

Digi Attendance – Artificial Intelligence Based Attendance System

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Abstract: Attendance of the students is much essential in the education system. To mark and store the attendance of student's different ways can be adopted like by calling the students one by one, signatures on the attendance sheet. The process has different drawbacks, like time consuming. we proposed a web-based student attendance system that incorporates face recognition as a solution to this problem. In the proposed system, to detect faces in images we use, Multi-Task Cascaded Convolutional Neural Networks (MTCNN), to extract features from image Facenet is used, and SVM is used as classifier. So, the computer can identify faces. According to the results of the experiments, the system resulted in recognizing faces and marking their attendance. By this process keeping the record of attendance becomes very easy for educational institutes.

Keywords: Student attendance system, Multi-Task Cascaded Convolutional Neural Networks (MTCNN), deep metric learning, Facenet.

1. Introduction

Attendance plays an important role in any organization. The importance of attendance cannot be overstated in any organization. Also, Educational organizations are imposing students' attendance to make the record of student presence for administrative purpose. We are having different traditional ways of marking attendance. Some manual ways to take attendance of students are:

- Calling names of students one by one to mark their attendance.
- Students made their signature on attendance sheet.

The traditional approaches to mark attendance are having multiple limitations:

- To call the names of students one by one is a time-consuming process.
- Student can mark the proxies to their friends.
- Record of attendance data can easily lose if not managed well by organization.
- To enter the data in database becomes additional work for the teachers.

To avoid the above problems and make the process of marking attendance easy and accurate we can mark attendance of students using face detection and recognition-based attendance system.

In this paper, we proposed an attendance system using face

detection and recognition-based attendance system. Machine learning algorithm like MTCNN is used as face detection FaceNet is used to produce extract features from image, and Softmax is used as classifier.

When a student's face is successfully recognised by the attendance system during testing, the system immediately enters attendance information, including the student's ID number, date, and time. The previous manual attendance system can be replaced with this new one.

2. Literature Overview

Over the past few years different systems have been developed to get over the limitations of traditional way of attendance system. Some of them are:

A. Attendance System Using Facial Recognition

This system was introduced in April 2022 with the aim to reduce time consumption and work load on teachers. The methodology used in system was CNN with openCV libraries. The drawback of the system is that the students who are far away from the camera are not recognized or there are less chances of them being recognized [1].

B. Automatic Face Recognition Attendance System using Python and OpenCv

This system was proposed march 2021. This system was proposed to change the conventional method of attendance taking. Algorithm and libraries used: openCV, tkinter, numpy, xampp server. The limitations of the system were if in case there were twins the system is not able to differentiate between them and was time consuming sometimes [2].

C. Attendance Monitoring System Using Face Recognition

This system was introduced in May 2020. The methodology used in this system was Haar cascade classifier, local binary pattern histogram (LBPH), GUI, open CV library. This system works as when the student logs in into the system, it will automatically store its picture and then at the time of attendance uses his picture for attendance [3].

D. Automatic Student Attendance System using Face Recognition

This system was proposed in February 2020. This system was

much efficient than other systems. Eigen face, haar cascade classifier, principal component analysis (PCA) is used for face detection and for face recognition process. This system takes the attendance of the students while they enter the class and then leave the class this decreases the chances of proxies [4].

E. Real Time Automatic Attendance System for Face Recognition Using Face API and OpenCV

This system proposed the concept of marking the attendance with use of smart phones. Region based convolution network (RCNN), faster RCNN, single shot detector was used. This structure is based on YOLO V3 (You only look once) algorithm for face detection and Microsoft Azure using face API for face recognition. The camera of smart phone was used to mark the attendance of students [5].

F. Computer Vision-Based Classroom Attendance Management System with Speech Output Using LBP Algorithm

This system was taken into place with the aim to introduce new way of taking attendance of students. Local Binary Pattern (LBP) was used for face detection and recognition [6].

G. Smart Attendance Monitoring Technology for Industry 4.0

Through this document, we found the OpenCV open-source image processing library to be an effective Raspberry Pi-based way to reduce product costs and help connect and participate in heterogeneous devices. When training, testing and collecting the students' photos and attendance, the system provides an easy-to-use user interface that enhance the user experience. Face detection and recognition is done using LBP histograms, and the database is updated using SQLite (a lightweight version of SQL for the Raspberry Pi) instead of MySQL [5].

3. Proposed System

We propose an AI based attendance system with the aim of reduce the workload of teachers and to overcome the limitation of manual process to attendance marking system.

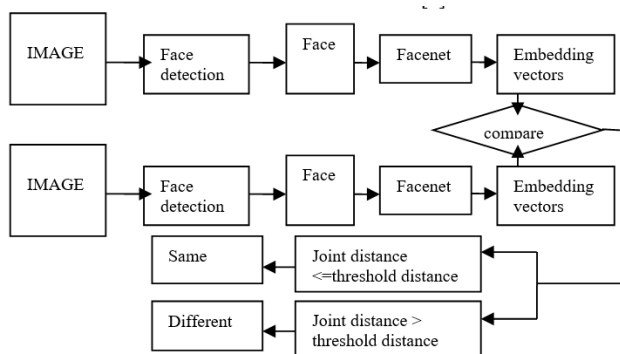


Fig. 1. Working of face detection and recognition system

In our proposed system the camera installed in the class will be used to take the pictures of the students present in the classroom. Pictures taken will be matched with the images present in the database to recognize the students and will mark their attendance automatically.

To achieve this goal, we used MTCNN algorithm to detect

the face of the student, FaceNet is used for feature extraction of the images and softmax is used as the classifier.

This proposed system is much efficient than existing attendance systems because in this system we used the MTCNN with FaceNet and softmax is used as classifier.

As per study this face detection and recognition system is much efficient and accurate than others [8].

4. Methodology

We use the following steps to get our goal:

- Face Detection
- Extraction of Features and Recognition of Face
- Classifier

A. Face Detection

The first and the basic step of the process is to detect the face of student in the classroom using the camera installed in the classroom.

For the face detection process we use the algorithm known as MTCNN (multi task cascade convolutional neural networks).

MTCNN is a neural network which is used to detect the face and facial landmarks on images. It was published in 2016 by Zhang et al [8]. It's the accurate and best tool used for the face detection.

This model consists of three neural networks (P-NET, R-NET and O-NET). The process of MTCNN can be summed up in three stages.

Stage 1: Image is passed to the system and different scaled copies are created and the said scaled images are passed to the P-NET. And this P-NET has been instructed like so that it gives an output the bounding box for every 12×12 kernel. Bounding boxes which are of low confidence are deleted here. And then conversion of kernel to un-scaled image coordinates, bounding box coordinates to un-scaled image coordinates and reshaping of bounding box to square shape is being done.

Stage 2: In this stage padding of the bounding box is done and the scaled images are handed over to R-NET.

The output of R-NET is a like as the P-NET. Here more accurate bounding boxes are delivered and with high and accurate confidence level of bounding boxes.

Stage 3: We have to pad the boxes which are out of bound and resizing of boxes to 48×48 is made before passing them to O-NET. O-Net provides 3 outputs: the coordinates of the bounding box (out[0]), the coordinates of the 5 facial landmarks (out[1]), and the confidence level of each box (out[2]).

Here also the scaled images with lower confidence levels are eliminated. Standardization of bounding box coordinates as well as facial landmark coordinates is done

At the last all the detailed are combined to the dictionary with following main parameters i.e. (bound-box, confidence, key-points)

B. Extraction of Features and Recognition of Face

FaceNet is used for the feature extraction and face detection. FaceNet is used for feature extraction and face recognition. It was published in 2015 by Google researchers Schroff et al [9]. FaceNet takes input images and performs the embedding.

Embedding means to extract 128 element vectors from an image. This 128-element vector represents the important features of the face. The distance between the extracted vector from the images of same face should be very low while as the distance between vectors of the two different two different face must be sensibly high. To obtain this condition, neural network use the method of triplet loss.

We do train the FaceNet at the starting of the training FaceNet creates random vectors for every image so, when the images are plotted, they are distributed randomly.

We have following steps to train the FaceNet:

- Have to choose an anchor image at random
- Choose an image of the same person as the anchor image (positive eg.)
- Choose an image of the person unlike than the anchor image (negative eg.)
- Do the important and needed modifications in the settings of facenet that the nearer to the anchor positive example is placed than the negative one.

This is to be done till there is no more changes. Images of the same person are at the same distance with correspondence to each other and with other images.

This way to training with anchor, negative and positive examples is said as Triplet loss.

After training of the images FaceNet is capable of face recognition. FaceNet is a pre trained neural network.

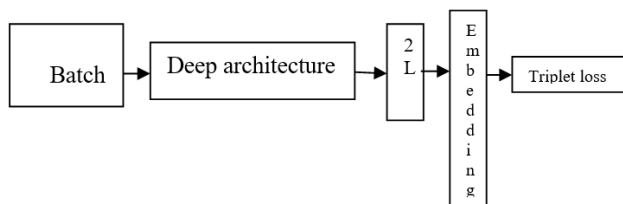


Fig. 2. Block diagram of FaceNet

C. Classifier

Classifier is used to classify the face based on embeddings. For this purpose, we use Softmax as a classifier we prefer using softmax as a classifier because our system is based on neural networks. We can also use SVM, Random Forest.

D. Marking attendance

After detecting and recognition of the images, face present in the classroom is matched with the photos of the students lying in the database and the attendance of students are marked who are actually present in the classroom.

5. Results and Discussions

A. Dataset

Dataset has a major part in the accuracy and the efficiency of the system. We can increase the efficiency with the help of datasets. Under training phase, we can train images like changing the brightness, blurring and contrast.

For this proposed system we have the taken the small dataset of our own for testing purpose. We could have taken the

available datasets but we preferred the data chosen from our college as our system is proposed to replace traditional attendance systems in colleges, schools and other educational institutes.

B. Working of MTCNN

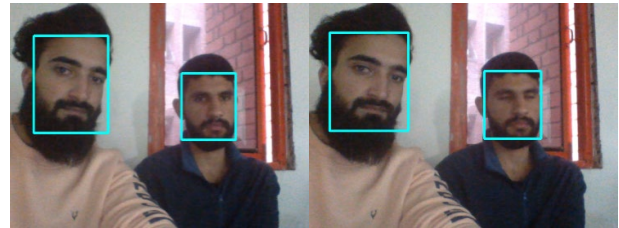


Fig. 3. Multiple faces detection



Fig. 4. Looking left



Fig 5. Looking down



Fig. 6. Looking upwards

C. Working of Facenet

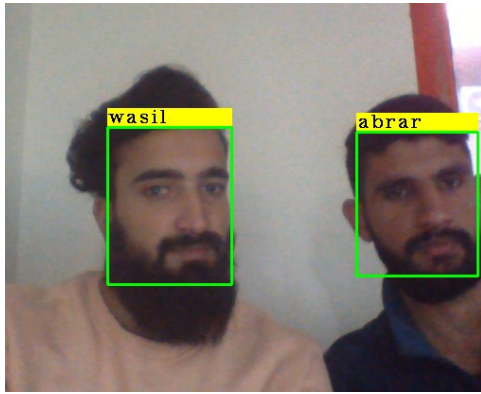


Fig. 7. Multiple face recognition

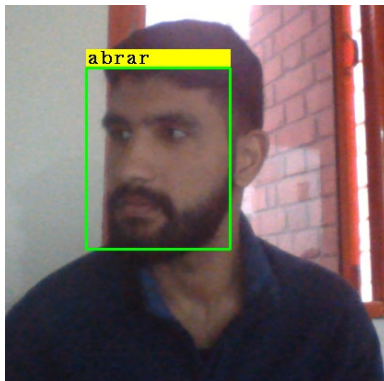


Fig. 8. Looking left

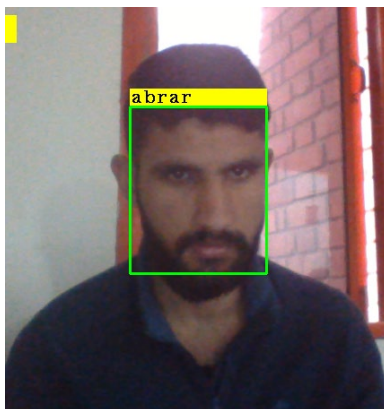


Fig. 9. Looking downwards

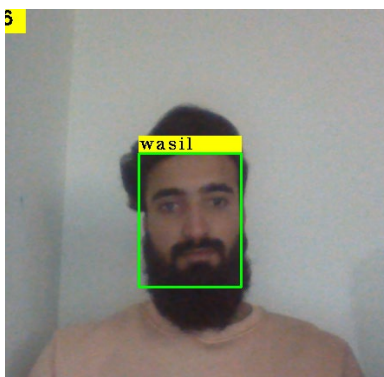


Fig. 10. Looking towards camera

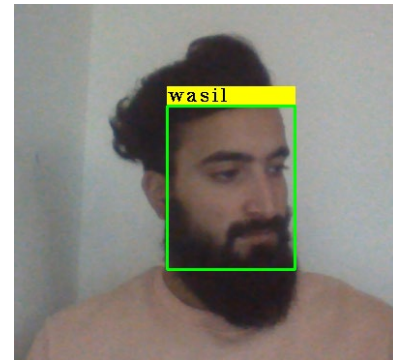


Fig. 11. Looking left

6. Conclusion

Face detection and recognition system is a much efficient and fast way of taking attendance. For eliminating the traditional process of attendance, we proposed the face detection and recognition-based attendance system. MTCNN is used for the instant detection of the face from the image with complex background. And the most accurate algorithm Facenet is used to recognition purpose. MTCNN along with Facenet is used to quick detection and recognition of faces from the image with different angles and properties. After study we came to know accuracy of face recognition of the improved Facenet is 1~3.5% high than other known face algorithms used for face recognition [10]. And also, it is fast as compared than the other recognition systems. This proposed is much accurate and quick attendance system with less human interference. It also eliminates the chances of proxies. This system is the best option despite we are having many biometric systems available.

7. Future Scope

Taking this proposed system in the context we can expand its usability in different aspects. Like we can use it in the different places irrespective of using it only for students we can use it at offices, airports, railway stations and also in different business establishments.

Taking the students attendance in the context we can improve its accuracy. We can also merge this system into the mobile application and can develop an application which could be able to take the students attendance and also we can add multiple features to that like to check the overall attendance, day wise attendance at the students end. The assignment uploads and study material download option can also be added to this system. We can say we can convert it into LMS.

More over face detection and face recognition system is used in different perspectives of life that's the reason that this system can be modified and improved with the respect to the change and need that is to be fulfilled.

References

- [1] Iffandi, M.D., Adiningrat, R.N., Pandapota, J.R., Ramadhan, J.F., Kanigoro, B., & Irwansyah, E. (2020). Attendance System with Face Recognition. *International Journal of Engineering and Advanced Technology*.
- [2] V. Suresh, Srinivasa Chakravarthi Dumpa, Chiranjeevi Deepak Vankayala, Hancesha Aduri, Jayasree Rapa, "Facial Recognition

- Attendance System Using Python and OpenCv,” *Journal of Software Engineering and Simulation*, vol. 5, no. 2, pp. 18-29, 2019.
- [3] Bhavana, D., Kumar, K.K., Kaushik, N. et al. Computer vision-based classroom attendance management system-with speech output using LBPH algorithm. *Int J Speech Technol* 23, 779–787 (2020).
- [4] Korukanti Ashritha, Sridhar Bhukya, “Automated Attendance System Using Face Recognition.” *International Journal for Research in Applied Science & Engineering Technology*, 2022.
- [5] Khan, S., Akram, A. & Usman, N. Real Time Automatic Attendance System for Face Recognition Using Face API and OpenCV. *Wireless Pers Commun* 113, 469–480 (2020).
- [6] Archana S. Nadhan, Chetana Tukkoji, Boosi Shyamala, N. Dayanand Lal, A. N. Sanjeev Kumar, V. Mohan Gowda, Zameer Ahmed Adhoni, Melaku Endaweke, “Smart Attendance Monitoring Technology for Industry 4.0,” *Journal of Nanomaterials*, vol. 2022.
- [7] G. Anitha, P. Sunitha Devi, J. Vidhya Sri, D. Priyanka, “Face Recognition Based Attendance System Using MTCNN and FACENET,” *Zeichen Journal*, vol. 6, no. 8, 2020.
- [8] Chunming Wu, Ying Zhang MTCNN and FACENET Based Access Control System for Face Detection and Recognition. *Aut. Control Comp. Sci.* 55, 102–112 (2021).