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Facial Recognition based Attendance Marking System

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ABSTRACT
The attendance system for training and placement in an institution is a tedious process. Taking attendance for various department students cost quite a time. In the traditional attendance system, the manual work included to maintain and manage the attendance sheets is difficult. To avoid these problems, we propose a system that recognizes theperson by matching the live capture digital image data with the recorded image of that person. The proposed work 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 this work,Multi-Task Cascaded Neural Network (MTCNN) is proposed to detect the faces and FaceNet algorithm is used to recognize the individual. After the 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 more reliable, more practical and introduces more easiness in the attendance marking systems.

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

I. INTRODUCTION

In the process of analyzing the students' performance the attendance acts as anessentialpartduring placement training. Moreover, students usually have the habit of avoiding classes or even switching classes, which causes a lack of training and it extremely affects the development of professional skills in students. In every placement or training event, there are about more than a hundred students are taking part. Manual maintenance of attendance in such event for every hour is a tedious task. So we develop an effective system to mark the students attendance routinely. 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 the traditional method, many attendance marking programs have been developedrecently. In recent years many techniques like RFIDs, fingerprint systems, wi-fi based systems, Bluetooth based systems, mobile and web application based systems evolved eventually.Nevertheless, these systems are having limitations in easy access, cost, and in efficiency. So to overcome the limitations of the previously developedmethods, face recognition based automatic attendance marking system is developed using deep learning algorithms.Face recognition technology is the most efficient method for the identification of people.Face recognition technology has its exclusivebenefits over other bio-metric techniques.

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The main two parts of our system are face detection and recognition. The beginning process of the system is the 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 the attendance of the students are marked.The students' attendance process is done by the respective staff by scanning 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 face recognition research, DeepFace was introduced by Facebook in the year 2014 which employed on convolutional neural network algorithm and produced 97.35%accuracy. The performance is comparable to artificial recognition. Google developed FaceNet in the year 2015, which scored 99.63% of accuracy.The triple loss function is used by the FaceNet.

II. LITERATURE SURVEY

ShreyakSawhney et al proposed an automated attendance management system that consists of two databases, a student database, and an attendance database [1]. This device would have a high definition camera mounted outside of the classroom to accomplish marking attendance. Students can take advantage of the access to the classroom by scanning in the camera their faces. Another camera will be mounted inside the classroom so that the camera's lens will be visible to any student in the class. This system uses the Viola and Jones algorithm for face detection and Principal Component Analysis for face recognition. This device is built to provide a considerable level of safety and also assists in overcoming the chances of proxies and fake attendance.

Nashwan Adnan Othman et al proposed a systembased on face recognition with the main objective of the prohibition of fake attempts in the examination halls [2]. Face database is used tofind fake attendance during the examination. Theremay be fake attendance given by someone, this problem is solved in this system. A proper examination of students' identity is done while the students are enteringthemfor examination. If any unknown student enters the exam hall, this new automatic face recognition system will send alertnotifications to the respective teacher's smartphone using the Internet of Things (IoT) and the system uses Haar cascade classifier for face detection. The suggested system is very fast, easy and low cost.

Kailai Sun et al proposed a system that incorporates the attendance and security functions and wraths, face recognition, image processing and deep learning to design an intelligent attendance and security system [3]. A sliding average method is proposed to identify the identity of each person. In this system 0.51% is the false reject rate, 2.52% is the false accept rate (FAR), and 98.85% is the correct identification rate. MTCNN for face detection and AlexNet for recognitionis used here. The system can be applied to some video surveillance areas, with the advantage of non-intrusiveattendance marking for multiple persons.

NusratMubin Ara et al. [4], proposed a system that 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.

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Zhao Pei et al proposed a more suitably method of attendance data, which attained through the Convolutional Neural Network (CNN). The old-style method of face recognition like Eigenfacehas the limits as sensitive to brightness, gestures, noise and expressions. It applies CNN to do face recognition, to cut the influence of environmental variations.In this method, the students face images are taken by the teachers and uploaded in the system for further processing.Face detection and recognition process are applied over the uploaded images and finally matches found between stored images and the uploaded images. Attendance will be marked according to the match results.

Harikrishnan J et al. [6], proposed a system which has fourdifferent functions for the vision based attendance system - Face Detection, training, Facial Recognition and Attendance Management in Excel. Haar cascade classifiers and Local Binary Patterns Histograms for face detection and recognition is used. A raspberry pi and a surveillance camera are the basic components to run the entire system. The system can perform well in poor lighting condition also because of the algorithms used.

Rong Fu et al proposed two deep learning algorithms to mark university class room attendance. The algorithms are MTCNN face detection and Center-Face face recognition [7]. This system includes additional features like to records absence, lateness and leaving early of the student. All students' attendance will be marked very quickly. This work achieved the accuracy of 92.98% and records the attendance in 100 milliseconds.

ThidaNyein et alproposed the system to acquireimproved accuracy for multi-face recognition by means of the combination of FaceNet and Support Vector Machine (SVM) [8]. In this work FaceNet is used to extract features and SVM is used for classification. For classification (feature matching), support vector machine is used. This gives 99.6% accuracy in face detection.

Lin Zhi-heng et al proposed a video based attendance marking system [9]. Here a camera is used to capture images of students' face and the video is divided into frames. From the frames the clear images with bright lighting conditions are selected. This system mentions advantages like it saves time, it will not interfere the teaching learning process.
I. Poona et al proposed a Deep Learning technique based attendance system [10] which identifies theface of students and marks attendance. Automatic feature extraction techniques are used and trained with minimal human intervention.

III. PROPOSED METHODOLOGY

The ultimate objective of the system is to improve and organize the training and placement attendance system and to decrease the number of errors occurred in the manual process.It Increases privacy and safety and eliminates false attendance and to provide attendance reports periodically. According to the proposed system, the respective staff must scan the entiretraining 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

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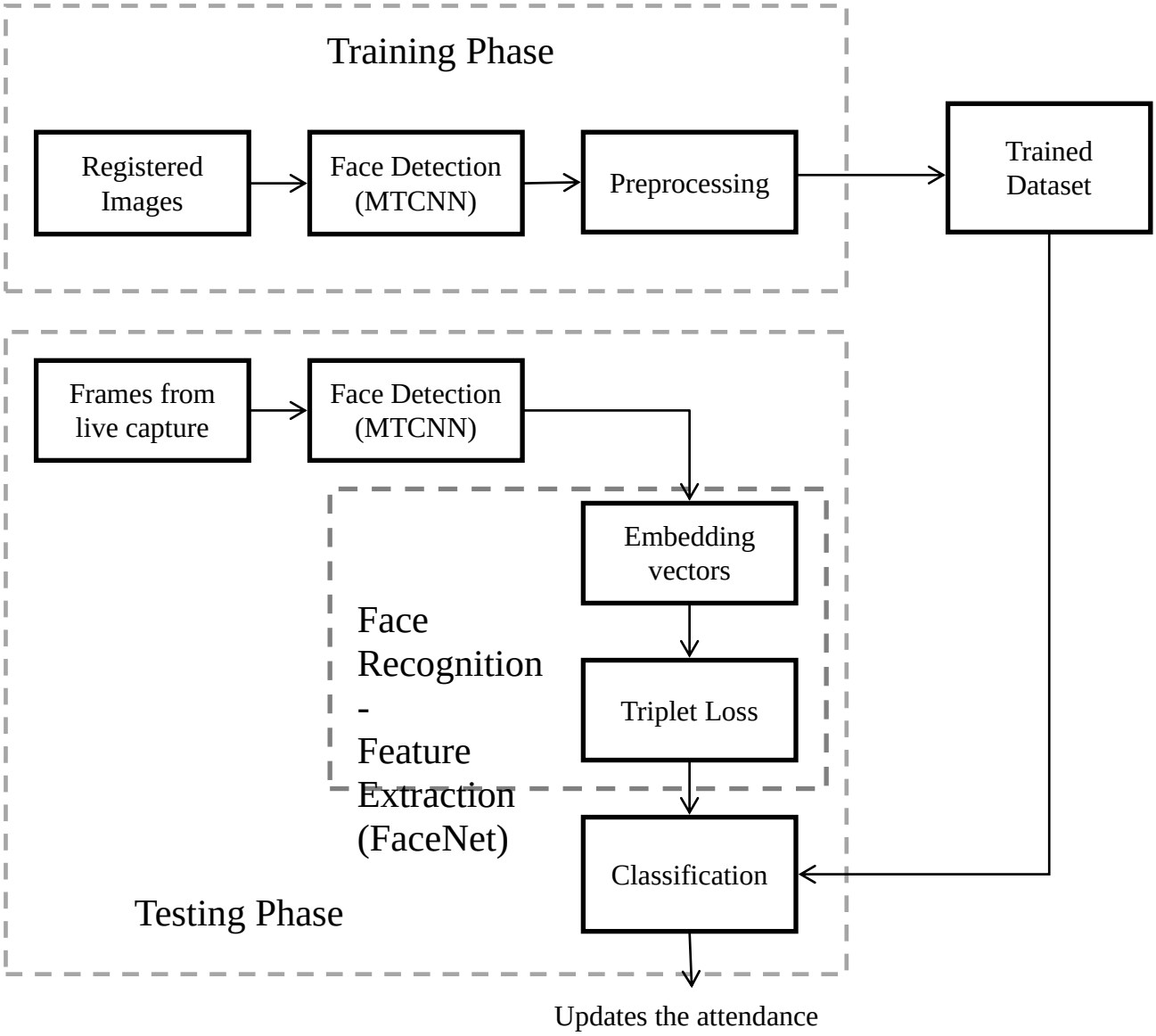

Figure 1: Block diagram of the system

A. Student Registration

Every student who belongs to the university must register for this process by giving their basic information, Name, Roll number, Year, and Department. Along with all this information student must upload their pictures based on our sample pictures. The sample will have six images – 2 straight facings, 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 the training phase.

Figure 2: 6 Different angle input images

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B. Dataset Generation

The dataset generation shows an important part in the face recognition process. 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, the 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 the training phase.

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

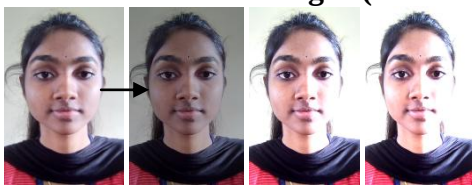

Figure 4: Different contrast images (values-0.7, 1.3, 1.5)

C. Face Detection

Face detection is a process that can identify and locate the presence of human faces in digital photos and videos. The work uses the Multi-Task Cascade Neural Network (MTCNN). A cascade structure with three networksis used by the network. The rescaling of the images in different sizes is done (called an image pyramid),Stage 1- the first model 'Proposal Network or P-Net' proposes candidate facial regions. Stage 2 –Refine Network or R-Netfilters the bounding boxes. Stage 3 - the facial landmarks are proposed by the third model 'Output Network'. Duringthe training phase, after the detection of the face from the student images, pre-processing is done. It is a process of improving image features. The proposed system crop and resize the detected faces from the dataset images and then convert them into greyscale images. The processed images are stored in a new folder for every individual. In the testing phase, the detected faces form the live capture are given as an input image to the FaceNet model for face recognition.It outperforms traditional methods over multiple benchmark datasets [19].

D. Face Recognition

Face recognition is performed using FaceNet. FaceNetis used to extract features from face images and transforms image data into 128 dimensions features. The FaceNetreconstruct the image into 128-dimensional vectors and place it in the Euclideanspace. Now, the FaceNet model is trained for triplet loss to identify the closeness and changesin the given image dataset. Feature vectors of FaceNet are used for face recognition, and verification [19]. Briefly, similar images distances are lesser than the non-similar images in the vectors. It also uses triplet loss function to minimize the distance between the anchor image and the sample. The anchor image is taken as the reference image. Finally, for classification, an SVM classifier is used.

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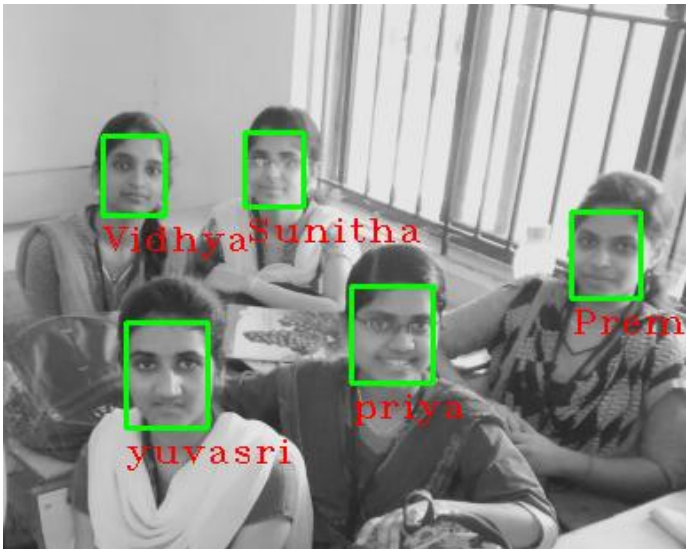

Figure 5: Face recognition output

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 the 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

Here an automated attendance monitoring system is proposed for marking attendance and it provides high accuracy. It also overcomes the drawbacks of the manual attendance system and proxy attendances.Though there are many biometric systems are available, this has a great impact on its usefulness. Later a system with more volume of the dataset can be developed to improve accuracy as well as efficiency.

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