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FACE RECOGNITION-BASED ATTENDANCE MANAGEMENT SYSTEM

Ms. Vinaya Kulkarni[1]

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Abstract

The processes now in place to record and report attendance are laborious and time consuming. When attendance is recorded manually, mistakes are more likely to occur. One of the most popular biometric methods now in use is facial recognition. It has a wide variety of potential uses, including but not limited to those of identification, authentication, and security. The goal of this system is to replace the current manual attendance system with a fully automated one.

The first half of this system is already live and contains features like Redis database integration, facial recognition, registration forms, and database access. During the second stage, we use tools like Streamlit and Dashboard.

Keywords : OpenCV, insightface, Redis Database , Streamlit.

[1]Assistant Professor, Changu Kana Thakur Arts, Commerce and Science College, New Panvel (Autonomous)
vinayab1989@gmail.com

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Introduction

Everything in the modern day has gone contactless, from business administration to classroom instruction to monetary transactions. Students' arrival and leave from the classroom can now be recorded reliably and conveniently through the use of contactless attendance systems. Successful preventative measures against the COVID-19 epidemic include going touchless.

Taking attendance the old fashioned way is a time-consuming and laborious process in classroom settings. Probabilities of a proxy showing up are not zero. As a result, a variety of alternative methods, including RFID, iris recognition, fingerprint recognition, and so on, have been implemented by numerous educational institutions as a means of keeping track of students' attendance.[4]

In recent years, face recognition has emerged as a highly effective method for analyzing and interpreting images, making it one of the most widely studied issues in computer vision. Some of the most common applications involve discovering missing persons, investigating retail crimes, identifying security threats, locating social media profiles, monitoring classroom attendance, and identifying drivers. Incorporating face recognition into everyday life has the potential to make it a safer, smarter, and more useful place. Methods typically used in facial recognition include:

Face Detection: Face detector algorithms locate faces, draw bounding boxes around faces, and keep the coordinates of bounding boxes. [5]

1. Face Alignments: Normalize the faces to be consistent with the training database.[5]
2. Feature Extraction: Extract features of faces that will be used for training and recognition tasks.[5]
3. Face Recognition: Matching the face against one or more known faces in a prepared database.[5]

Traditional face recognition technology has some drawbacks. For each person to train a model, massive sample sizes of photos are needed (200 to at least 100 photos per person). Unable to add additional person details to a trained model. Retraining the model with all the data is necessary. As the number of people classified increases, the model's accuracy decreases. Prolonged processing time.

Fast Face Recognition Model has benefits such as Fewer samples being needed, For a new person no model retraining is necessary, It is accurate enough and It has quick processing.

Face recognition, machine learning, artificial intelligence, and other fields use OpenCV, a Python open-source package, for computer vision. The term "OpenCV" refers to the Open-Source Computer Vision Library, which is frequently used for image identification or recognition. In 1999, Intel gave it its official debut. Early versions were written in C/C++, although Python is also frequently used for computer vision today.

Insight Face is an integrated Python library for 2D&3D face analysis. Insight Face efficiently implements a rich variety of state-of-the-art algorithms for face recognition, face detection, and face alignment, which optimized for both training and deployment. Research institute and industrial organization can get benefits from Insight Face library.[6]

Literature Review

Authors in [4] proposed a model of a face recognition-based attendance system. The four stages of this system are database building, face detection, face recognition, and attendance updating. Images of the students in class are used to develop databases. The Haar-Cascade classifier and the Local Binary Pattern Histogram technique are used, respectively, for face detection and recognition. Faces are picked up and recognized in the classroom's live-streamed footage. Attendance will be

mailed to the relevant professors at the conclusion of the session.

In this paper [3], Face detection is the procedure where a face is sought out in an image that is provided as an input (picture), and then the facial image is cleaned up for easier face identification. To identify faces, the CNN algorithm can be used.

Authors in [1] proposed a model of an Attendance Management System Using Face Recognition. The primary goal is to automate the attendance system by integrating facial recognition technology with the Matlab Graphical User Interface (GUI), modified Local Binary Pattern (LBP), and Support Vector Machine (SVM) algorithm. Once face detection and feature extraction are completed using Viola Jones and LBP, the image is relocated for recognition.

In this paper [2], The EigenFaces recognizer will be the one on which this research will centre. The idea behind EigenFaces is straightforward: it detects a certain face by identifying its largest deviation, then turns those variances into data that can be compared when a new face enters the scene. The path to each image and its labels will be read from the csv file during training and stored into a list variable. The list will then be provided into the training function, where it will take a specific amount of time to complete the training. The amount of time required to train those images will increase with the size of the face database.

Methodology for face recognition:

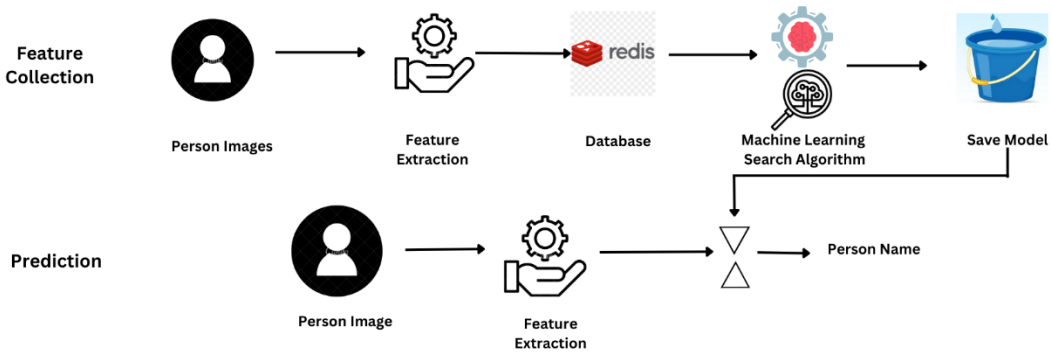

Figure. Fast Face Recognition Model

An image of a person is recorded using video surveillance. In the Radis database, capture footage is kept. Redis is an in-memory data structure store that is open source (BSD licenced), used as a database, cache, message broker, and streaming engine. Redis uses an in-memory dataset in order to deliver the best performance.

Machine Learning Search Algorithms like Euclidean Distance, Manhattan Distance, and Cosine Similarity are used to extract features. Machine learning heavily relies on distance measurements. Depending on the sorts of data, different distance measures must be selected and applied. As a result, it's critical to understand the implementation, calculation, and

interpretation of a variety of widely used distance measures.

The shortest distance between two vectors is represented by the Euclidean Distance. It is the sum of squares of differences between corresponding elements, or its square root. The L2-norm of a difference between vectors and vector spaces is equivalent to the Euclidean distance metric. It is determined mathematically using Pythagoras' Theorem. The sum of the squares along each perpendicular ordinate represents the overall distance between two objects.

Euclidean Distance may be expressed as:

$$D(x,y) = \sqrt{\sum_{i=1}^{n}(x_i - y_i)^2)}$$

The Manhattan Distance is the total of all the absolute disparities between two points in all the dimensions.

Manhattan Distance may be expressed as:

$$D(x,y) = \sum_{i=1}^{k} |x_i - y_i|$$

The cosine similarity index calculates how similar two vectors in an inner product space are to one another. It establishes whether two vectors roughly point in the same direction by calculating the cosine angle between them.

The cosine similarity may be expressed as:

$$D(x,y) = cos(\theta) = \frac{x \cdot y}{\|x\| \, \|y\|}$$

An open-source Python toolkit called Streamlit makes it simple to develop and distribute stunning, personalized web apps for data science and machine learning. Using Streamlit App, an attendance app was developed.

Results and Discussion

The project's basic operating premise is that video data is transformed into images in order to be detected and recognised. Additionally, attendance includes the student's recognisable photograph.

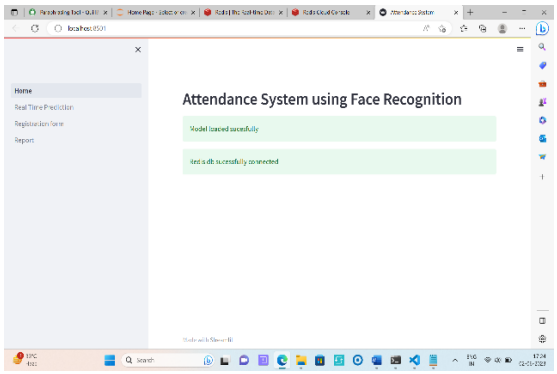

Figure 1: Home Page

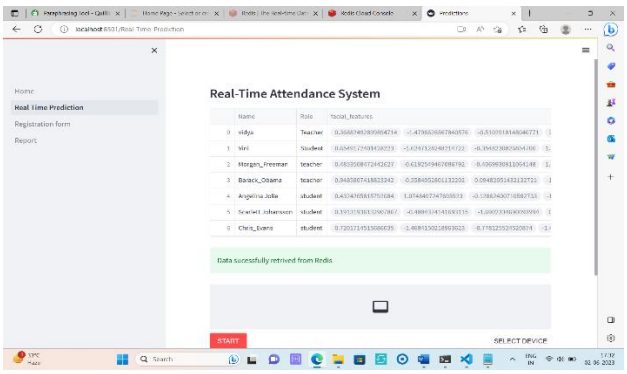

Figure 2 : Dataset

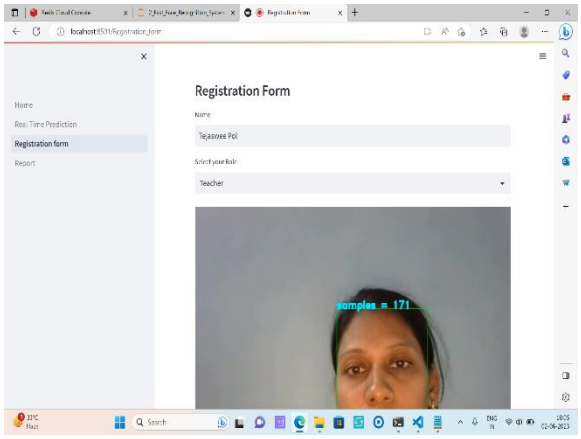

Figure 3: Registration

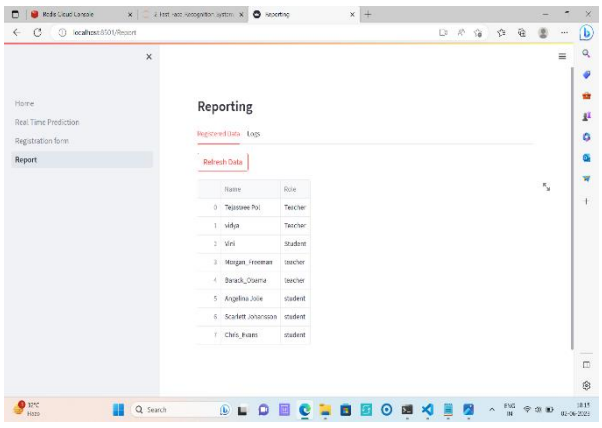

Figure 4 : Registered Data

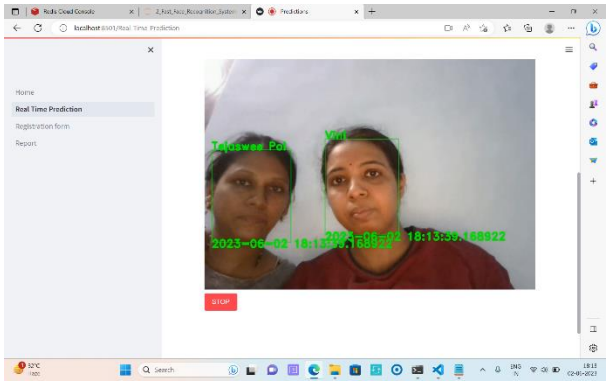

Figure 5: Real Time Prediction

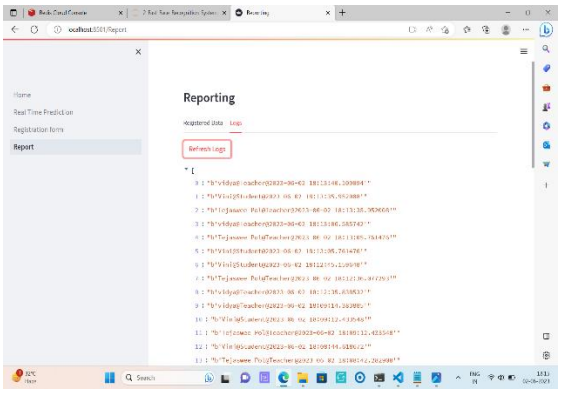

Figure 6 : Log Report

Conclusion

A face-recognition automatic attendance system automatically determines the name of the person. The suggested application can identify registered teachers and students.

For individuals who don't register, this system identifies the unregistered. Each day, note when students enter and leave. Obtain the instructor's and the student's daily attendance records.

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