TEST Engineering & Management

July – August 2020
ISSN: 0193-4120 Page No. 4646 - 4650

Classroom Attendance Management System using Facenet Model

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Article Info
Volume 83
Page Number: 4646 - 4650
Publication Issue:
July - August 2020

Article History
Article Received*: 06 June 2020*
Revised*: 29 June 2020*
Accepted*: 14 July 2020*
Publication*: 25 July 2020*

Abstract

Capturing attendance of a classroom is an important part of daily student evaluation these days. Automation is one of the essential parts of our digitization world. When everything is automated these days, it will be really helpful for everyone to automate attendance management system also. Taking attendance in a large classroom is cumbersome, repetitive and consumes valuable class time. Updating the student attendance into the end-system is another tedious job at the end of every semester/year. This project is designed to simplify this process and improve the accuracy of the attendance data.

Keywords: *Face recognition, Face detection, Deep Learning, Convolutional Neural Network, Facenet Model*

I. INTRODUCTION

Classroom attendance management system deal with the maintenance of the student's attendance details. It captures the attendance of the student based on his presence in the classroom. This project is created using the concept of Face recognition where Face is used as the evaluation metric for all the students. Face recognition is a computer vision task of identifying and verifying a student based on the features of the face.

II. LITERATURE SURVEY

Face recognition is a combination of two major operations:

- Face detection
- Face classification

Face recognition system is a technology which can be used to detect and identify any number of persons present in a photograph or video captured.

This technology analyzes the face image to extract the facial features from the person identified and then identify the specific target.

Convolutional neural networks have been present as the deep learning technique in almost all face recognition systems. Significant breakthrough made by DeepIDs, DeepFace, Face++, Facenet.

Facenet model stands out to be the winner of all the models with respect to its accuracy on the standard

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benchmark datasets. This model was developed by a group of researchers at Google in the year of 2015.

Facenet model can be used broadly to extract high-quality features from face called Face embeddings that can be used to train a face identification classifier.

Below are the important steps for the project pipeline:

- Face Detection: Scan the image and find all the possible human faces
- Face Extraction: Focus on each face identified and extract the faces.
- Feature Extraction: Extract the unique features from the face and create the embedding vector for each face.
- Classifier Training: Create a SVM classifier to compare the embedding vector matrices of one face with another face to identify students present in the image.
- End-System Update: Update the attendance in the end-system directly.

III. PROBLEM DEFINITION

Recognizing faces in computer vision is a challenging problem. Thus face recognition algorithms must exhibit robustness to variations in the above parameters. The existing techniques do not perform well in cases of different illumination, background or rotation. Thus there is a need to address the above mentioned disadvantages.

The project aims to design and implement a system which is less sensitive to illumination, is rotation invariant, scale invariant and robust enough to be implemented in practical applications.

IV. PROPOSED METHOD

A. Model Building

Model is designed by following the below steps.

- Dataset Preprocessing
- Faces Alignment
- Model Training

A.1 Dataset Preprocessing

Images of all the students in the class are captured and placed inside different folders with their registered number. Each student should have minimum of 10 images to make sure that we neither over fit nor under fit the model.

Fig. 1. Data Preprocessing

A.2 Faces Alignment

MTCNN algorithm is mainly used to extract the faces from the image uploaded and store in a new folder with their registration number.

In this step, the size of the face image is set to 160 X 160 so that all the aligned images are of the same size before sending them for model training.

Fig. 2. Faces Alignment

A.3 Model Training

All the student faces images extracted and aligned are fed as an input to the model training.

Facenet model creates a embedding vector for each face identified and calculates the distance between the two faces that are compared.

If the distance is less than the threshold set within the system, it is assumed that the faces are similar and else distinct.

Training is done using Triplet learning approach:

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- Anchor Image – One image of a face
- Positive Image – Same Face
- Negative Image – Different face

This is the main reason for the Facenet model to attain state-of-the-art performance (record 99.63% accuracy on LFW, 95.12% on YouTube Faces DB) using only 128-bytes size per face.

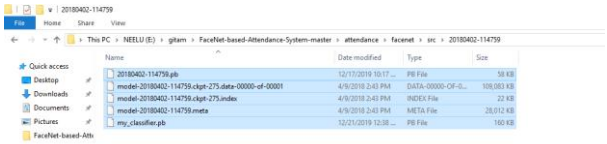

Fig. 3. Model Training

B. Model Testing

Once the model is ready, we can test the model using the below command. New image is created

```
$pythonface_recognition_image.py
E:/gitam/FaceNet-based-Attendance-System-
master/attendance/facenet/dataset/test-
images/classroom_pic.jpg
```

Fig. 4. Model Testing

C. User Interface

A flask application is created which acts as a user-interface which uses the model that is created for capturing the attendance of a class. Below are the options that are available in the UI.

- Home Page
- User Registration
- Login
- Take Attendance

C.1 Home Page

Student attendance management system home page contains all the options to register, login and capture attendance.

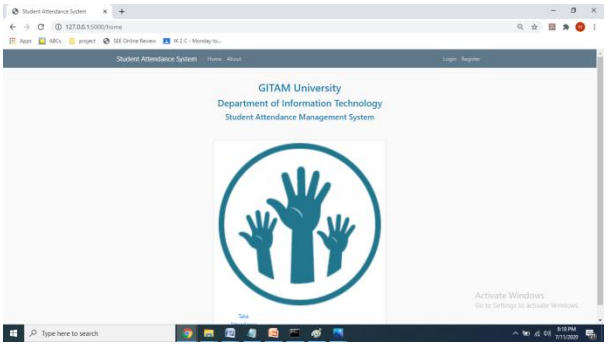

Fig. 5. Home page

C.2 User Registration

All the users should be registered in the system for using the application. Only admin and lecturers can access this feature.

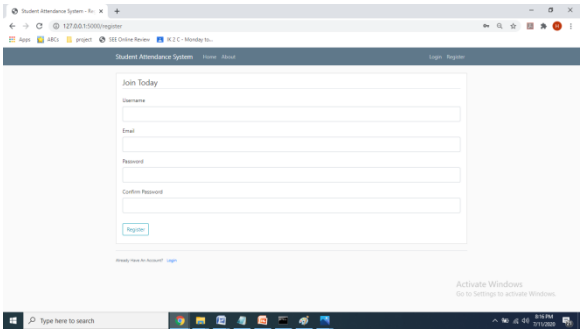

Fig. 6. Registration

C.3 Login

In order to capture the attendance, login is mandatory to make sure that the user is authorized.

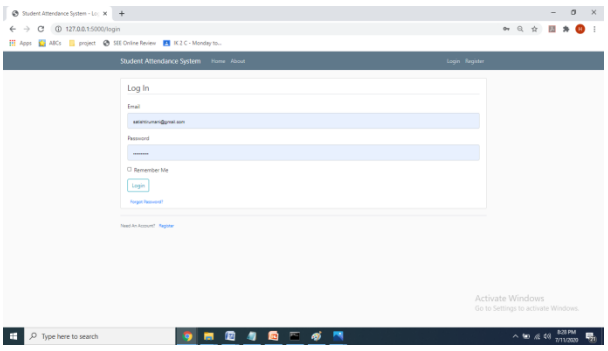

Fig. 7. Login

C.4 Take attendance

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Once user logs into the system, attendance can be captured by following the below steps.

- Classroom image should be captured.
- Picture captured needs to be uploaded.
- Click on “Recognize Students” button.

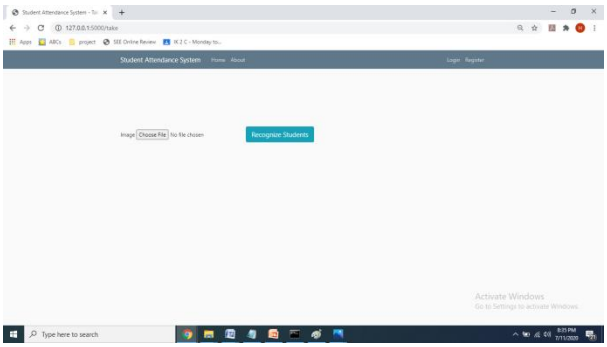

Fig. 8. Take Attendance

Once the students are identified, their attendance is captured and updated.

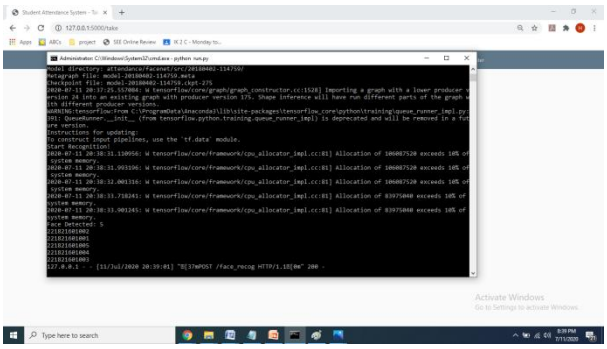

Fig. 9. Recognized Students

D. Reporting

System captures the classroom snapshot image and the attendance in the excel sheet.

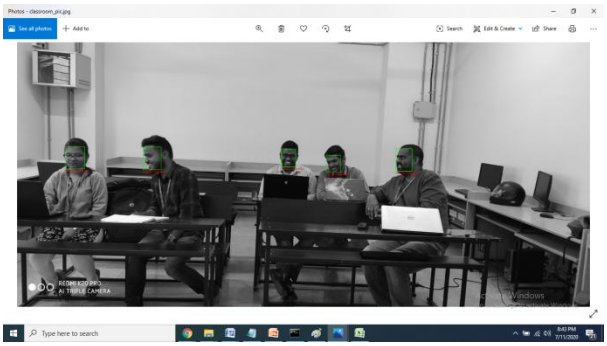

Fig. 10.Classroom Snapshot

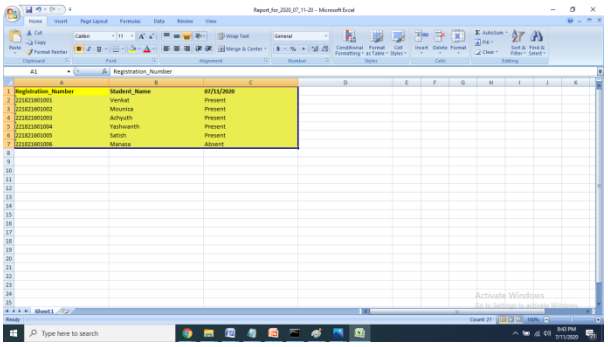

Fig. 11.Excel Report

V. CONCLUSION

The purpose of reducing the errors that occur in the traditional attendance taking system has been achieved by implementing this automated classroom attendance management system. In this paper, face recognition system has proved that student attendance can be captured automatically with accuracy of 98.3% and updated directly into the system. This system is also efficient and tested with students with different poses and different conditions in the classroom. The result is then used to generate an excel sheet, the pdf of which is sent to the students and parents on weekly interval. This system is convenient to the user and it gives better security. It also reduces the manual error in capturing the attendance and proxy attendance calling from students.

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