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Face Recognition Attendance System

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ABSTRACT: The face is the identity of a person. The methods to exploit this physical feature have seen a great change since the advent of image processing techniques. The attendance is taken in every school, colleges and libraries. Traditional approach for attendance is professor calls student name and record attendance. It takes some time to record attendance. If the duration of class of one subject is about 5o minutes, it takes 5 to 1o minutes to record attendance. For each lecture this is a waste of time. To avoid these losses, we're going to use automatic process which is based on image processing.

Identification of any people in any organization or colleges for the purpose of attendance marking is one of such software. Authentication is a significant issue in computer-based communication. Human face recognition is an important branch of biometric verification and has been widely used in many applications. The use of Attendance Management System is to perform the regular activities of attendance marking and analysis with less human intervention.

In this new approach, we are using face detection and face recognition system. This face detection distinguishes faces from non-faces and is essential for accurate attendance. The other strategy is facing recognition for marking the student's attendance. We have used OpenCV for this system. The camera will be connected using OpenCV module that converts the image into the RGB format which in turn is mapped to the pre-trained neural networks using HOG algorithm to recognize the face pixels. This system offers effective way to manage the attendance system which is time efficient and offers massive scaling for future purposes.

KEYWORDS: Face Recognition, Image Processing, OpenCV, HOG Algorithm.

I. INTRODUCTION

These days, technology attempts to convey a significant amount of knowledge-oriented technical innovation. For both students and teachers in an educational setting, attendance is regarded as a crucial aspect.[1] With a manual student attendance management system, the instructor in charge of the relevant topic must call the students' names and manually record their attendance. Manually recording attendance may be viewed as a time-consuming task, and occasionally students or teachers may overlook someone on their companions' absence several times. Hence, when we consider the conventional method of recording attendance in the classroom, a difficulty occurs [1].

In practice, MAS staff may struggle toalways approve and maintain every student's record in a classroom. In a classroom with a high teacher-to-student ratio, marking each student's attendance physically and cumulatively becomes a tedious and time-consuming process [2].

Although this face recognition framework has seen several advancements, the two most crucial ones are face detection and face recognition. Firstly, the pictures of the pupils' faces will be needed to record attendance. The camera that will be placed in the room so that it can see the entire classroom can be used to record this image. The system will take this image into account as an input. The image should be improved using image processing techniques like grayscale conversion and histogram equalisation to identify faces accurately.After improving the image's quality, face detection will be used. The face recognition process comes after face identification. For face recognition, a variety of methods like Eigen face, PCA, and LDA hybrid algorithm are available. When faces are recognised in the Eigen face, they are removed from the image. Different facial highlights are retrieved with the element extractor's help. The student is identified using these faces as Eigen characteristics, and their attendance is noted by coordinating with the face database. The creation of the face database is necessary for comparison [3].

There are two forms of face recognition: two-dimensional and three-dimensional. Two-dimensional face identification has difficulties with fluctuations in illumination, facial expression in poses, severe occlusion, and image resolution. The second kind is three-dimensional facial recognition, which has lately proven to be more effective, particularly in

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lighting and position variations. However, because it is difficult and expensive to build 3D capture devices, these techniques are not directly deployable [4].

How to improve the effectiveness of the face recognition algorithms used in the system to extract accurate results and minimize the rate of failure, what measures are to be taken to ensure the reliability of the attendance recording system, and which data retrieval mechanism is to be employed to enable error-free matching of the facial features will be covered in class without the need for excessive use of system and outside resources. The methods and procedures suggested in this paper effectively and precisely address these problems [5].

The goals of this paper are to design a face recognition attendance system that is supported by a database, to put the design into practice, to add the novelty of being able to send attendance results taken via a cellular network to designated handheld devices, and to test how variations in face angle, facial expression, and lighting affect the accuracy of the designed and implemented system [6].

II. LITERATURE REVIEW

S.No	YEAR	AUTHORS	TECHNOLOGY USED	RESULT
1.	2o22	Priyanka Pimpalkar,Anand D. G. Donald	Principal Component Analysis (PCA)	Saves time , efficient and improves the security.
2.	2o19	Nandhini R.	Convolution Neural Network(CNN)	It improves the accuracy and speed.
3.	2o19	Shreyak Sawhney, Karan kicker, Samyak Jain	Neural Network and Principal Component Analysis (PCA)	Two camera some camera is used for the face detection and recognition at the door of classroom and the camera is used at inside the classroom for checking proxy attendance.
4.	2o18	Omkar abdul rhmansa lim	Raspberry Pi , LBPs	Capturing image in a better way is done by Raspberry Pi
5	2o18	Kritika Shrivastava, Shweta Manda, Prof. P.S. Chavani	Haar Cascade, LBPH Algorithm along with LDA Model.	Fully automated face recognition with improved accuracy and limited time.
6	2o17	Samuel John	Viola Jones algorithm, Fisher faces algorithm	Create proper patterns and automated face detection.
7	2o17	Jenif D Souza	Histogram Algorithm	This system overcome the problem of time consuming.
8	2o17	Poornima S, Sripriya N	Viola Jones algorithm and Principal Component Analysis	They use gender classification and voice conversation to perform accurate results.

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9	2o17	Prof. Arun Katara1, Mr. SudeshV. Kolhe2,	Raspberry Pi,open CV	It improves efficiency and accuracy.
1o	2o16	E Vardharajan, R Dharani, S Jeevitha,SHemalata	Eigen Faces, Eigen Weight method	It defines accurate results, but the only problem is strict facial alignment required when training and identifying faces.
11	2o15	Jonathan Chin Eu Tsun, Chew Wei Jen, and Florence Choong Chiao Mei	Viola-Jones algorithm and Eigen Face methodology	Frames from the video are taken at predetermined intervals and used for additional processing. Due to its excellent efficiency, the Viola-Jones method is employed for face detection
12	2o14	Rekha AL and Dr. Chethan HK	Viola-Jones algorithm	The efficacy of face identification is quite low in photos where numerous people are taken in the same or distinct sequences.
13	2o14	Muhammad Fuzail, Hafiz Muhammad, and Fahad Nouman	HAAR classifier and Eigen Face methodology	This system is designed for only front view images. Also, the faces that the HAAR classifier is unable to recognise must be manually cropped, which lowers the system's overall efficiency.
14	2o12	Naveed Khan Balcoh	Viola Jones algorithm for face detection and Eigen face methodology for face recognition	At regular interval video was captured and the faces were cropped for analysis, but the system was inconsistent when the faces were tilted or at different angles.
15	2o16	Visar Shehu and Agni Dika	Learning Management System (LMS), HAAR classifier	The students attending the lecture are automatically identified and registered by this method. The method makes use of a discrete digital camera that is installed in the classroom and scans the space every five minutes to take pictures of the students.

III. PROBLEM STATEMENT

In recent years, several research projects have sought to construct an automatic attendance system using biometric features. This study will now show a proposed design for an automated attendance system with audiooutput that makes use of image processing and voice conversion capabilities. This project involves having students sit in columns in a classroom while using a variety of postures, gestures, and accessories.

Attendance is an important part of daily classroom evaluation. At the beginning and end of class, it is usually checked by the teacher. Face recognition-based attendance system is a problem of recognizing face for taking attendance by using high-definition video and other information technology. The concept of face recognition is to give a computer system the ability to find and recognize human faces quickly and precisely in images or videos. Numerous algorithms and techniques have been developed to improve the performance of face recognition. Recently, deep learning has been highly explored for computer vision applications. Human brain can detect and recognize multiple faces automatically and instantly. But when it comes to computer, it is very difficult to do all the difficult tasks on the level of human brain.

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In biometrics, the basic traits of human are matched to the existing data. Facial features are extracted and implemented by algorithms, which are efficient. Computers that detect and recognize faces could be applied to a wide variety of practical applications including criminal identification, security systems, identity verification etc.
A system that can autonomously learn and make decisions based on its own experience without any explicit programming can be created by applying machine learning. Allowing computers to learn and make decisions on their own without human intervention is the core goal of machine learning. It can access data and learn on its own by the instruction given earlier or from experience and makes better judgement.[7]

IV. METHODOLOGY USED

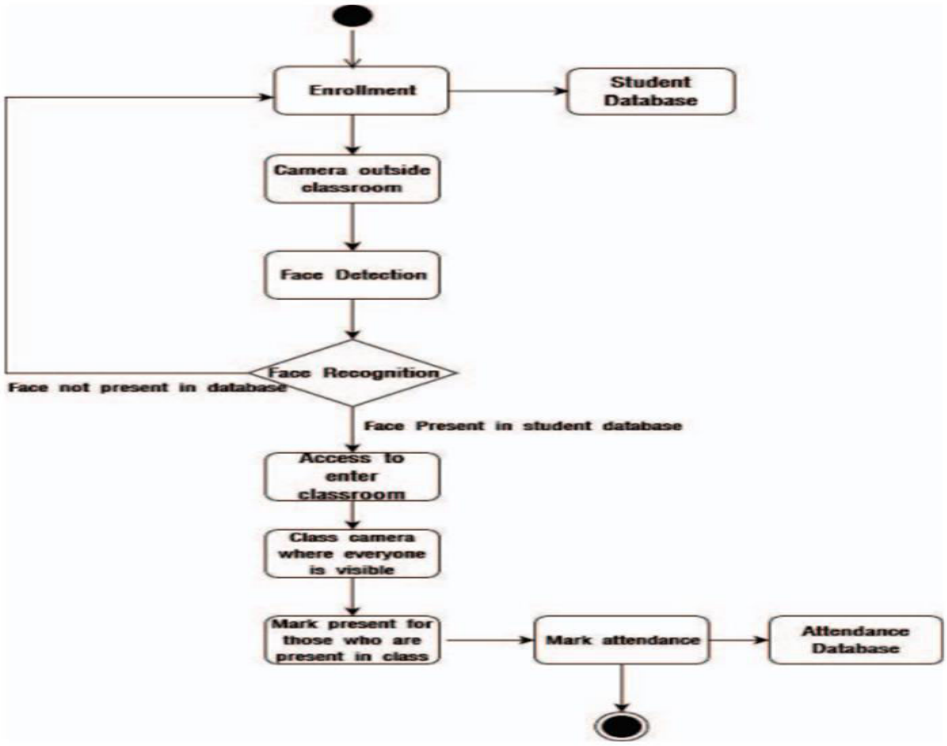

Fig 1. Workflow of face recognition

V. ALGORITHM

This proposed system is created to address the weaknesses of the current system. To train the classifier for this technique, many positive and negative images are required. In this system, there are four modules. The proposed system's algorithm is described below:[7]

Input: Faces of students at Entrance.
output: Automatic Marking of the attendance.
Problem Statement: Recognition of faces and marking attendance accordingly.
Step I: Commence
Step II: Enrolment of students' details in the student database.
Step III: Setup a camera outside the classroom.
Step IV: Face Detection
Step V: Face Recognition by comparing the students' face with images in the student database.
Step VI: IF: student is present in database.
Grant access to the classroom.
ELSE: Go back to Step 2.
Step VII: Camera installed in the class is used to check the presence of the student in the class.
IF: Faces recognized in step 6 are present
Mark them present.

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ELSE: Mark absents.
Step VIII: Mark the attendance in the attendance database.
Step IX: End.

VI.FRAS (FACE RECOGNITION ATTENDANCE SYSTEM)

A. How does face detection works?

In order to identify human faces from larger images—which frequently include a lot of non-face items like buildings, landscapes, and different body parts—face identification technology uses machine learning and algorithms.
As one of the simplest face traits to recognise, human eyes are typically the first thing that facial identification algorithms look for. The algorithm might then try to locate the mouth, nose, eyebrows, and iris. The programme then does additional tests to verify that the facial feature it has extracted is in fact a face after identifying these facial features and reaching this conclusion.Algorithms must be trained on enormous data sets including hundreds of thousands of photos to be as precise as feasible. While some of these pictures have faces, others don't.The algorithms' capacity to determine whether a picture contains faces and where those facial regions are located is aided by the training techniques.
A good moment would also be now to define the major categories of algorithms, including ML.

- Machine Learning (ML): ML algorithms look for patterns in vast volumes of data using statistics. Words, figures, pictures, clicks, and other types of data are all possible. Many contemporary services, including voice assistants (Alexa and Siri), search engines (Google and Baidu), and recommendation engines (Spotify and Netflix), are powered by machine learning (ML);
- Artificial intelligence (AI): An ML solution is AI if it is built to learn how to do a task rather than just perform it. AI-based systems exhibit traits associated with human intellect, such as planning, learning, perception, manipulation, and reasoning.
- Deep Learning: With the help of this method, which is a subset of machine learning, deep neural networks are created, giving machines a larger capacity for seeing and amplifying minute patterns.

Such networks consist of multiple layers of computer nodes that work together to analyse data and provide predictions.
Regarding the precise technologies employed in the creation of face detection applications, they comprise:

1. TensorFlow
2. OpenCV
3. MATLAB
4. Neural networks.

All of these employ a face detection process that is nearly identical.

B. Face Detection Methods

A classification of facial detection techniques was released by David Kriegman, Ming-Hsuan Yang, and Narendra Ahuja, three researchers from the University of California. Face detection techniques can be categorised into twoor more of the four available categories. Let's examine each category individually.

1. Method Based on Features

This technique identified faces by removing structural characteristics. An algorithm must first be trained to be a classifier. The next step is to separate face from non-facial regions using it. The overall goal is to go past people' innate understanding of looks. Features-based strategies offer a 94% success rate when applied to pictures containing numerous faces.
Summary: To identify a face, characteristics like a person's nose or eyes are used.

2. Information-Based Approach

A knowledge-based algorithm is based on human understanding and is reliant on a set of rules. For instance, "rules" can state that a face needs to have eyes, a nose, and a mouth in particular alignments. The creation of an adequate set of rules is a highly complex task, which makes this kind of approach quite challenging. Contrarily, if the rules are too specific, the system may produce many false negatives. If the rules are too wide, there may be many false positives.
Summary: A face's classification depends on whether it complies with a set of rules devised by a human.

C. Installations

The installation process for this project is a bit more than usual. First we have to download a C++ compiler. We can do this by installing Visual Studios. You can download the community version for free from their website. once the

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installer we will run it and select the 'Desktop development with C++'. The download and installation will take some time as it is a few Gbs.After completing and restarting the computer, now we will head on toour PyCharm project. Here we will install the required packages. Below is the list.

1. CMake
   The operating system- and compiler-independent build process is managed using the extensible, open-source CMake framework.CMake is intended to be used in conjunction with the native build environment, unlike many cross-platform systems. Standard build files (such as Makefiles on Unix and projects/workspaces in Windows MSVC) are generated using straightforward configuration files called CMakeLists.txt files and are utilized in the normal manner. CMake can produce a native build environment that can assemble executable binaries, compile source code, build libraries, produce wrappers, and more.
2. Dlib
   one of the most potent and user-friendly open-source libraries, Dlib includes a number of software development tools as well as machine learning techniques and libraries. It was first made available in 2oo2. It has been extensively employed in numerous large enterprises, businesses, and for numerous large projects, etc. Additionally, it has a larger variety of algorithms that are more useful in the real world.
   Dlib is primarily utilised for facial recognition. Using the HoG (Histogram of oriented Gradients) and CNN (Convolutional Neural Networks) functions, they examined the object/face. In many applications today, face recognition is employed often.
3. NumPy
   The Python package NumPy is used to manipulate arrays.Additionally, it has matrices, fourier transform, and functions for working in the area of linear algebra.
   In the year 2oo5, Travis oliphant developed NumPy. You can use it for free because it is an open source project.Numerical Python is referred to as NumPy. The equivalent of arrays in Python are lists, although they take a long time to execute.
   OpenCV
   OpenCV is a sizable open-source library for image processing, machine learning, and computer vision. It now plays a significant part in real-time operation, which is crucial in modern systems. Using it, one can analyze pictures and videos to find faces, objects, and even human handwriting. Python is able to handle the OpenCVarray structure for analysis when it is integrated with different libraries, such as NumPy. We use vector space and apply mathematical operations to these features to identify visual patterns and their various features.

D. Understanding the problem

In recent years, several research projects have sought to construct an automatic attendance system using biometric features. This study will now show a proposed design for an automated attendance system with audiooutput that makes use of image processing and voice conversion capabilities. This project involves having students sit in columns in a classroom while using a variety of postures, gestures, and accessories [8].

Another possible application of biometrics is gender classification. Researchers have experimented with gender classification in a variety of contexts utilising image processing techniques such as classification methods, fuzzy rules, genetic algorithms, etc. But upgrades are anticipated to boost its categorization effectiveness. To count the number of male and female students in the class during lecture hours, this paper also took a first step in classifying gender [9].

VII. RESULT AND DISCUSSION

Tests were run to determine the recognition system's accuracy.The numbers in the table below show how frequently a person was successfully recognised [Number of Positives (NoP)] and how frequently there was a false negative match [Number of False Negative Match (NFN)].

S/N	Name	NOP	NFN	Accuracy
1	Vaibhav	7	3	8o
2	Ram	6	4	7o
3	Aman	7	3	8o

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4	Aryan	6	4	9o
5	Shreyansh	9	1	9o

Accuracy= 80+70+80+90+90= 82%

5

Efficient and automatic attendance management is required in our daily life. This method is simple and efficient. The management of attendance in this method is simpler and the attendance is taken more accurately[1o].

VIII. CONCLUSION

According to the findings presented in the results and discussion section, the suggested attendance collection and tracking system may keep track of the students to make sure they are present for a predetermined amount of time before capturing their attendance. The face detection and identification technology is used by the attendance system to keep track of the pupils who are really in the class.[11] The outcomes for the face detection and face recognition systems demonstrate that both are highly successful and accurate. The monitoring and attendance marking results demonstrate that both students who are primarily in class and those who leave mid-lesson can have their attendance accurately recorded [12].

For a learning and teaching environment, an automated system for tracking student attendance is required. Most of the current systems take time and need some semi-manual work from the teacher or students, such as calling students' names and passing around attendance sheets during class. The suggested approach aims to address the issues by incorporating facial recognition into the process of managing attendance [13].

For many organizations, like schools, universities, offices, etc., an automated attendance recording, and management system is a crucial tool. Most of the current systems take a lot of time and involve manual labour. The flaw in every other system was fixed by the suggested system.[14] Persons' faces are recognized, and attendance is recorded by using machine learning and face recognition techniques. Every single entry in the database is updated for usage in the future. Since this system employs a modular design, any development can be incorporated. Environmental modifications may also be incorporated into the system. This system uses modern, in-demand technologies to efficiently carry out daily tasks [15].

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