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A Real Time Facial Recognition and Tracking System for Personnel Presence

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Abstract: ***Our project aims to revolutionize the conventional attendance system by implementing a facial recognition-based solution. The existing manual methods are prone to human error and require significant maintenance. By leveraging facial recognition technology, our system will offer improved precision and efficiency, reducing the need for manual work. The system will maintain a database of students' images, matching them during class to mark attendance accurately. Utilizing machine learning techniques, specially the Haar-Cascade classifier and local binary pattern histogram method for face detection and recognition, respectively, our system will ensure reliable attendance tracking. The attendance data will be stored in a MySQL database and Microsoft Excel file, providing a streamlined and secure alternative to the traditional attendance process.***
Index Terms: Machine Learning, Face Recognition, Face Detection, Attendance System, OpenCV.

I. INTRODUCTION

In educational institutions and organizations, monitoring attendance is essential for various purposes. While traditional methods like paper-based systems exist, modern advancements have introduced automated solutions, including biometric techniques. One such advanced method is facial recognition technology, a computerized biometric software that verifies individuals by analyzing their facial features. Over the years, facial recognition systems have evolved significantly and found applications in security and various commercial operations. This project focuses on utilizing facial recognition technology for attendance tracking, a practical and efficient solution. As institutions or organizations grow, managing attendance becomes increasingly complex. This project addresses these complexities by automating the attendance tracking process. It involves counting and identifying students or employees in each setting and maintaining accurate attendance records. This project aims to simplify attendance management for institutions and organizations.

II. LITERATURE SURVEY

A real time facial recognition and tracking system personnel presence proposes that the system is based on face detection and recognition algorithm which detects the student face when he/she come in front of camera and then compare the face with the images stored in the data folder if the match is found it will mark the attendance. This system surpasses the traditional system as it saves time also there is no chance of proxy. Here is a detailed summary of some of the existing research studies on this topic:

1) In their research paper titled “Smart Attendance System using OPENCV based on Facial Recognition” S.Bussa (2020) implemented the Smart Attendance System using the LBPH algorithm demonstrates the effectiveness of this method for face recognition in Attendance Management. LBPH stands out due to its superior performance, with a confidence factor 2-5 times higher than other algorithms and minimal noise interference. The system's success highlights a correlation between the recognition rate and the threshold value, indicating LBPH's reliability in accurately identifying students in an educational institute and preventing proxy attendance.

2) Dr A Manjula (2023) proposed in their research paper titled “Facial Recognition Attendance Monitoring System using Deep Learning Techniques” a system that has automated attendance solution for lectures streamlining the process for lecturers or teaching assistants to record student attendance. This automation not only enhances operational efficiency but also enhances the institution's reputation by addressing shortcomings in the traditional manual system. The system's effectiveness was demonstrated through extensive testing of the face detection and recognition algorithms, ensuring accurate student attendance records by recognizing their faces and storing the data in an attendance sheet.

3) Dr.A.Muthumari (2020) present in their research paper titled “Face Recognition Automated Attendance Management System using Machine Learning Algorithm” a Fully Automated Recognition Attendance System (FRAAS) which utilizes face detection and recognition technology to automatically update attendance records in a database. It includes features like SMS alerts to parents for verification and monthly attendance reports via email.

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The system is implemented using Python Django Framework, Haar cascade classifiers, and the LBPH Algorithm for higher accuracy.

4) In their survey paper titled "Face Detection and Recognition Using OpenCV" R.Hasan (2021) highlights the significant role of OpenCV in face detection and recognition. It discusses popular algorithms used in OpenCV for these tasks and explains the OpenCV modules, focusing on Python based implementations. Additionally, it explores various applications of OpenCV. Furthermore, the paper assesses and compares recent literature reviews that utilize OpenCV for human face detection and recognition across different elds. These applications aim to enhance human life through improved technology.

5) Archana (2022) introduce in their research paper titled "Real time Face Detection and Optimal Face Mapping for Online Classes" a web-based tool for real-time face recognition using Convolutional Neural Networks (CNN) and Local Binary Patterns Histograms (LBPH). The study reveals that CNN achieves an impressive accuracy of 95%, while LBPH lags at 78%. Additionally, leveraging a larger dataset of faces in diverse contexts could further improve identification accuracy. Integration with NoSQL/SQL databases could enhance model training performance.

III. PROBLEM STATEMENT

A Real time Facial recognition and tracking system's primary objective is to modernize the way attendance is recorded in educational institutions by introducing a smart system based on face recognition technology. This system aims to replace the traditional, time consuming method of manual attendance tracking with an automated, efficient, and secure process. Our goals are to enable institutions to effortlessly add new students, ensure accurate face recognition, accommodate various classes or subjects, and automatically maintain attendance records while generating detailed reports. In essence, we are creating a system that simplifies attendance management, making it quicker and digitally accessible for educational organizations.

IV. PROPOSED METHODOLOGY

The process involved in face recognition are: 1. Capture 2. Extraction 3. Comparison 4. Matching The operation in each process is: In step one the capture is the way to snap the picture during the enrolment of the system. Then in the Face Recognition step, extraction is used for finding or extract the specific feature from the face. The third step is comparison, where new input is used for comparison with the database (sample data). Finally, the last step is matching: the system will try to find the matching of the new face with the registered face based on extraction and comparison process. Below mentioned is the proposed methodology that contains data collection, training the classifiers, face detection and face recognition.

1) Data Collection: This stage is responsible for gathering and creating the dataset necessary for training the facial recognition system. This module captures facial images of students and stores them in a structured format to create a training dataset. The dataset is a crucial component for training the machine learning model used in face recognition.

2) Training the Classifiers: OpenCV enables the creation of XML filles to store features extracted from datasets using the Face Recognizer class. The stored images are imported, converted to grey scale, and saved with IDs in two lists with same indexes. Face Recognizer objects are created using face recognizer class. Each recognizer can take in parameters that are described below: cv2.face.createLBPHFaceRecognizer() 1. The radius from the center pixel to build the local binary pattern. 2. The number of sample points to build the pattern having a considerable number will slow down the computer. 3. The number of cells to be created in X axis and Y axis. 4. A threshold value like Eigenface and Fisher face. if the threshold is passed the object will return - 1Recogniser objects are created and images are imported, resized, converted into NumPy arrays, and stored in a vector. The ID of the image is gathered from splitting the file name, and stored in another vector. By using Face Recognizer. train (NumPy Image, ID) objects are trained. It must be noted that resizing the images were required only for Eigenface and Fisher face, not for LBPH. In the next step, the configuration model is saved as a XML file.

3) Face Detection: First stage was creating a face detection system using Haar-cascades. Our project uses OpenCV has a set of Haar-cascades although training is required for creating new Haar cascades. To obtain stable face detection we use face cascades which alone can cause random objects to be identified and eye cascades were also incorporated. Classi er class is used to create classifier objects through the cv2.CascadeClassifier() and loading the respective XML les. A camera object is created using the cv2.VideoCapture() to capture images. By utilization of CascadeClassifier.detectMultiScale() object of various sizes are matched and location is returned. Using this location data, the face is cropped for further verification. On the other hand, eye cascade is used to verify there are two eyes in the cropped face. If satisfied a marker is placed around the face to illustrate a face is detected in that particular location.

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4) Face Recognition: Face recognizer object is created using the desired parameters. Face detector is used to detect faces in the image, cropped and transferred to be recognized. This uses the same technique used for the image capture application. For each face detected, a prediction is made through FaceRecognizer.predict() which returns the ID of the class and confidence. The same process is followed for all algorithms and if the confidence his higher than the set threshold, ID is -1. Finally, names from the text with IDs are used to display the name and confidence on the screen. In case if the ID is-1 the application will print unknown face without the confidence level.

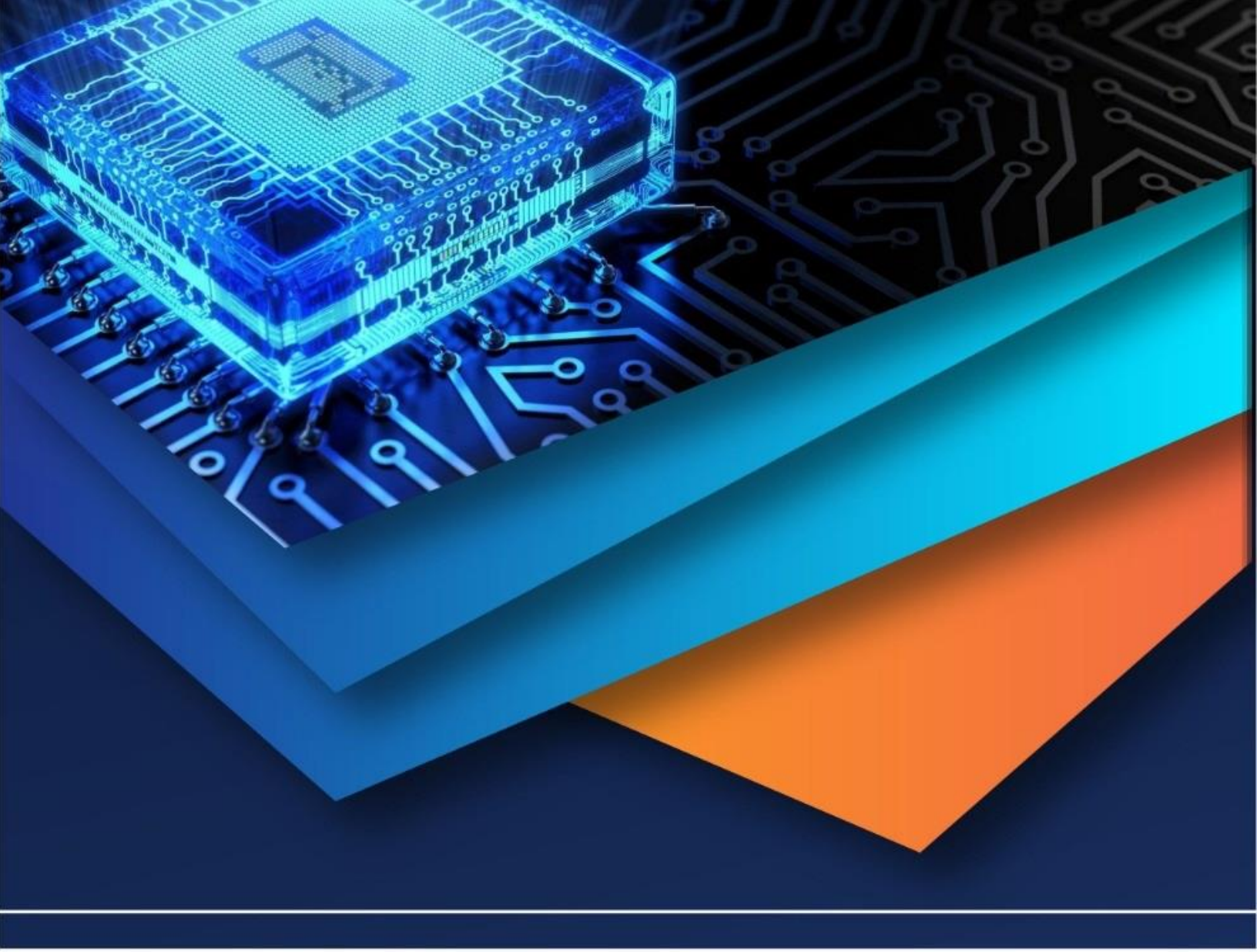
V. CONCLUSION

This paper introduces a facial recognition system to address the inefficiencies of attendance tracking. With its accuracy, efficiency, and digital accessibility, it has the potential to transform attendance management across educational institutions. The system has used Open CV face recognition method accessible for managing attendance. The system is implemented using the Haar- cascade and LBPH algorithm. LBPH surpasses other algorithms by confidence factor of 2-5 also has least noise interference. The implementation of the A Real Time Facial Recognition and Tracking System for Personnel Presence portrays the existence of an agreement between the appropriate recognition rate and the threshold value. Therefore, LBPH is considered the most authentic and competent face recognition algorithm found in Open CV for the face recognition. A real-time face recognition attendance system is a powerful tool that simplifies attendance management with accuracy and efficiency. To succeed, organizations must prioritize data protection, adapt to evolving regulations, and ensure responsible use. When thoughtfully implemented, this system streamlines attendance processes, enhancing overall operational efficiency.

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