Mini Project Report on

Attendance Automation using Face Detection

Submitted in partial fulfilment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE & ENGINEERING

Submitted by:

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CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the project report entitled **"Attendance Automation using Face Detection"** in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Computer Science and Engineering of the Graphic Era (Deemed to be University), Dehradun shall be carried out by the under the mentorship of **Dr. Neeraj Kumar Pandey,** Department of Computer Science and Engineering, Graphic Era (Deemed to be University), Dehradun.

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Chapter 1

Introduction

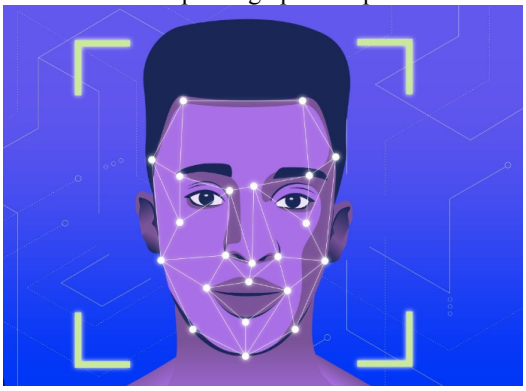
1.1 Introduction

Face recognition is the process of using a person's unique face to identify them as an individual. These kinds of systems can be applied in universities, colleges, and other settings. This article's goal is to offer a machine technology approach that is easy to understand and straightforward. With the use of such technology, a person can quickly identify a face using a dataset that matches a person's appearance. The most effective technique for detecting a person's face is the one that uses OpenCV and Python in deep learning. Numerous industries, including the military, security, educational institutions, finance, gambling, online web apps, and airlines, can benefit from this technique. This solution makes use of a potent Python algorithm that makes face detection and recognition incredibly simple and effective.
A type of computer vision known as "face detection" helps identify and display facial features in photos or live recordings that have been taken. This kind of object detection method looks for semantic instances of a certain class (such people, automobiles, and houses) in digital photos and movies. With the advancement of technology, face recognition has become more and more crucial, particularly during the COVID-19 epidemic when biometric attendance marking could be hazardous.

What Makes Face Recognition Ethical?
• Efficiency: Less time and work is needed than with manual tracking.
• Accuracy: Face recognition software has a high degree of accuracy when identifying people.
• The classic challenge: lowering the likelihood of proxies.
Important elements
• Face Detection: Faces in pictures or video frames must be able to be found and identified by the system.
• Face Recognition: After a face is identified, the system needs to match it with a database of people who are known to it.
• Attendance Logging: Upon finding a match, the system logs the person's name and time of attendance in a file.
Face Detection: Due to its uses in both computer and human interaction, face detection has drawn a lot of interest recently. One aspect of image processing is face detection. The main purpose of image processing is to enhance, compress, or extract useful information from images. With the use of facial recognition technology, unwanted background noise can be eliminated from images by identifying one or more faces. Basically, a face identification algorithm has to divide images into two categories according to whether or not a face is present. The objective of the face detection method is to analyze the image in detail, determine whether faces are present in it, and eliminate any background. False negative and false positive face detection errors are the two categories into which they fall. When a face is recognized in an image that doesn't contain any faces, this is known as a false positive. When the algorithm denies the existence of anything in the image, it produces a false negative. The ratio of faces correctly detected by the system to those identified by humans is called the detection rate. The face detection algorithm's detection rate ought to be as high as feasible.

1.2 Project Objective:

For both teachers and students in an educational institution, attendance is crucial. Thus, maintaining a record of attendance is crucial.
When we consider the conventional method of taking attendance in a classroom, the issue appears.
Inquiring about a student's attendance by calling their name or roll number requires energy in addition to time. Thus, every issue listed above can be resolved with an automated attendance system.
Many institutions currently employ automated systems for creating attendance records. Despite being automatic and improving upon the previous method, it is unable to fulfill the time constraint..



It takes time for the student to wait in line to give their attendance. With no disruption to the regular teaching process, this project provides an involuntary attendance marking system. The technique can also be used in classroom settings where attendance is crucial, such as during exam periods. This technology does away with traditional methods of identifying pupils, such calling their names or examining their identity cards, which can cause disruptions to the teaching process and anxiety among students during test times. Furthermore, in order for the pupils to be identified, they must register in the database. The user-friendly interface allows for immediate enrollment.
During the lecture periods, attendance sheets are distributed throughout the classroom in addition to calling names. It could be challenging to circulate the attendance sheet around the lecture hall, particularly in classes with a lot of pupils. As a result, the manual method of manually signing kids' attendance—which is tedious and distracts students—is to be replaced with a face recognition attendance system. Moreover, the automated student attendance system based on facial recognition can effectively tackle the issue of fraudulent approaches, hence eliminating the need for lecturers to repeatedly count the number of students to verify their presence.

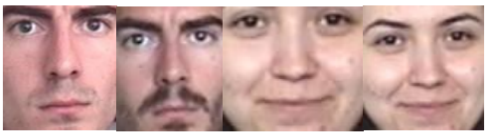
1)To classify the features in order to recognize the face detected.
2)To record the attendance of the identified student.

1.2.1 Face Detection

Finding and identifying every face in a single picture or video, regardless of its position, scale, orientation, age, or expression, is known as face detection.

1.2.2 Face Recognition

Ace recognition technology, a subset of computer vision, has emerged as a potent tool for identifying individuals based on their distinctive facial features. Face recognition is therefore simply the task of identifying an already detected face as a known or unknown face and in more advanced cases telling exactly whose face it is. In order to address the issue of attendance management in educational institutions, this study proposes a novel approach that combines face detection and identification methods with deep learning using Python and OpenCV. The main goal is to reduce the amount of time needed to track students' presence by eliminating manual labor and streamlining attendance procedures.



Different face samples

The suggested solution makes use of OpenCV's extensive computer vision library and Python's capabilities to provide an accurate and effective face detection and recognition system. This method works well in a variety of educational contexts, such as schools, colleges, and universities, because it can be used to real-time circumstances as well as images and films.

Face detection, face recognition, and attendance recording are the system's main components. While the face recognition module checks and matches detected faces against a database of known people, the face detection method finds and locates faces in pictures or video frames. When a match is made successfully, the system records the user's attendance along with their name and the time of the match.
The efficiency and precision of facial recognition as an attendance system make it significant. It lessens the difficulties involved in manual tracking, guaranteeing a smooth experience for teachers and students alike. In order to minimize disturbances to regular teaching procedures, the research also addresses the usual issues associated with attendance systems, such as proxy attendance, by creating an involuntary attendance marking system.

In addition, the suggested system seeks to provide a real-time, non-intrusive, and user-friendly substitute for the current automatic attendance systems, which include biometrics and RFID. This study looks into the possibilities of facial recognition technology in educational settings, with a focus on how it can improve attendance control and provide a more comfortable learning environment.

1.2.3 Approach:

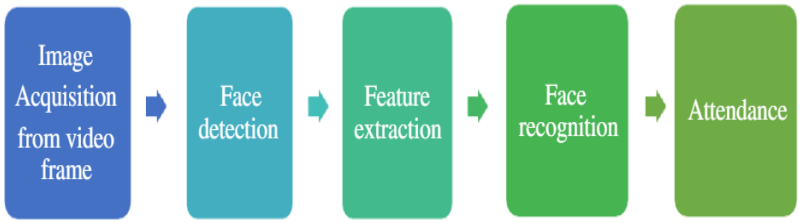
Take a picture with Open CV from the webcam.
Once the face is identified, the folder is saved using the face recognition model.
It compares the faces on file with the ones in the folder at the time of attendance.
Attendance was recorded if the match was discovered.
One of OpenCV's objectives is to offer a user-friendly computer vision infrastructure that enables the rapid development of somewhat complex vision applications. OpenCV is the main technology used in face recognition. The user maintains a minimum distance of 50cm in front of the camera, and his image is captured as input. After being taken out of the picture, the frontal faces are saved to a file.

Chapter 2

Literature Survey

2.1 Literature Survey

Significant progress has been made in facial recognition technology, with Python and OpenCV emerging as useful tools for creating effective systems. Usually, the procedure is taking pictures with a webcam, identifying faces in them, and comparing them to record attendance.



Overall process

2.1.1 OpenCV as a Core Technology:

In facial recognition systems, OpenCV, an open-source computer vision library, is essential. It offers an easy-to-use interface for taking webcam pictures and a smooth integration of computer vision features. OpenCV is a key component in the development of face recognition systems because of its adaptability and ease of use, which enable the development of complex vision applications (OpenCV).

2.1.2 Image Processing for Facial Recognition:

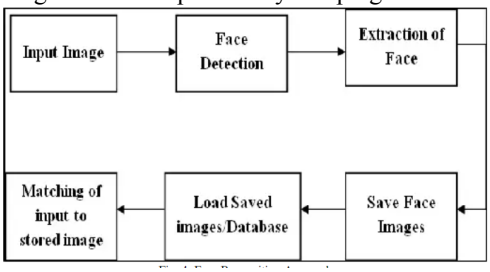
The suggested method starts the facial recognition process by taking pictures from a webcam with OpenCV. The discovered faces are saved into a specific folder when the model recognizes and extracts facial features. In order to provide a reference dataset for later attendance comparisons, this step is essential.

2.1.3 Attendance Marking through Face Matching:

The system checks the faces now captured by the webcam with the pre-saved faces in the folder throughout attendance time. The attendance is noted if a match is discovered. This method offers a smooth and effective substitute for manual tracking, streamlining the conventional attendance process.

Distance Factors Affecting Accuracy:

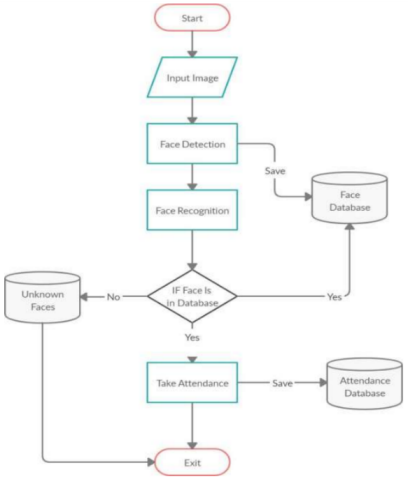
The user must be at least 50 centimeters away from the camera in order for accuracy to be guaranteed. For consistent and clear facial picture capture, this distance value is essential. Reliability of face recognition is improved by keeping a constant distance, which raises the system's total accuracy.



Despite the large body of research on face attendance and recognition systems, earlier studies highlight

how crucial precise face detection and recognition is for real-world use. Using OpenCV for image processing is consistent with the general direction of computer vision research. For dependable face recognition results, researchers have emphasized the need of building strong datasets and adjusting distance factors.
Even with these developments, real-time precision and handling lighting, expressions, and occlusion variations are still difficult problems to solve. Future studies might concentrate on incorporating machine learning methods to improve the accuracy of face recognition and investigating sophisticated aspects like anti-spoofing techniques to distinguish between genuine and fraudulent faces.

The research concludes by highlighting OpenCV's significance as a key component of facial recognition systems. The suggested method is in line with accepted procedures; it highlights the significance of precise face detection, uniform picture taking, and smooth attendance recording via face matching. Research in this area is still ongoing and aims to improve system capabilities and solve problems for more general use cases.



Chapter 3

Methodology

3.1 Methodology

A number of crucial procedures must be followed in order to successfully integrate face alignment, facial feature detection, and attendance marking capabilities utilizing Python libraries in the creation of a face attendance and recognition system.

3.1.1 Steps included.

Step 1: Install Libraries
Install the necessary libraries first. These are Opencv for picture pre-processing, Tkinter for creating a graphical user interface (GUI), Pillow for managing several image file formats, and face_recognition for higher-level Python-based face recognition. File path operations are performed by the os.path module.

```
opencv-python==4.6.0.66
Pillow==9.2.0
face_recognition==1.3.0
```

Step 2: Import Libraries
To use the installed libraries' functionality in the project, import them into the Python script.

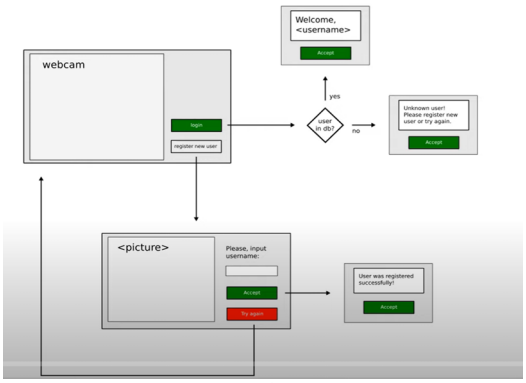
```
import os.path
import datetime
import subprocess
import tkinter as tk
import cv2
from PIL import Image, ImageTk
import util
```

Step 3: User Interface
Create an intuitive user interface with Tkinter to make interacting with the face recognition system simple.

```
import tkinter as tk
from tkinter import messagebox
```

Step 4: Capture Frames

Use OpenCV to initialize the camera and start capturing frames in real time. If more than one camera is attached, change the camera parameter (e.g., set "0" for the default camera) to choose the one you want.



Step 5: Creation of Attendance File

To ensure an orderly and thorough record of attendance data, create a file to hold attendance records and timestamps.

Step 6: Attendance marking and face matching

Apply the fundamental reasoning for facial recognition:

Use face_recognition to calculate face embeddings for the faces that were detected.

Examine and contrast the calculated embeddings with those of recognizable people.

Update the attendance file with the relevant timestamp and record the attendance for that individual if a match is discovered.

Face Identification System:

This makes it easier to compare and match these embeddings against the data of known individuals by using face_recognition for face detection and recognition.

3.1.2 Attendance Logging

Record the timestamps and matched faces in an organized attendance log. This log helps with analysis by offering a thorough record of attendance information.

3.1.3 User Interface Enhancement

Make constant improvements to the Tkinter-based UI to ensure the best possible user experience. Make sure that the interface continues to be user-friendly and accessible so that end users with different degrees of technical expertise may utilize it.

Chapter 4

Result and Discussion

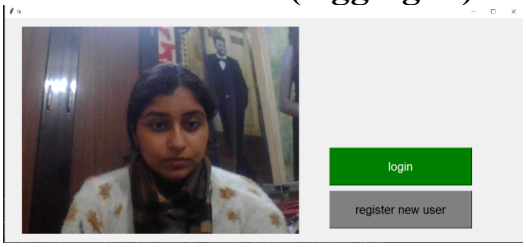
4.1 Result

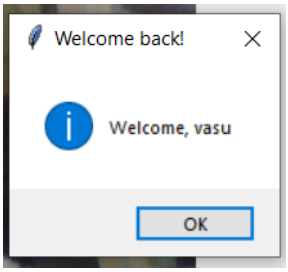
The facial recognition system that has been put into place is incredibly functional; it accurately and intuitively handles the fundamentals of managing attendance. The system has functions that enable real-time face detection, real-time user registration, and attendance logging based on identified persons.

4.1.1 User Registration:

The ability to easily register new users is one noteworthy feature. The face detection model records and stores a user's facial traits in a specified file after receiving their name. The system's database may be easily expanded thanks to the user-friendly registration process.

For known users (logging in):





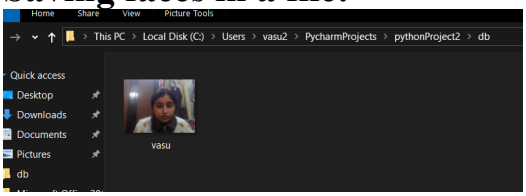
Attendance recorded with date and time in a log file:

```
vasu, 2024-01-17 20:35:01.731051
```

4.1.2 Real-time Face Detection:

The face detection model kicks in when someone tries to log in. The identified face is compared by the model with the stored facial traits of users who have registered. The attendance is left unmarked if the face is not recognized, suggesting that the person is unknown. This function keeps unwanted access to attendance records at bay as a security precaution.

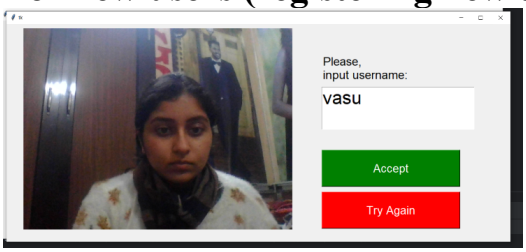
Saving faces in a file:



4.1.3 Attendance Logging for Known Individuals:

The technology compares the present face with the stored faces of registered users to identify known individuals. Following a successful match, the known person's attendance is noted in a log file that is kept up to date. This file provides a thorough record of attendance activities and contains relevant data like the person's name and a timestamp.

For new users (registering new users)



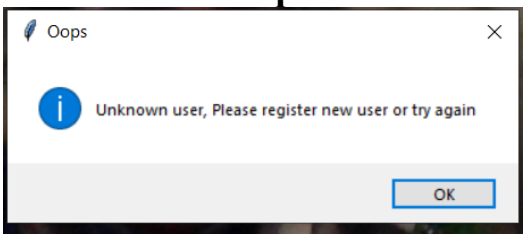
4.1.4 Efficient Timestamped Logging:

A methodical, timestamped record of every attendance event is provided by the attendance log file. This thorough log makes it easier to observe attendance trends over time, which makes analysis and reporting later on easier. Making well-informed decisions is made possible by the ability to identify attendance trends and patterns thanks to the timestamped inputs.

4.2 Discussion

Easy-to-use Interface: The Tkinter-based user interface of the system improves user experience. User interactions are easily accommodated by the straightforward design, which guarantees a seamless registration procedure and efficient face detection during login attempts. The system is usable by people with different technological backgrounds because of the interface, which serves as a link between the sophisticated facial recognition algorithms and the end users.

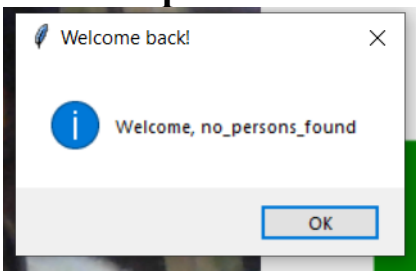
When unknown person is their:



Security and Privacy Measures:

Security is given top priority in the system design, which differentiates between known and unknown faces. Attendance records are not compromised by unauthorized attempts. Furthermore, since just the data required for identification is saved, the use of facial features for registration offers an additional degree of privacy.

When no person is found:



The system effectively achieves its goal of providing safe and effective attendance control. The system's success is demonstrated by the smooth registration procedure, accurate attendance reporting, and real-time face detection. This system's combination of strong security features and user-friendly features makes it an invaluable tool for a variety of situations, including business offices and educational institutions. Its applicability can be improved and its ability to satisfy changing user needs can be continuously improved with more refinements and scalability choices.

Chapter 5

Conclusion & Future Work

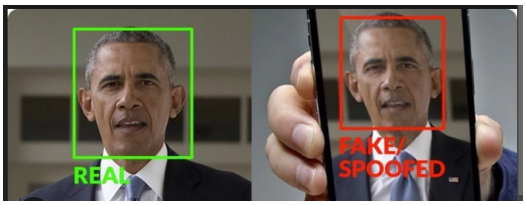
5.1 Conclusion

Modernizing attendance management has advanced significantly with the use of Python and OpenCV to integrate face attendance and recognition. The method works well because it uses computer vision in an elegant way, and OpenCV is a powerful tool for processing images and extracting facial features. The implementation's ability to automate attendance using real-time face matching highlights its applicability and potential in a variety of industries.

Still, there are issues that need to be resolved, such as improving system security, speed, and accuracy. To discern between genuine and counterfeit faces, additional advancements are necessary, tackling certain weaknesses such as picture spoofing. Even if the current system is effective, it might be improved further to reach real-time precision and dependability in a range of environmental circumstances.

5.2 Future Work

This project's future course calls for a bold feature expansion to strengthen the system against new threats. It will be crucial to implement anti-spoofing systems, which use sophisticated algorithms to distinguish between real and faked facial photos. By using parallel processing and improved algorithms, speed and accuracy can be increased while maintaining system responsiveness and adaptability to changing conditions.



Furthermore, investigating machine learning methods for facial recognition may lead to increased precision, particularly in situations with different illumination and different facial expressions. By incorporating these developments, the system will be positioned as a sophisticated and trustworthy instrument for managing attendance in commercial and educational settings alike.

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