AUTOMATIC STUDENT ATTENDANCE MANAGEMENT SYSTEM USING FACIAL RECOGNITION

Name :
@lewisu.edu
Lewis University

***Abstract*—In this work, we present a fully automated attendance-taking system. Attendance taking in the classroom is a tedious task. Moreover, the job is time-consuming; as the number of student size increases, the complexity of taking attendance also increases. A fully automatic system can be used to take attendance to reduce the complexity of taking attendance. Earlier works on attendance taking include the classic name-calling method, taking signatures on paper. Both these methods are either prone to proxy or time-consuming. Other methods like RFID and fingerprinting are time-consuming. Each student has to go and place their thumb or scan their ID. Facial recognition can be used to make the system fully automatic. Facial recognition uses the facial features of people to identify and recognize people. Facial recognition has recently been used in many areas, like surveillance, facial recognition, facial expression detection, and many more. To make the attendance-taking task easier and less time-consuming, a system trained on the student's facial features can be used to mark attendance of students with a classroom photo given as input then the system detects and identifies a student whose features match with the image and generate a comma separated file with details of all the students who were detected in the photo. The facial features of the students are extracted using the trained facial feature detection and face encoding models.**

Keywords — CNN, Facial recognition, Feature extraction, Face Encoding.

I. INTRODUCTION

Early attendance-taking methods like signing on paper lead to the proxy marking of attendance, and calling names of students are less prone to proxy but time-consuming. In a class of typically 40 students, attendance consumes 10-15 mins on average in an hour class, which is around 20% of the class time. 20 percent is a lot. So, it is important to develop a system that is less time-consuming and less prone to proxy. It is also important that the students attend the classes regularly to prevent the risk of students failing the exam. We need a system that is prone to proxy and less time-consuming. Many automated attendance systems have been developed, like fingerprint attendance taking [1], RFID attendance taking systems, and Iris scanning systems. All the above methods are time-consuming. Each student must go to the scanner and record their biometrics to mark their attendance. Using the help of facial recognition, with a single picture of the entire class, every student can be identified, and it is less time-consuming. CNN has been used to extract the features of each student, and the face recognition module's face encoding has been used to encode the features of the students. Face encodings of each student have been stored in the face encodings along with the student's details.

We designed a fully automated system that can do tasks like adding new students to the class, taking attendance, generate a single CSV file with names and details of the students who were recognized from the image captured in the classroom.

II. RELATED WORK

There are many systems available out there. Many of the systems out there use students' biometrics like fingerprints, iris scans, and RFID. Our proposed system also uses facial recognition to mark the students' attendance. Pre-processing was performed on the image obtained from the classroom.

In [1], Basheer *et al.* developed a portable device with UI that can perform operations like adding new students into the classroom. Once a student is added to the database, then the student's finger is used to mark the attendance of the student. Once the students' attendance has been taken in the classroom, the device then synchronizes the data with the host's computer.

In [2], Shah *et al.* use IoT for the RFID attendance system. The system installed in the classroom uses the ID of the student and staff to read their data and stores the data in the database where all the data is stored. The attendance of the students can then be generated from the database.

In [3], Khatun *et al.* use iris images of the students to take attendance. Images of the student are taken with good quality, then the images are pre-processed using MATLAB; the eyes of the students are obtained and then stored in the system's database. Later, when attendance is taken, the iris of students is matched with the system's database, and the system compares with the database if the systems identify students.

In [4], Clyde Gomes *et al.* use the Haar Cascade algorithm to identify the students' individual faces and then obtain each student's features like eyes, nose, and ears. The area of Interest is obtained from the Haar Cascade algorithm after the pre-processing and cropping of the images of students, which helps identify the faces. Even though this system is foolproof, it is not time efficient.

In [5], Samiksha *et al.* built two systems using the Haar Cascade algorithm and the face recognition library. According to them, the Haar Cascade algorithm was

trained using positive and negative images. This algorithm was trained to detect objects. This algorithm is time efficient. This system uses the Local Binary Pattern (LBP) to compare the features of the images with the database. This method has many drawbacks, like the classifier can't detect faces on the z-axis and can only detect faces on the x and y-axis.

III. PROPOSED METHODOLOGY

Figure 1 shows the overall system architecture of the proposed system. The system takes inputs of each student's image for training; once training is complete, it can recognize multiple people from the webcam. The system performs a series of processes to mark the students' attendance. The series includes capturing images, detecting faces, cropping the area of interest(face), extracting the facial features, encoding the features, and then saving it in the database with details of the student.

3.1 Database Creation

When a student enrolls in the classroom, we must add the student to our database [11] to mark the student's attendance. We took a single picture of the student; the student's face is detected using the trained facial feature detection [10], and the area of interest (facial region) is cropped out of the image [8]. The facial features are extracted from the image, the extracted features are encoded using the face recognition module. Finally, the encoded facial features and details of the students are put into the database for recognition of the face while taking attendance.

3.2 Overview of Architecture

Figure 1 shows our proposed fully automatic face-recognition system architecture, which consists of six basic components of the system; capture an image of the classroom, detect faces in the images, crop out the detected faces from the picture, extract features from the image, encode the extracted image, compare the encoded image with the encoded images in the database, and if there is a near match found, then mark attendance for the

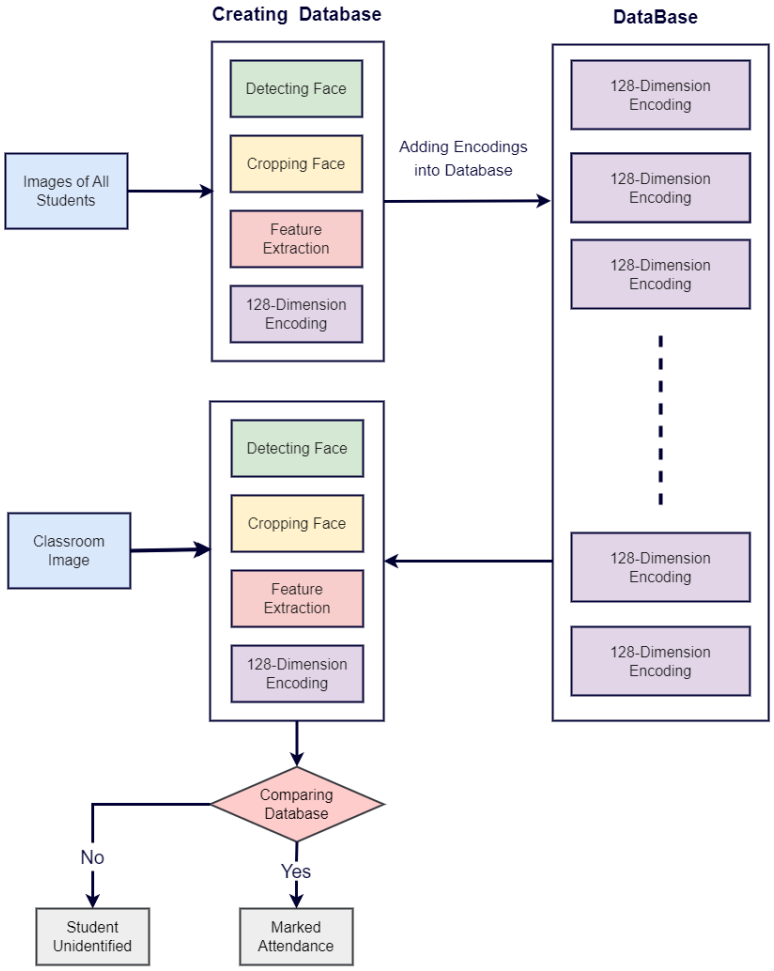
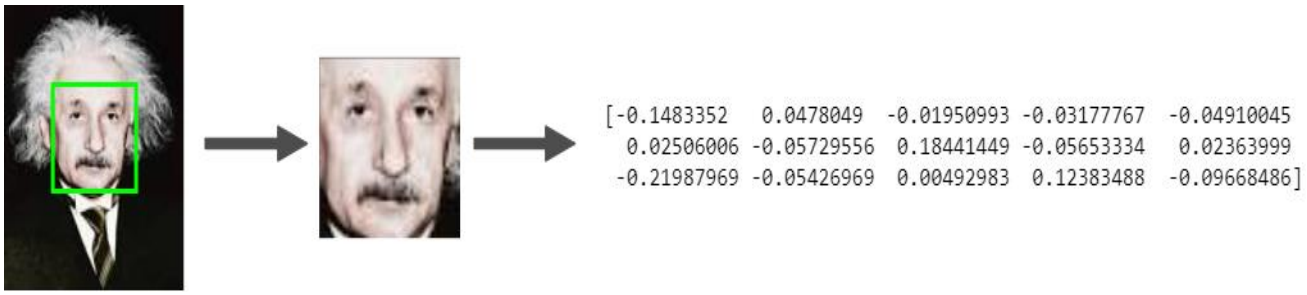


Fig 1. The architecture of the Proposed Model

student, if no match is found in the database, then the student is not enrolled in the class. The student can enroll in the classroom by adding the student to the system's database.

3.3 Image Acquisition

For the acquisition of the image, we attached high-definition cameras in the classroom [9] in a way the entire classroom can be covered. If the classroom is very



big, two or more cameras can also be used. The cameras stay on during the entire class continuously as students express different expressions, the system might not recognize students. As the system recognizes a student, then the attendance of the system is marked for that student. At the end of the class, faces that were matched with the encoded faces in the database, attendance is marked for those students with the time and date of recognition.

3.4 Face Detection & Cropping

Images that are obtained from the camera contain both the face and non-face region; it is important to crop out the unwanted area of the face. To crop out the unwanted area, first, we detected the face region. To detect students' faces from the classroom image, faces of students are detected in the images with the help of Davis King's pre-trained model for detecting faces with the help of facial features [7]. We only need the face region for better accuracy in recognition of the faces. Each face of a student detected in the classroom image is cropped such that the images are face-centered.

3.5 Feature Extraction & Encoding

In facial recognition, the extraction of features plays a vital role. Each student has unique facial features that help us differentiate one student from another. To obtain the features of each student, we have the pre-trained model. For each face detected from the image obtained from the camera, we have used facial recognition module built on the pre-trained model developed by Davis King on facial feature extraction [14][12]. The model extracts a feature of the face like skin color, skin texture, eye color, nose position, etc. [15]. Encoding of the facial features extracted is carried out using the ResNet model trained on thousands of human faces. Each face is encoded into an array of 128 features.

3.6 Face recognition & Attendance marking

When encoding is carried out, the encodings of the same person are very similar, and the encodings of two different people are far different. To compare the encoding of students obtained from the classroom image and the database, the Euclidean distance between the encodings is calculated, and the encoding with the least distance is used to recognize the person. Once the student is recognized from the database, attendance for that is marked [13], and a similar process is done for each face detected from the classroom image.

IV. REFERENCES

[1] Basheer, K. P. Mohamed, and C. V. Raghu. "Fingerprint attendance system for classroom needs." *2012 Annual IEEE India Conference (INDICON)* (2012): 433-438.

[2] S. N. Shah and A. Abuzneid, "IoT based smart attendance system (SAS) using RFID," IEEE Long Island Systems, Applications and Technology Conference (LISAT), 2019.

[3] A. Khatun, A.K.M. Fazlul Haque, S. Ahmed, and M. M. Rahman, "Design and implementation of Iris recognition-based attendance management system," 2nd Int'l Conf. on Electrical Engineering and Information & communication Technology (ICEEICT) 2015, Bangladesh.

[4] Gomes, Clyde, Sagar Chanchal, Tanmay Desai, and Dipti Jadhav. "Class attendance management system using facial recognition." In ITM Web of Conferences, vol. 32, p. 02001. EDP Sciences, 2020.

[5] Malhotra, Samiksha, et al. "Comparison between attendance system implemented through haar cascade classifier and face recognition library." IOP Conference Series: Materials Science and Engineering. Vol. 1022. No. 1. IOP Publishing, 2021.

[6] S. Dev and T. Patnaik, "Student Attendance System using Face Recognition," 2020 International Conference on Smart Electronics and Communication (ICOSEC), 2020, pp. 90-96, doi: 10.1109/ICOSEC49089.2020.9215441.

[7] Elias, Shamsul J., et al. "Face recognition attendance system using Local Binary Pattern (LBP)." Bulletin of Electrical Engineering and Informatics 8.1 (2019): 239-245.

[8] Kuang, Weidong, and Abhijit Baul. "A real-time attendance system using deep-learning face recognition." (2020).

[9] Surve, Mayur, et al. "Automatic attendance system using face recognition technique." International Journal of Recent Technology and Engineering 9.1 (2020): 2134-2138.

[10] Harikrishnan, J., et al. "Vision-face recognition attendance monitoring system for surveillance using deep learning technology and computer vision." 2019 international conference on vision towards emerging trends in communication and networking (ViTECoN). IEEE, 2019.

[11] Damale, Radhika C., and Bazeshree V. Pathak. "Face recognition based attendance system using machine learning algorithms." 2018 Second International Conference on Intelligent Computing and Control Systems (ICICCS). IEEE, 2018.

[12] Bhattacharya, Shubhobrata, et al. "Smart attendance monitoring system (SAMS): a face recognition based attendance system for classroom environment." 2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT). IEEE, 2018.

[13] Jadhav, Sharad R., Bhushan U. Joshi, and Aakash K. Jadhav. "Attendance System Using Face Recognition for Academic Education." Computer Networks and Inventive Communication Technologies. Springer, Singapore, 2021. 431-436.

[14] Setialana, Pradana, et al. "Intelligent Attendance System with Face Recognition using the Deep Convolutional Neural Network Method." *Journal of Physics: Conference Series*. Vol. 1737. No. 1. IOP Publishing, 2021.

[15] Khan, Sikandar, Adeel Akram, and Nighat Usman. "Real time automatic attendance system for face recognition using face API and OpenCV." *Wireless Personal Communications* 113.1 (2020): 469-480.