

# FACE RECOGNITION BASED ATTENDANCE SYSTEM USING MTCNN AND FACENET

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## ABSTRACT

The attendance system for training and placement in an institution is a tedious process. Taking attendance for various department student costs quite a time. The manual work included in the maintenance and management of the traditional attendance sheets is difficult. To avoid these problems, we propose a system that identify an individual by comparing live capture or digital image data with stored record for that person. The proposed system is a mobile application. It is used to live capture the student, then identify and recognize the individual and mark attendance. By using the mobile application the staff should capture the entire training hall to mark the attendance for that session. In proposed system Multi Task Cascaded Neural Network (MTCNN) algorithm is used to detect the faces and FaceNet algorithm is used to recognize the individual. After facial recognition process it updates and generates an attendance sheet and shares the report through mail to the respective departments and staff members. The outcome of the system is practical, reliable, and eliminate disturbance and time loss of traditional attendance system.

**Keywords:**Face detection, Face Recognition, MTCNN, FaceNet, attendance, mobile application.

## I. INTRODUCTION

The Placement Cell endeavours to become a link between the job seekers (student) and job providers (companies/corporate by building up their capacity and networking with Industries. In order to achieve its placement objectives, the Training Cell will organize various training programmes, Guest lectures, seminars, workshops, internship and other allied activities in addition to academic/non-academic activities for ensuring employability of its students. Attendance plays a pivotal role in determining performance of students during placement training. However, students generally have the phenomenon of skipping classes or even substituting classes, which lead to poor training, seriously affecting the improvement of students' professional level. In every placement or training event there are about more than hundred students are taking part. Manual maintenance of attendance in such event for each and every hour is a tedious task. Therefore we implement an effective system which will mark the attendance of students automatically. Some of the reasons why traditional attendance system is inefficient are it consumes much time and energy, manual errors may occur, false attendance and proxies are also possible.

To resolve the problems faced by traditional method, many attendance management systems have been introduced in recent years. As technology took its shape, techniques like RFID systems, fingerprint systems, wi-fi based systems, bluetooth based systems, mobile and web application based systems evolved eventually. However, most of these systems have limitations in portability, accessibility, authenticity or cost. So an endeavour to overcome the shortcomings of the respective systems leads to the development of a smart attendance system based on face recognition using deep learning algorithms. Face recognition technique is the most efficient technique for identification of people. Unlike other biometric and non-biometric means of attendance system, face recognition technology has its unique advantages.

The process of our proposed system is divided into various steps, but the important steps are detection of face and recognition of face. The beginning process of the system is training phase. The images of all the students must be captured and stored in the training dataset. The next phase is the testing phase in which we use the system, to mark the attendance of the students. To mark the attendance of students, the respective staff should scan the students using the mobile application. While using the application the tablet/mobile camera automatically live captures the students. The system will detect the faces from the live capture and compare it with the training dataset. Then mark the attendance and generate the report. In our proposed system, Multi Task Cascaded Neural Network (MTCNN) algorithm is used for face detection. Then the detected faces are cropped and resized and stored as a testing dataset. In the area of face recognition, Facebook proposed DeepFace, a face recognition network based on deep learning, in 2014. In DeepFace face recognition was performed by using deep convolutional neural networks and large-scale face image datasets. It achieved 97.35% on LFW dataset. The performance is comparable to artificial recognition. The VGGNet network achieves 98.95% accuracy with a deep network structure and a large data of images. In 2015, Google proposed FaceNet, which achieved an accuracy of 99.63%. FaceNet uses the triple loss function and adds an embedded layer extraction feature in the network. The proposed system uses FaceNet because of its high accuracy.

## II. LITERATURE SURVEY

Shreyak Sawhney et al. [1], proposed an automated attendance management system that consists of two databases, a student database, and an attendance database. For the accomplishment of marking attendance, this system will have a high-definition camera installed outside the classroom. Students will avail the access to enter the classroom, by scanning their faces in that camera. Another camera will be installed inside the classroom in such a way that every student in the class will be visible to the lens of the camera. Facial detection and recognition algorithms will be applied to both the cameras to analyze the faces and mark their attendance accordingly. This system uses Viola and Jones algorithm for face detection and Principal Component Analysis for face recognition. This system is aimed at providing a significant level of security and also assists in overcoming the chances of proxies and fake attendance.

Nashwan Adnan Othman et al. [2], proposed a system with the main objective of prohibition of fake attempts in the exam hall, which is based on face recognition. There is a face database that can be used for finding fake attendance during examination. Sometimes someone on behalf of his/her attendance will send someone else with that name to do the test, this problem is solved in this system. While the students entering the exam hall for examination, they will be investigated properly before doing their tasks. Meanwhile, when an anonymous student enters the hall of exam, directly this smart system will alert and emit notifications and an anonymous picture will be sent to the teacher's smartphone, which is based on Internet of Things (IOT) and the system uses Haar cascade classifier for face detection. The suggested system is exact fast and has low computational cost.

Kailai Sun et al. [3], proposed a system that integrates the attendance and security functions and fuses video image processing, deep learning, and face recognition to design an intelligent attendance and security system. It proposes a sliding average method to identify persons' identities. The experimental results verify the effectiveness of their method. The false reject rate (FRR) in this system reaches 0.51%, the false accept rate (FAR) reaches 2.52%, and the correct identification rate reaches 98.85%. The system uses MTCNN for face detection and AlexNet for recognition. The system can be applied to some video surveillance areas, with advantages of non intrusive, passive attendance and multiple persons attendance at the same time.

Nusrat Mubin Ara et al. [4], proposed a system uses Convolutional Neural Networks (CNN) to generate a low dimensional representation called embeddings. Then those embeddings are

used to classify the person's facial image. This system can be used to develop different types of applications like student attendance system, building security etc.

Zhao Pei et al. [5], proposed a more conveniently method of attendance statistics, which achieved through the Convolutional Neural Network (CNN). The traditional method of face recognition like Eigenface is sensitive to lighting, noise, gestures, expressions etc. Hence, they utilize CNN to implement face recognition, in order to reduce the effect of environmental change. Using the method, teachers only need to take a picture which contains all the students who attend the class, and then upload onto the system the student's attendance records will be processed by the technology of face detection and face recognition. This method not only solves the problem of time consuming and prone to errors, but also makes the attendance records are easier to preserve.

Harikrishnan J et al. [6], proposed a system which has 4 main phases for the vision attendance system - Face Detection and its respective gathering of data, Training the recognizer, Facial Recognition and Attendance Management in Excel. The system used Haar cascade classifiers and Local Binary Patterns Histograms (LBPH) for face detection and recognition. The entire system can be run on a raspberry pi along with a surveillance camera which is the only requirements. The modularity of the system enables it to be implemented or applied in classrooms and lab facilities for real-time surveillance or regular attendance even under poor lighting conditions due to the Image Pre-processing techniques which are being used in the system. The system enables the user to store the data (attendance) automatically to the attendance server onboard and also online which saves time and is also user friendly.

Rong Fu et al. [7], proposed a university classroom automatic attendance system by integrating two deep learning algorithms MTCNN face detection and Center-Face face recognition. This system records three violations of classroom discipline for automatic attendance that is absence, lateness and leaving early. An attendance table about all students of the class is immediately recorded. This system identifies faces very fast and took 100 milliseconds to one frame and gives a high accuracy. This face recognition model has an accuracy rate of 98.87% and the true positive rate under 1/1000 the false positive rate is 93.7% on LFW.

Thida Nyein et al. [8], the main objective of the proposed system is to get a better accuracy for multi-face recognition by using the combination of FaceNet and Support Vector Machine (SVM). In this proposed system, feature extraction is done by using FaceNet by embedding 128 dimensions per face and SVM is used to classify the given training data with the extracted feature of FaceNet. In this system for face recognition, we have to do three steps: pre-processing, feature extraction and classification. By using python libraries (PIL and face\_recognition), the raw dataset of students' faces are pre-processed. FaceNet model is used for feature extraction. Features are extracted from pre-processed images. For classification (feature matching), support vector machine is used. This proposed approach is good enough for multi-face recognition with an accuracy of 99.6%. It is stated that this system better than VGG16 model on the same data-set.

Lin Zhi-heng et al. [9], proposed a classroom attendance system based on video face recognition technology. This system uses a camera installed in the classroom to obtain classroom video information. The video is first divided into a frame of static pictures, and from the pictures, several pictures with clear face and better light are selected for face recognition, and then the recognition results are aggregated and merged. This system mentions advantages like it saves time, it will not interfere with the classroom and it can improve students learning efficiency.

I. Poona et al. [10], proposed an attendance system based on face recognition that uses Deep Learning technique (Neural Networks) which identify the individuals based on stored Image data sets [Image Recognition]. These networks use features to classify images. This network learns the features itself during the training process without the human involvement. Smart Attendance Systems involves the face detection and analyzes the data accurately. This approach has the ability to solve the time consuming traditional method of attendance system and paves way for new advanced technologies.

### III. PROPOSED METHODOLOGY

The ultimate objective of the system is to improve and organize the training and placement attendance system. Reduce manual process errors by providing automated and reliable system. Increase privacy and security and eliminate false attendance and to provide attendance reports periodically. According to the proposed system the respective staff must scan the entire training hall using the mobile application. The system is broadly divided into two phases – training and testing phase. To develop the proposed system the steps to be followed are:

- Student registration
- Dataset Generation
- Face detection
- Face recognition
- Attendance marking

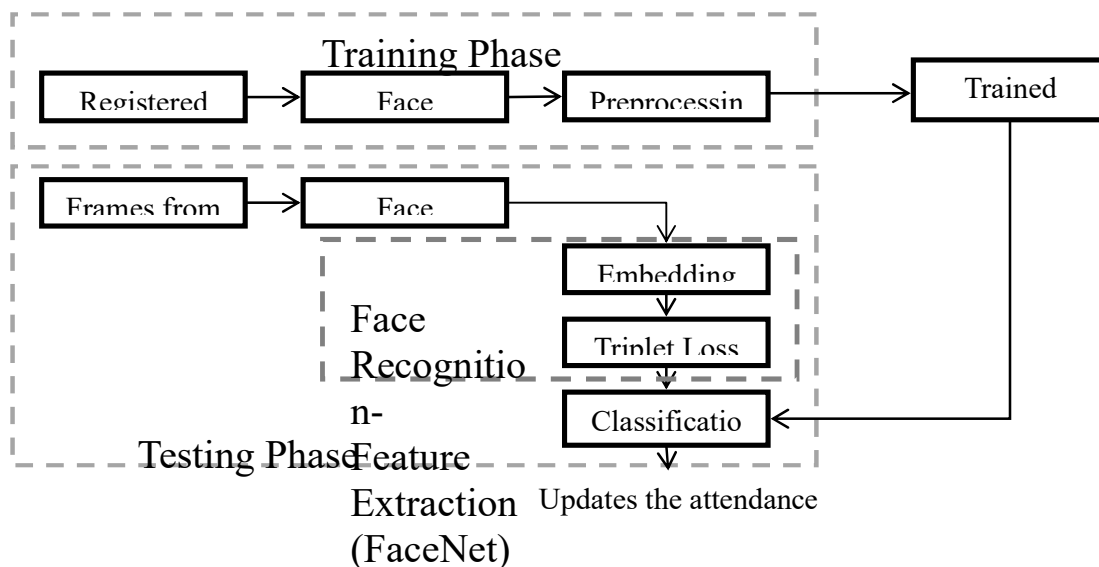


Figure 1: Block diagram of the system

#### A. Student Registration

Every student who belongs to the university must register for this process. General information like Name, Roll number, Year, Department and Section by using the application created for the system. Along with all this information student must upload their pictures based on our sample pictures. The sample will have six images – 2 straight facing, 2 right side facing and 2 left side facing images. These 6 images will be stored in a folder with their name/roll no. This step comes only under training phase.

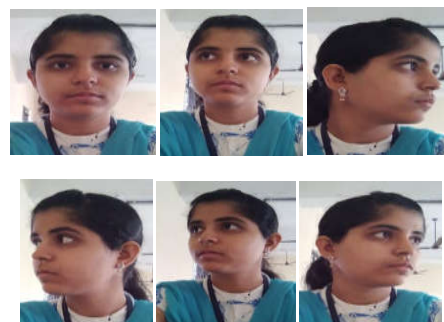


Figure 2: 6 Different angle input images

## B.Dataset Generation

The dataset generation plays an important role in the face recognition system. Based on the dataset the accuracy of the system will get increased. From the above mentioned six images the dataset will be generated. The operations like blurring, contrast/brightness, rotation will be applied for each of the six images. For each image the brightness will be changed with different values [e.g-0.7, 1.3, 1.5] and the blurring is also done with different degree/values [e.g-10, 15, 20]. This step comes under training phase.



Figure 3: Different Blurred images (values-10, 15, 20)



Figure 4: Different contrast images (values-0.7, 1.3, 1.5)

## C.Face Detection

Face detection is a process that can identify and locate the presence of human faces in digital photos and videos. The system uses Multi Task Cascade Neural Network (MTCNN). The network uses a cascade structure with three networks(P-Net, R-Net, O-Net). First the image is rescaled to a range of different sizes (called an image pyramid), Stage 1- the first model 'Proposal Network or P-Net' proposes candidate facial regions. Stage 2 -the second model 'Refine Network or R-Net' filters the bounding boxes. Stage 3 - the third model 'Output Network or O-Net' proposes facial landmarks. During training phase, after the detection of face from the student images, pre-processing is done. It is a process of improving the image features. The proposed system crop and resize the detected faces from the dataset images and then converts it into greyscale images. The processed images are stored in a new folder for each and every individual. In testing phase, the detected faces from the live capture are given as an input image to the FaceNet model for face recognition. Experimental results had always been demonstrated that while keeping the reliability of real-time performance, MTCNN consistently outperforms the sophisticated conventional methods across most of challenging benchmarks[19].

## D.Face Recognition

To implement facial recognition in this system, the FaceNet model is used. FaceNet is a deep neural network used for extracting features from an image of a person's face. FaceNet takes an image of the person's face as input and outputs a vector of 128 numbers which represent the most important features of a face which is called as an embedding. The FaceNet transforms the face image into 128-dimensional vectors and place it in the Euclidean space. FaceNet model thus created is trained for triplet loss to capture the similarities and differences on the image dataset provided. The embeddings with 128 dimensions, created by the model could be used to cluster faces in, a much effective and precise manner. Using FaceNet embeddings as feature vectors, functionalities such as face recognition, and verification could be implemented after creating the vector space[19]. In short, the distances for the similar images would be much closer than the random non similar images in the vector space. It also uses triplet loss function to minimize the distance between the anchor image and

the sample, if the sample is positive and signifies the same identity and also maximizes the distance between the anchor and sample, which signifies a different identity. The anchor image refers to the reference image that we took from the dataset. SVM classifier is used as a final step to classify a person based on a face embedding.

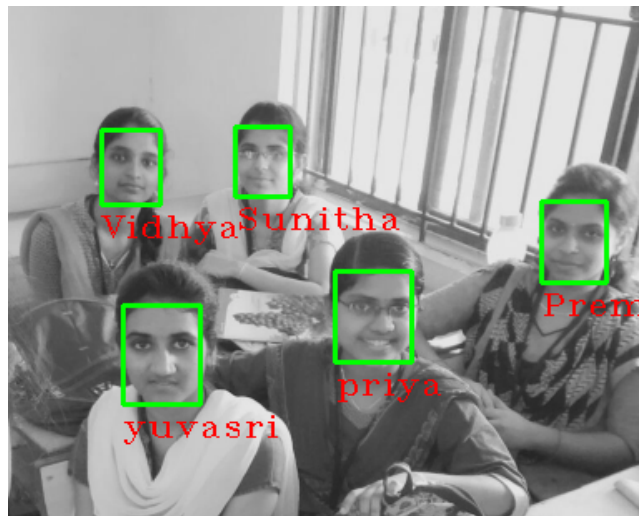


Figure 5: Face recognition output

**E.Attendance Marking**

After recognition and classification the attendance will be marked in the excel sheet respective to the training event and report will be sent to the placement cell and staffs through mail.

	A	B	C	D
1	Name	Attendance		
2	Sunitha Devi P	Present		
3	Vidhya Sri J	Present		
4	Priyanka D	Absent		
5	Prema G	Present		
6	Priyadharshini C	Present		
7	Yuvasri D	Present		
8	Yuvasree A	Absent		

Figure 6: Attendance sheet

**IV. CONCLUSION**

The proposed automated placement and training attendance system using face recognition is a great model for marking the attendance of students in training events. This system also assists in overcoming the chances of proxies and fake attendance. In the modern world, a large number of systems using biometrics are available. However, the facial recognition turns out to be a viable option because of its high accuracy along with minimum human intervention. This system is aimed at providing a significant level of security and reducing manual errors.

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