MTCNN BASED AUTOMATIC ATTENDANCE SYSTEM USING FACE RECOGNITION

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Abstract - Maintaining the attendance register amidst daily events can be challenging, as the current practice of calling out each student's name is time-consuming and susceptible to fraud or proxy. To address this issue, a new approach based on facial recognition has been developed to secure students' attendance records. The attendance records are organized by subject and already stored by the administrator. The proposed method captures snapshots at the designated subject-specific times, performs face detection and recognition on the images, and identifies the recognized students as present, updating their attendance records with the appropriate subject ID and timestamp. The objective of this study is to suggest an automated attendance system using facial recognition technology, utilizing the MTCNN(Multi-task Cascaded Convolutional Neural Networks) method for face detection and the CNN method for facial image recognition. Additionally, Face Net and SVM are used for feature extraction and classification, respectively.

Key Words: Attendance, Face Recognition, MTCNN, CNN, Face Net.

1.INTRODUCTION

The traditional manual method of calling out student names is a time-intensive process, whereas the RFID card system assigns a unique card to each student, which holds their identity information, but it poses a risk of card misplacement or unauthorized use, resulting in inaccurate attendance records. Furthermore, other biometric techniques such as fingerprint, iris, or voice recognition have their limitations and are not entirely accurate.

For organizations to effectively manage attendance records, they require a robust and dependable system. Our proposed solution is to automate the attendance system by utilizing face recognition technology. Given that the face is a crucial aspect of human interactions, carrying essential information about an individual, we have developed a real-time system that can recognize frontal faces of students from images captured within the classroom, streamlining the attendance process. The ability to recognize individuals from their facial features is an innate ability that all humans possess, and our system leverages this feature to identify faces.

Implementing facial recognition for attendance tracking is a smart strategy for managing attendance. Compared to other methods, facial recognition is a more accurate and faster method, reducing the possibility of attendance fraud or proxy. Facial recognition also provides a non-invasive means of identification where the person being identified does not have to take any active measures to verify their identity. To achieve this, we use the MTCNN technique for face detection and feature extraction, followed by face recognition. The proposed approach involves five stages, including data preparation for training, using MTCNN for face detection from the data, embedding each face using the Face Net Keras model, classifying feature vectors using SVM, and finally conducting face recognition.

2. LITERATURE REVIEW

2.1 Automated Attendance Management System Based on Face Recognition Algorithms

This study presents a proposed automated attendance management system that utilizes face detection and recognition algorithms to automatically identify students as they enter the classroom and mark their attendance accordingly. The paper provides a detailed description of the system's architecture and the algorithms employed at each stage. Additionally, different real-time scenarios are considered to assess the performance of various face recognition systems, while also proposing techniques to address potential security threats like spoofing. By replacing traditional attendance tracking methods, this system saves time and enhances student monitoring capabilities.

2.2 FaceTime-Deep Learning Based Face Recognition Attendance System

This paper provides a detailed description of the entire process involved in developing a face recognition model. The model utilizes advanced techniques, including CNN cascade for face detection and CNN for generating face embeddings, to achieve the primary objective of practical application in face recognition tasks. Despite the fact that CNNs deliver the best results with larger datasets, which may not be feasible in a production environment, this research aimed to apply these methods to smaller datasets. To address this challenge, a new approach for image augmentation in face recognition tasks was proposed. The suggested facial recognition model achieved an accuracy of 95.02% on a limited dataset comprising authentic face images of employees in a real-time setting. The model can be incorporated into another system with or without minor modifications as a primary or supporting component for monitoring purposes.

2.3 Automatic Student Attendance System Using Face Recognition

This paper presents an automated student attendance system that utilizes unique face detection and recognition techniques to automatically identify students as they enter the classroom and mark their attendance. The system focuses on specific features such as the face, eye, and nose of humans, and various real-time scenarios are considered to evaluate the performance of different face recognition systems. The paper also proposes techniques to handle security concerns such as spoofing and proxy attendance. By enhancing student tracking capabilities compared to traditional or current systems, this system saves time and promotes efficient attendance management.

3.METHODOLOGY

This section provides a detailed explanation of the process used to develop the attendance system. The development procedure can be broken down into several modules.

3.1 Input Image:

The primary input for the model is an image, which can be in different formats, including JPEG, PNG, and BMP.

3.2 Image pre-processing:

Preprocessing is a crucial step in preparing images for model training and inference. It involves formatting the images to enhance the accuracy and reduce the complexity of the model. Preprocessing techniques may include adjusting orientation, correcting colors, and resizing images to a suitable size.

3.3 Face Detection:

The first step of MTCNN involves detecting faces in the input image. This is achieved by using a cascade of neural networks, including P-Net, R-Net, and O-Net. Each network is responsible for progressively refining the face detection process, leading to higher accuracy. The outcome of the face detection step is the identification of the bounding box coordinates of the detected faces in the input image.

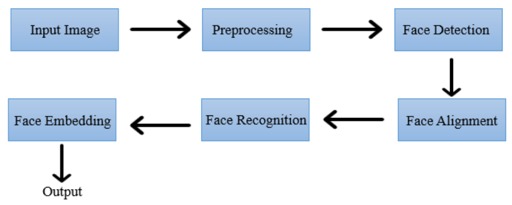


Fig.1 Flow Chart

3.4 Face Alignment:

The next step after face detection in MTCNN involves aligning the face region to a standard pose using the bounding box coordinates obtained in the previous step. This procedure, referred to as facial landmark detection, compensates for any head tilt, rotation, or scaling disparities that may exist in the input image, leading to an improvement in the final outcome accuracy of the subsequent face recognition step. The MTCNN architecture, including P-Net, R-Net, and O-Net, is utilized for efficient facial landmark detection.

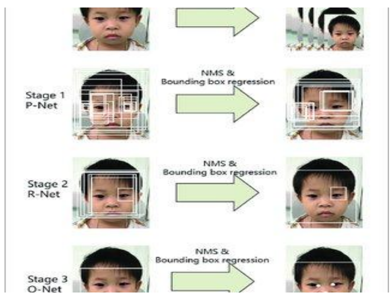


Fig.2 Using Neural Networks

3.5 Face Embedding:

Through the use of a deep neural network, the aligned facial area is converted into a compressed collection of attributes known as a "face descriptor" or "face representation". The encoded features encapsulate the unique characteristics of the face and can be compared with other face descriptors to determine if they correspond to the same person. The facial descriptor is, in essence, a concise representation of the face that can be utilized for precise and effective facial recognition.

3.6 Face Recognition:

Once the face descriptor is generated, it is compared to a pre-existing database of face descriptors to determine a match. This process involves using a similarity metric such as Euclidean distance or cosine similarity to measure the likeness between two face descriptors. If the calculated similarity falls below a set threshold, the faces are identified as belonging to the same person, and the system outputs the corresponding identity based on the database entry.

3.7 Proposed Application Algorithm:

i. Acquire an image of the individual

ii. Apply preprocessing techniques to improve the image quality

iii. Utilize detection algorithms to locate and extract facial features

iv. Align the facial landmarks and create a feature map

v. If in the enrollment phase:

- Save the characteristic map to the database

Else:

- Compare the feature map with those in the database for a match

vi. Record attendance by storing the result in the attendance sheet.

4.MODELLING AND ANALYSIS

Our method employs a feature map instead of the usual computer vision techniques that take numerous user images, leading to a remarkable improvement in precision. Our approach eliminates the common problems encountered in traditional methods such as recognition errors due to lighting, image quality, or spectacles.

Our composite model structure, which integrates MTCNN architecture (comprising P-Net, R-Net, and O-Net) as the foundation and a CNN structure in the head, significantly enhances accuracy and robustness. Additionally, our system provides the option to modify the confidence threshold for matching multiple facial features during recognition, thereby offering flexibility.

Workflow of MTCNN

The MTCNN is a sophisticated neural network structure that is utilized for recognizing and detecting faces, which involves a three-stage process consisting of P-Net, R-Net, and O-Net.

The initial phase in the architecture is the P-Net stage, which is tasked with producing potential face areas in an input image. P-Net is a completely convolutional network that utilizes a group of filters to create a set of candidate face regions and their associated confidence scores from the input image.

The R-Net phase, which is responsible for refining the initially detected face regions identified by P-Net, is the second stage of the architecture. Like P-Net, it is a fully convolutional network that takes the identified face regions as input and improves their accuracy by eliminating false positives and refining the precision of the bounding box.

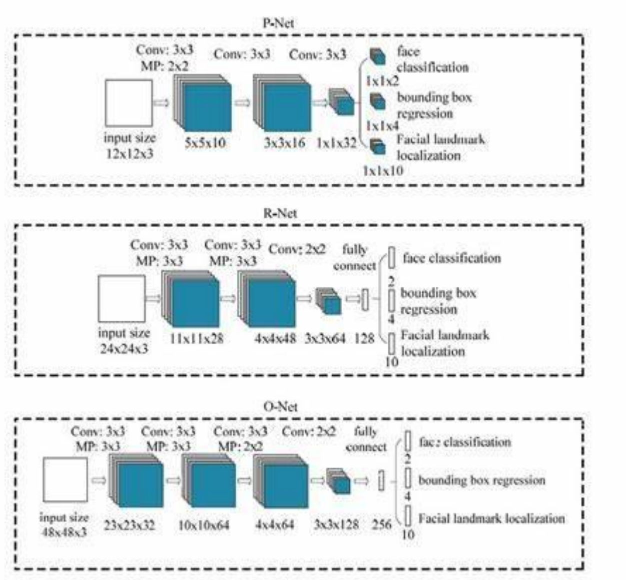


Fig.3 MTCNN Architecture

The last stage in the architecture is the O-Net phase, which is responsible for generating facial landmarks and further refining the bounding box. O-Net is a complex deep learning model that takes the refined candidate face regions from R-Net as input and recognizes crucial facial landmarks such as the corners of the eyes, nose, and mouth The MTCNN's three phases constitute a cascaded structure that iteratively improves the face detection process, leading to a more precise final outcome. The output of the MTCNN network is a collection of bounding boxes or other related applications.

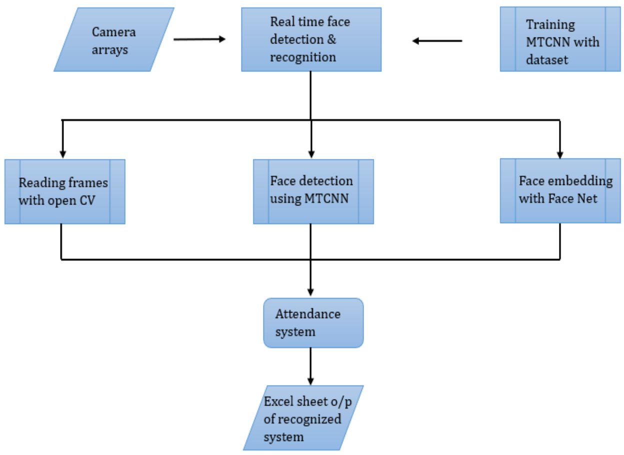


Fig.4 Block Diagram of Implementation

5. RESULTS AND DISCUSSION

5.1 User Interface of the system

This consists of the primary interface and several options that are available for both the user and the teacher to investigate.

5.2 Face Recognizer

The system matches the facial characteristics of the input image with those saved during the recording stage. Whenever a match is discovered, the associated name will be retrieved.

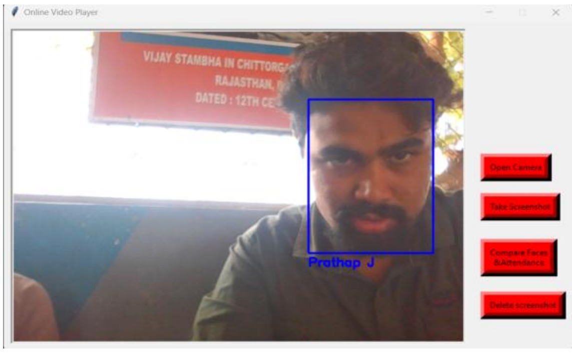
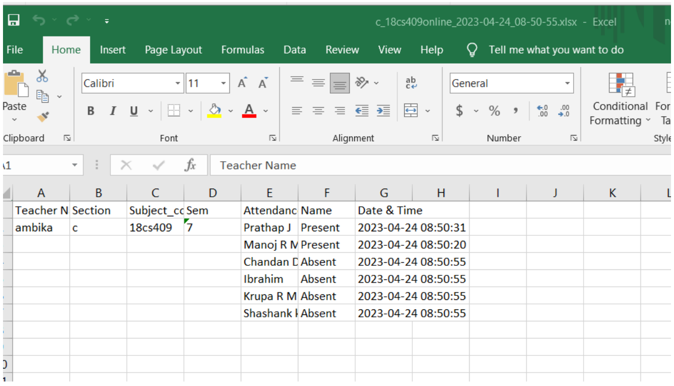


Fig.5 Face Recognizer with Single Student

Fig.6 Face Recognizer with Multiple Student

5.3 Attendance Sheet Creating & Marking

When the Compare faces & attendance button is clicked, a text file is produced in the Face recognizer directory. A new text file is generated for each new day to record attendance.



Teacher N	Section	Subject_cc	Sem	Attendanc	Name	Date & Time
ambika	c	18cs409	7	Prathap J	Present	2023-04-24 08:50:31
				Manoj R M	Present	2023-04-24 08:50:20
				Chandan D	Absent	2023-04-24 08:50:55
				Ibrahim	Absent	2023-04-24 08:50:55
				Krupa R M	Absent	2023-04-24 08:50:55
				Shashank I	Absent	2023-04-24 08:50:55

Fig.7 Attendance Register

6.CONCLUSION

Based on the research, we can infer that the suggested method utilizes facial recognition and detection technologies to develop a computerized attendance system for effective classroom management. The system facilitates attendance marking using facial identification by recognizing faces through a webcam and then updating attendance records for identified students.

The primary aim of this project is to capture video footage, convert it into individual frames, integrate it with a database to verify whether students are present or absent, and record real-time attendance to ensure precise records. By improving accuracy and speed, this Automated Classroom Attendance System can achieve high-precision real-time attendance, which is necessary for automated classroom evaluation. Therefore, this paper's key objective is to capture student videos, transform them into frames, compare them with the dataset to confirm their attendance, and mark attendance for each student individually to ensure accurate records.

7. REFERENCES

[1] "Automatic Attendance Management System Using Face Recognition" by Jumon Joseph, K.P.Zacharia, International Journal of Science and Research,2017.

[2] Face recognition based automated student attendance system using deep learning by P.C. Senthil Mahesh, Shashikala, Rudra Kumar, International Journal of Advanced Trends in Computer Science and Engineering 2020.

[3] "Class attendance management system using facial recognition" by Clyde Gomes, Sagar Chanchal, Tanmay Desai, Dipti Jadhav, International Conference on Automation, Computing and Communication 2020.

[4] " The Application of Adaptive Tolerance and Serialized Facial Feature Extraction to Automatic Attendance Systems" by Chun-Ling Lin & Yi-Huia Huang, International Conference on Innovative Computing and Communications; Springer: Berlin/Heidelberg, Germany,2021. [5] "Automated

attendance system with face recognition" by Akash Singh, Shreya Bhatt, Abhishek Gupta, International Journal of Engineering Applied Sciences and Technology 2021.

[6] "Automatic Student Attendance System Using Face Recognition" by Partha Chakraborty, Mahmooda Khatun, Chowdhury Shahriar Muzammil & Fahmida Islam, International Journal of Engineering & Advanced Technology 2020.

[7] "Attendance management using face recognition" by Sandhya Patidar, Riya Falle, Prajakta Kotha wade, Arati Pad ale, International Journal of Engineering Research & Technology 2021.