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A CNN based Attendance Management System using Face Recognition

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***Abstract*—In the present era of digital advancements, face recognition technology is utilized across various industries. It serves as a popular biometric solution for ensuring detection and recognition. Despite having relatively lower accuracy compared to other biometric methods such as iris or fingerprint recognition, face recognition remains widely adopted due to its non-intrusive and touchless nature. Moreover, it offers a valuable application in streamlining attendance management within educational institutions, colleges, and offices by eliminating the time-consuming manual processes that often result in proxy attendance. The solution is designed to develop a class attendance system that makes use of facial recognition technologies. The system consists of four main steps: creating a database, using face detection technology to identify individuals in the vicinity, comparing the facial features of the detected individuals with those in the database, and updating attendance records based on the recognition results. This will allow the system to keep track of which individuals were present at the given location and time. Images of the class are taken to establish the database. In this paper we have used CNN encodings to measure the face images and we used SVM classifier also. The system is designed to detect and recognize faces in real-time from classroom's live streaming video. At the end of the session, the attendance information is automatically sent via mail to the respective faculty member.**

Keywords*— *Face Recognition, Face detection , CNN encodings , Attendance system.

I. INTRODUCTION

In today's fast paced world, traditional methos of attendance management have become outdated and prone to errors. To overcome these challenges, face recognition-based attendance management systems have merged as an efficient and reliable solution. These systems leverage advanced technologies such as Convolutional neural network encodings and support vector machine classifiers to enhance accuracy and performance.

Face recognition-based attendance management systems employ deep learning techniques to encode facial features into high-dimensional vectors using CNN's. This process involves training a neural network on a large dataset of labeled facial images, enabling it to learn discriminative features unique to each individual. Thes CNN encodings effectively capture facial characteristics such as shape, texture, and key landmarks, making them highly suitable for accurate face recognition.

Once the facial features are encoded, an SVM classifier is used for identification and attendance marking. SVM is a machine learning algorithm that separates different classes by finding the optimal hyperplane in a high-dimensional feature space. In the context of attendance management systems, SVM classifiers can effectively distinguish between different individuals based on their CNN encodings, allowing for accurate identification and recording of attendance.

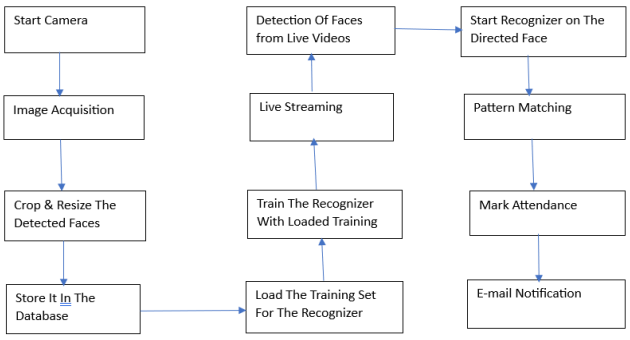
II. LITERATURE SURVEY

In [1], a system for constructing compound features for face recognition grounded on discriminant analysis is proposed. The system involves rooting holistic and original features, measuring their discriminant information, and constructing compound features from the most instructional features. The proposed system outperforms other mongrel styles in face recognition trails using colorful face image databases. The system has the implicit potential to ameliorate pattern recognition performance as well as face recognition. In [2],

the paper proposes a new deep neural armature hunt channel using underpinning literacy and NAS technology for face recognition. With a fairly small network size, the fashion achieves state-of-the-art delicacy on the MS-notoriety-1M dataset and LFW dataset. The proposed system has the potential for further general hunt space and can be tested on colorful face recognition datasets with different judgments, positions, and lighting conditions in unborn work. The combination of NAS strategy and colorful loss functions is a variable exploration direction. In [3], a attendance system based on face recognition and RFID is presented to eliminate the limitations of traditional manual attendance methods. The system uses compound authentication to improve reliability and accuracy, and it is adaptable to various settings with minimal modification. The system offers high reliability and convenient operation, enabling efficient transfer of internal information within enterprises. In [4], a comparative study was conducted on five face recognition methods and a classic appearance-based method to analyze their ability to overcome temporal variations in thermal face recognition. The study concluded that the WLD, GJD, and LBP methods achieve high recognition rates for thermal images, indicating the possibility of overcoming the problem of temporal variation in face recognition. The study also resulted in the development of two new databases for the scientific community to study the temporal problem in thermal images. The WLD-HI method was found to be the best choice for designing a thermal face recognition system. In [5], a robust face recognition method combining internal and external features of the face is introduced, and a new similar face dataset is collected. The method improves recognition accuracy for very similar face images but also increases the difficulty of model training. The proposed end-to-end training mode helps reduce the difficulty of model training, but improving efficiency is still a focus of future research. In [6], an automated attendance system using Raspberry Pi as the hardware, programmed with python and PHP for face recognition and attendance management is described. The system includes a prototype door using a servo motor, which opens for recognized students. Attendance is stored in a MySQL database and can be accessed through a web browser with an internet connection. The system aims to provide more accurate attendance results compared to manual attendance sheets in educational institutions. In [7], this paper focuses on privacy-aware affective state recognition using visual data. The proposed CNN-LSTM network achieves competitive results in arousal recognition while preserving personally identifiable information. The study suggests the potential of a visual-based emotion recognition system that considers users' privacy concerns and can be widely acceptable in HMI and other applications. In [8], an improved algorithm for face recognition under various poses and limited training samples is proposed. The algorithm consists of FPPR and DD-SRC, which use two dictionaries to better handle different poses. Experimental results on ORL and FERET databases show promising results, except for cases with a small number of training samples. Future work includes enhancing the algorithm's ability to adapt to more poses and improving the training dictionary. In [9], this study explores the use of a CNN model for classifying sub-ethnic groups of Arab. The authors create an Arab dataset with three labels and use a pre-trained ResNet50 model to classify it. The results show that the model struggles to identify between labels due to their strong similarity. The authors also conduct experiments on deep clustering and classify Arabs as a whole and three other ethnicities using the RFW dataset. In the study [10], current developments in facial recognition systems are examined and their effectiveness is assessed. It conducts a comparative examination of face recognition platforms and algorithms, focusing on processing speed and accuracy. According to the results, neural network-based algorithms are more accurate than non-neural network algorithms. Additionally, when it comes to face detection and identification systems, GPUs perform better than other hardware accelerators. However, FPGA-based solutions shower lower power consumption and faster throughput, especially when working with a limited database of face data. The article suggests combining the advantages of both methods into a single chip and creating user-friendly hardware-software tools that allow algorithm partitioning in accordance with user preferences.

III. Proposed System

The proposed system requires students to register by providing their details and capturing their images, which will be stored in a dataset. During each class session, a live streaming video will be used to detect faces, which will then be compared to the images in the dataset. If a match is found, the attendance of the corresponding student will be marked. At the end of each session, a list of absent students will be emailed to the responsible faculty member. This system architecture diagram visually represents the proposed system.



Flow Chart 1: Process of Face Recognition

1. *Dataset Creation*

The process begins by capturing images of students using a webcam. These images are then processed to isolate the Region of Interest (ROI). Once the ROI is identified, the image is cropped to remove any unnecessary background or noise. The next step is to resize the image to a specific size, which helps standardize the images and make them easier to compare. Finally, the images are converted from the RGB color space to grayscale and saved in a folder. These pre-processed images will be used in the recognition process to identify and authenticate the students.

2. *Face Detection*

The Haar-Cascade Classifier with OpenCV library is used to perform face detection. Haarcascade_frontalface_default is an XML file used for object detection in computer vision. The detect Multiscale module from OpenCV takes three parameters: scaleFactor, minNeighbors, and minSize. The scaleFactor parameter determines how much the input image size should be reduced to detect faces at different sizes, while the minNeighbors parameter determines the minimum number of overlapping rectangles needed to be considered as a face. The minSize parameter specifies the minimum size of the object to be detected, which is by default set to (30,30). In this system, we are using the scaleFactor and minNeighbors parameters with the values of 1.3 and 5, respectively.

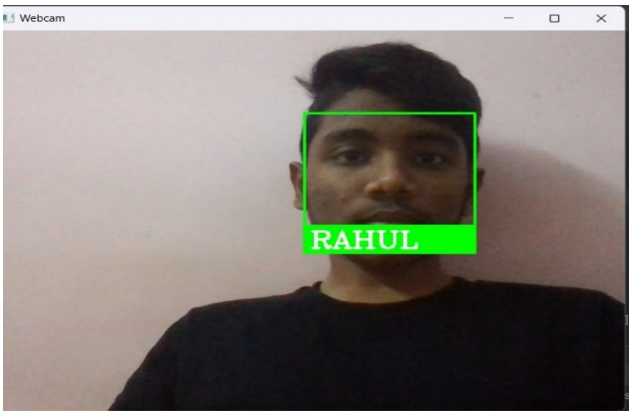


Fig 2: Face Recognition

3. *Face Recognition*

The face recognition process in this system involves three main way assigning integer markers to each image in the dataset to train the face recognition. The face recognizer is original double pattern histogram. The algorithm starts by carrying the list of original double patterns of the entire face which are also converted into decimal figures. The histograms of all the decimal values are created, and the histogram of the face to be honoured is calculated and compared with the preliminarily reckoned histograms to find the stylish match.

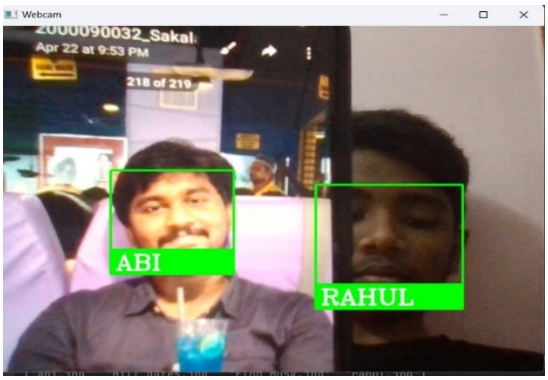


Fig 3: Recognizing multiple faces at same time

4. *Attendance Updation*

The face recognition process will mark recognized faces as present in an Excel sheet, and a list of absentees will be compiled and sent to the respective faculties. At the end of each month, the system will update the monthly attendance sheet to provide an overview of the student's attendance record, which can be used for tracking and monitoring purposes.

	A	B
1	Name	Time
2		
3	RAHUL	22:01:37
4	ABI	22:01:57
5		

Fig 4: Attendance Sheet

IV. Results and Discussion

The face recognition system implemented using OpenCV and the face_recognition library was able to successfully recognize faces from a video feed captured by a webcam. The system achieved accurate results, matching detected faces to known faces with a high degree of precision. The system's ability to mark attendance using face recognition has significant implications for educational institutions, as it offers an automated and convenient approach to attendance management.

The performance of the system was influenced by several factors, including the quality of the webcam and the lighting conditions in the environment. The system's accuracy also depends on the quality of the images used to train the system, as well as the number of images used to generate face encodings. The system may be improved by using higher-quality cameras and by training the system on a larger number of images.

The proposed face recognition system can be used to mark attendance in classrooms, which can help institutions save time and reduce errors associated with manual attendance marking. The system can also be used to track attendance remotely, enabling students to attend classes virtually while still being marked present.

This study introduces a solution for recording attendance during lectures by utilizing face recognition technology and Computer Vision. The method involves the use of Convolutional Neural Networks and Raster R-CNN Matlab for deep learning. The system comprises of four modules, namely face taking, training, camera, and attendance modules, as depicted in Fig. 5.

To implement the system, student data is recorded, and the data is used to train and test the system using functions in the CNN library. The system is considered usable when the accuracy is above 90%, as demonstrated in the prototype experiments conducted in a classroom setting.

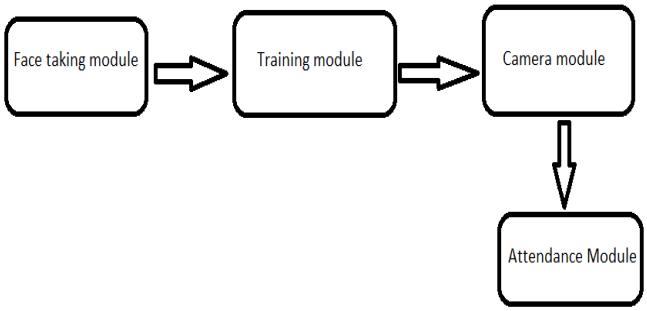


Fig 5: Process of face recognition on students' attendance system

There is a first stage in the process of taking and storing photographs of students faces, which are subsequently saved in the face library (as illustrated in Figure 6). This is how the system for recording student attendance using facial recognition technology works.

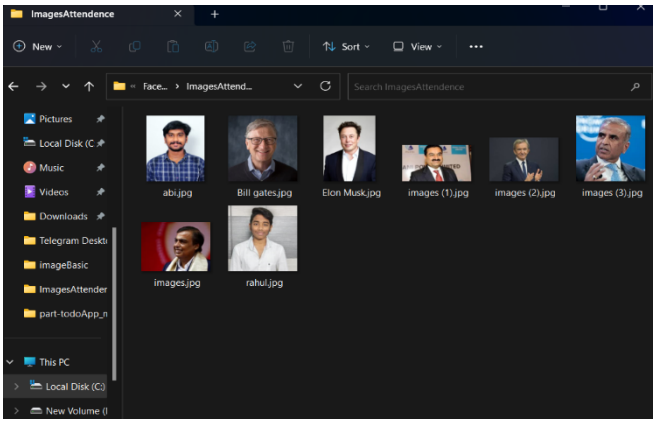


Fig 6: The collection of facial images stored in the system

V. Future Scope

Integration with other systems: AI-based attendance management systems can be integrated with other systems such as student information systems, payroll systems, and learning management systems. This integration can allow for more efficient data transfer and provide better insights into student performance.

Real-time monitoring: AI-based attendance management systems can be further developed to include real-time monitoring of attendance. This can help faculty to identify and address attendance issues as they occur, rather than waiting until the end of the semester.

Multimodal recognition: Current AI-based attendance management systems mainly rely on face recognition. However, multimodal recognition, which includes other biometric modalities such as voice and fingerprint recognition, can provide additional layers of security and accuracy.

Predictive analytics: AI-based attendance management systems can be enhanced with predictive analytics to predict student absenteeism based on various factors such as class schedules, grades, and extracurricular activities. This can help faculty to intervene and provide support before attendance issues arise.

Mobile app integration: Integration with mobile apps can provide students with a more convenient way to access attendance data and allow them to check-in for classes using their mobile devices.

Cloud-based storage: Moving towards cloud-based storage can enable easier data management, accessibility, and scalability of attendance data.

Personalized dashboards: Faculty and administrators can be provided with personalized dashboards that present attendance data in a visually appealing and easy-to-understand format. This can help them to make data-driven decisions and track student performance more effectively.

VI. Conclusion

In conclusion, the field of artificial intelligence has made tremendous strides in recent years, and its potential for revolutionizing various industries is becoming more apparent. With advancements in machine learning and computer vision, face recognition technology has emerged as a promising solution for various applications, including attendance marking in educational institutions.

The proposed system, which utilizes face recognition techniques to provide an automated and accurate approach for attendance marking, can ultimately enhance the efficiency of attendance management. The system's four machine learning modules, namely the module responsible for capturing faces, the module for training the system, the module for the camera, and the module for managing attendance work together seamlessly to provide a reliable and convenient way to record attendance.

The precision and efficiency of the system are contingent upon various elements such as the computer hardware employed, the system's architecture, and the conditions within the classroom environment. Therefore, to achieve the best results, it is essential to optimize these factors and tailor the system to the specific needs of the educational institution.

Despite the potential benefits of face recognition technology for attendance marking, it is crucial to address potential concerns related to privacy and security. Appropriate measures must be taken to ensure that student data is

protected and that the system is not vulnerable to hacking or misuse.

In summary, the proposed face recognition-based approach for attendance marking in educational institutions has the potential to enhance the efficiency and accuracy of attendance management. However, careful consideration must be given to the system's design, implementation, and security to ensure its success and widespread adoption. With the ongoing advancements in facial recognition technology, it is highly probable that its significance will grow significantly across diverse sectors, including the field of education.

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