is used to make it easier to predict attendance, saving time and money. The device incorporates a temperature check and hand sanitization mechanism to handle with a covid scenario.

IV. CONCLUSION

The study proposes a novel approach to facial recognition by developing 2D to 3D image reconstruction models using a Convolutional Neural Network (CNN) and Principal Component Analysis (PCA) for feature extraction. The CNN method is used to convert 2D images to 3D images, and PCA is used to extract features from the 3D images. The Mahalanobis method is then used for classification inthe face recognition-based attendance system. The proposed method achieved a high accuracy rate of up to98%.The study suggests that using reconstruction algorithms from 2D to 3D forms can be beneficial in improving facial recognition systems. The proposed method can be used for face recognition in various applications such as security systems, access control, and attendance systems. However, further research is required to test the proposed method on a larger dataset and in real-world scenarios.

Overall, the study provides an effective and accurate approach to facial recognition by using 2D to 3D image reconstruction models and feature extraction methods. It demonstrates the potential of combining multiple techniques to achieve high accuracy rates in face recognition-based attendance systems.

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