Attendance automation using deep learning

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Abstract - In this paper we propose an automated attendance management system. This system, which is based on face detection and recognition algorithms, automatically detects the student, in an image and marks the attendance by recognizing him. The system architecture and algorithms used in each stage are described in this report. Different real time scenarios are considered for evaluation of performance of various face recognition systems. This report also proposes the techniques to be used in order to handle the threats like spoofing. Comparing with traditional attendance marking, this system saves time and also helps in monitoring the students. Smart Attendance using Real-Time Face Recognition is a real-world solution which comes with day to day activities of handling student attendance system. Face recognition-based attendance system is a process of recognizing the students face for taking attendance by using face biometrics based on high definition monitor video and other information technology.

1.INTRODUCTION

Attendance is prime important for both the teacher and student of an educational organization.
So it is very important to keep record of the attendance. The problem arises when we think about the traditional process of taking attendance in class room. Calling name or roll number of the student for attendance is not only a problem of time consumption but also it needs energy. So an automatic attendance system can solve all above problems. There are some automatic attendances making system which are currently used by much institution. One of such system is biometric technique. Although it is automatic and a step ahead of traditional method it fails to meet the time constraint. The student has to wait in queue for giving attendance, which is time taking.
This project introduces an involuntary attendance marking system, devoid of any kind of interference with the normal teaching procedure. The system can be also implemented during exam sessions or in other teaching activities where attendance is highly essential. This system eliminates classical student identification such as calling name of the student, or checking respective identification cards of the student, which can not only interfere with the ongoing teaching process, but also can be stressful for students during examination sessions.

1.1 Literature Survey

Florian Schroff et al. presents a basic premise of facial recognition using convolutional neural network. Face recognition consists of various steps. Detecting all faces in a picture, analyzing facial features, comparing them against known faces and then finding a match, if any. A convolutional neural network works as the basic model to achieve the targets like fast convergence, signal noise suppression and high accuracy of feature points positioning. Since the training of convolutional neural network needs massive samples a sample transformation method is proposed in this paper to avoid overfitting.
Despite significant recent advances in the field of face recognition implementing face verification and recognition efficiently at scale presents serious challenges to current approaches. This paper presents an approach called FaceNet, that directly learns a mapping from face images to a compact Euclidean space where distances directly correspond to a measure of face similarity. Once this space has been produced, tasks such as face recognition, verification and clustering can be easily implemented using standard techniques with FaceNet embeddings as feature vectors.
This method uses a deep convolutional network trained to directly optimize the embedding itself, rather than an intermediate layer as in previous deep learning approaches. This approach results in a record accuracy of 99.63% making it superior than any previous approaches. Previous face recognition approaches based on deep networks use a classification layer trained over a set of known face identities and then take an intermediate bottleneck layer as a representation

used to generalize recognition beyond the set of identities used in training. In contrast to these approaches, FaceNet directly trains its output to be a compact 128-D embedding using a triplet based loss function based on LMNN(Large margin nearest neighbor) classification method.

1.2. Project Purpose

The main objective of this project is basically to apply the concepts of Deep Learning and Convolutional Neural Network in attendance automation, conveniently eliminating the time taken in taking attendance and reduce and/or eliminate the possibility of proxies.

1.3. Proposed System

In this project we use CNN in a deep learning model to produce a bunch of numbers that describe a face (known as face encodings). When you pass in two different images of the same person, the network should return similar outputs (i.e. closer numbers) for both images, whereas when you pass in images of two different people, the network should return very different outputs for the two images. Using this concept, we train the model using images of people, pick them from a group, identify the person and record the attendance in the database.

2. System Design

Project consists of 3 major steps.

1. Training
2. Testing
3. Attendance Recording

The following flow chart shows in detail how these 3 steps are achieved.

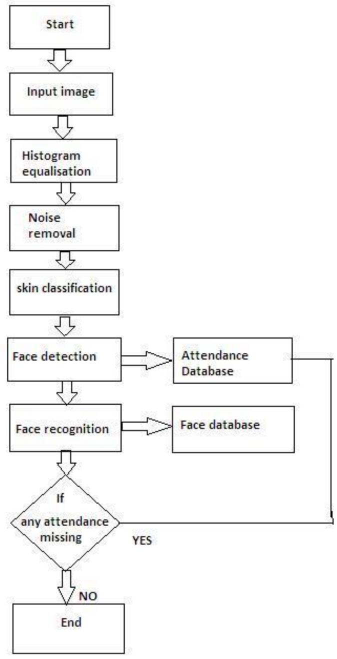

Fig 1. Flow Chart

Images are fed to a training model(available in dlib library) that gives the face encodings ie; the face values of each person. The training model takes in multiple images of a single person from different angles. The testing model is the one that does the recognition, by comparing the face encodings obtained from the previous step with the live images gathered, and the attendance is recorded in the respective database if values matches, else is discarded.

The hardware used here is any High Definition Camera. The Recognition model takes person's faces as input from the camera and stores them with corresponding face encodings in the image database. The comparison of the input image is then done with the images from the trained faces database.

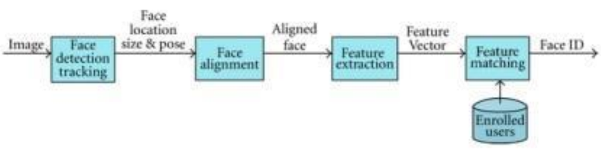

Fig 2. Block Diagram

Based on the output from the comparison the attendance database is updated, basis on whether the student is present on that particular day. For this a positive integer variable is used as value for every key which is the student name and its value is incremented on every positive recognition else left unchanged. The faces in the trained faces database comes from a pre trained model from dlib available in python, which takes faces of people as input and outputs an array of face encodings (face values corresponding to respective faces). The accuracy of the encodings depends on the resolution of the camera, clearness of images and the model used in training. The comparison is based on these face encodings itself. Faces with similar values or encodings are recognized as same faces or same people.

A file very similar to an attendance register is used to store the person(s)' name and the attendance except that it is automated from the training and comparison models unlike in a manual way.

The Procedure followed to achieve the result is as :

1. Detect/identify faces in an image (using a face detection model).

2. Predict face poses/landmarks (for the faces identified in step 1).

3. Using data from step 2 and the actual image, calculate face encodings (numbers that describe
the face).

4. Compare the face encodings of known faces with those from test images to tell who is in the
picture

5. Update attendance based on the result from step 4.

2.1. Training The Model

For training the model, we create a folder named images in which we place multiple
images of each person. These images, named after the person will be used to train the model.

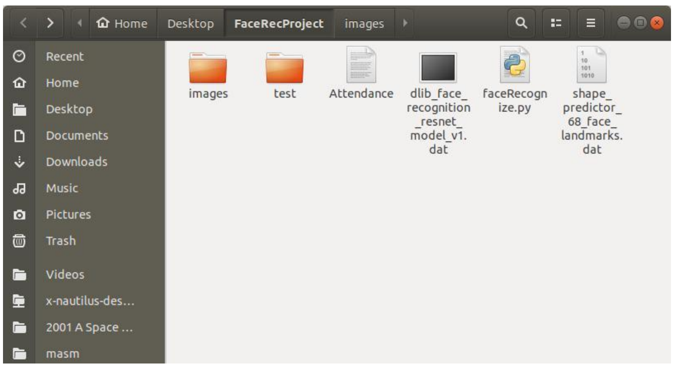

Fig 3. Screenshot of training and testing models

The model shape_predictor_68_face_landmarks.dat takes images as input and stores respective face encodings(face values) for each face(image) in an Array, which is later used in facial recognition in the testing process.

Fig 4. Images to Train the model

2.2. Testing The Model

Comparing faces is done by a function that will compare a given face encoding with a list of known face encodings. It will return an array of boolean (True/False) values that indicate whether or not there was a match. The images of people to be recognized is stored in the "test" folder.

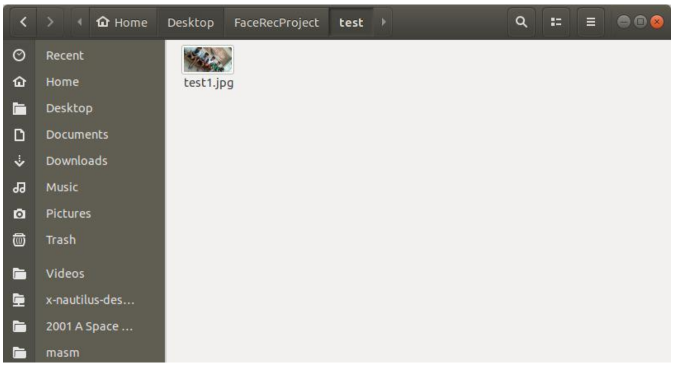

Fig 5. Test Image fed to the testing model

The model, dlib_face_recognition_resnet_model_v1.dat does the comparison of individual faces in a group and returns True or False based on the comparison.
The CNN uses Boundaries to separate faces and Recognizes the individual faces based on the output from the previous training step.

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Fig 6. Recognition of People in a group

2.2. Recording Attendance

After testing the test image for a subject, the attendance is recorded in a text file that contains key value pairs, Key being the person's name and the Value being a positive integer value starting from zero. This integer value is incremented for every time there is a match of the corresponding subject in the test image or else it is left unaltered.

Key value pairs before testing :

Attendance.txt - Notepad

File Edit Format View Help

Key	Value
Bipin	0
Shreyas	0
Nikhil	0
Akash	0

Fig 8. Attendance Before The Recognition

Key value pairs after testing is shown below.

Attendance.txt - Notepad

File Edit Format View Help

Key	Value
Bipin	1
Shreyas	1
Nikhil	1
Akash	0

Fig 9. Attendance After The Recognition

3. Conclusion

We have successfully shown that a CNN is very effective in facial recognition and we can use that to automate attendance, which is not only simpler than manual method or biometric systems that take up more memory to store the information about the person but also saves a lot of time spent taking attendance.

This also eliminates the concept of proxies, hence avoid any malpractices. When implemented on a higher level, this proves to more effective and simpler, with very less hardware requirement and such a low initial investment and maintenance.

This could be the future of attendance systems everywhere considering its effectiveness and simplicity.

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