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Automated Attendance System using ImageProcessing and IOT smart system to eradicate attendance difficulties

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Abstract: -

Face detection technology has widely attracted attentiondue to its enormous application value and market potential, such as face recognition and video surveillance system. Real- time face detection not only is one part of the automatic face recognition system but also is developing an independent research subject. In this paper, we have proposed an automated Face Recognition System for Time and Attendance application. The model is developed with the help of real time OpenCV library. It takes a real time image of the class using a dedicated camera module and evaluates the attendance of class using the student's data. The attendance is sent to theconcerned person via mail to the concerned person.

I. Introduction

Person Recognition is one of the emerging research fields in image processing. The major application for person recognition is for Classroom Attendance system, where the attendance is automatically taken and mailed to the concerned person. This system is developed in order to avoid the manual drudgery for lecturers in entering the data daily while taking attendance and also to avoid proxy. They are several biometrics used for Person. Recognition like Iris, Fingerprints, Face etc. Since Iris and Fingerprints are very short-distance biometrics. As a worst case, our system should be able to recognize a person who is sitting at the lastbench, which might not be possible by using Iris or Fingerprints as a biometric. Hence, we go for a mediumrange Biometric i.e., Face with the help of which we can recognize a person and mark his attendance.

II. Raspberry Pi Camera

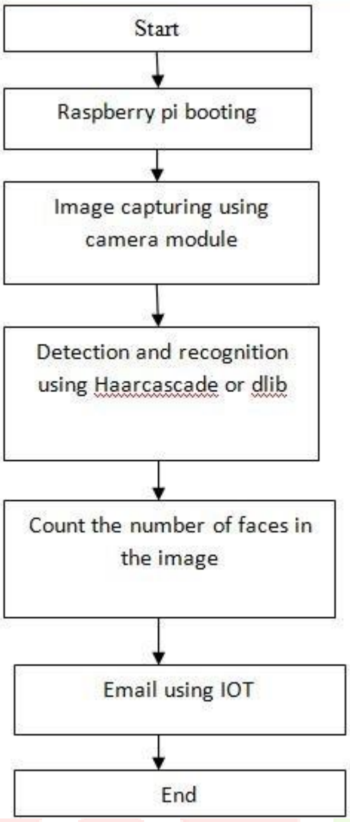
The cameras connecting wirelessly with IP address in local network and use for Image Processing is basic idea for this project. Two major steps involve in this whole process. First step is to put the camera in in such a location so that it could take a picture of the entire class. Then the camera has to send a real time image of the entire class to the raspberry pi microcontroller so that the students in the image can be compared to the database and their corresponding attendance could be taken.

III. PROPOSED SYSTEM'S ARCHITECTURE

The system designed consists of following steps. It can be constructed in many modules:

- Image capturing,
- Face Detector and
- Face recognizer.

Flowchart:


Start
Raspberry pi booting
Image capturing using camera module
Detection and recognition using Haarcascade or dlib
Count the number of faces in the image
Email using IOT
End

A) Image Capturing

Images are captured using a module that is a raspberry pi camera module whose link is integrated to the application that is developed using the proposed idea. After an image is captured, the image is sent to microcontroller for processing. Together with the image, the web service accepts the course code. Using this course code, the LMS is aware of which students are enrolled in that class and do face matching only for those students. The camera takes pictures on a given interval until an appropriate image in which the faces of all the students can be detected.

B) Implementation

I. Haar Cascade

II. Dlib

Haar Cascade

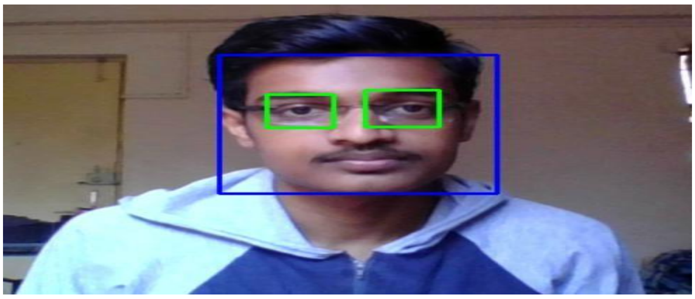
A Haar Cascade is basically a classifier which is used to detect the object for which it has been trained for, from the source. The Haar Cascade is by superimposing the positive image over a set of negative images. The training is generally done on a server and on various stages. After the model is trained, it is able to identify face features, which is later, stored on a XML file. Better results are obtained by using high quality images and increasing the amount of stages for which the classifier is trained.

Dlib

There are 68 facial coordinates where the dlib facial landmark predictor was trained on. Regardless of which dataset is used, the same dlib framework can be leveraged to train a shape predictor on the input training data — this is useful if you would like to train facial landmark detectors or custom shape predictors of your own. The first parameter to the detector is our grayscale image (although this method can work with color images as well). The second parameter is the number of image pyramid layers to apply when upscaling the image prior to applying the detector. The benefit of increasing the resolution of the input image prior to face detection is that it may allow us to detect *more* faces in the image — the downside is that the larger the input image, the more expensive the detection process is.

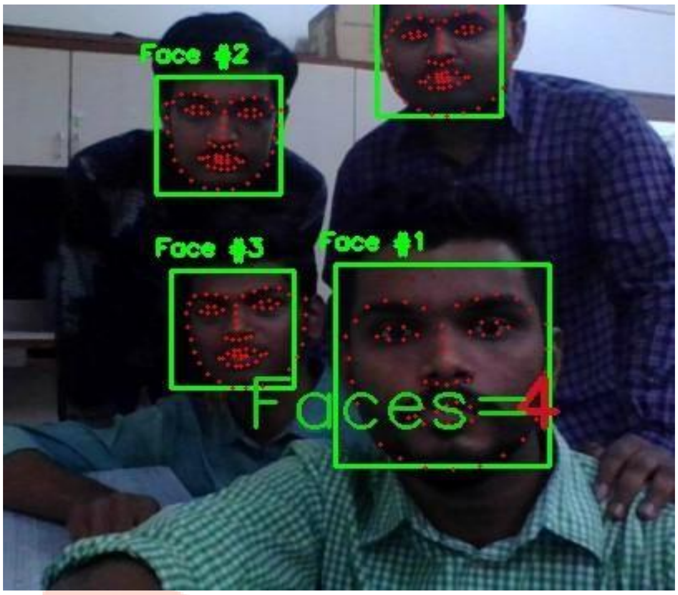
C) Face Detection

Because of processor intensive job of the face detection algorithm, this tool is server based. Detecting a face is in essence an object detection task, where the object of interest in this case is the face. However, many factors can interfere with the face detection algorithms, factors such as face pose, scale, position, rotation, light, image colors etc. The same problems arise when one wants to identify (recognize) a face, with addition to some other obstacles which is discussed shortly. The process of detecting faces from still pictures containing multiple faces can be separated in few steps. There are plenty face detection algorithms which can effectively detect a face (or any other specific object) in a picture. In the system presented here, most students face the camera frontally hence we chose to use the HAAR classifier for face detection. This classifier is implemented on Intel's Open CV library. The classifier works by training a model using positive face images and negative face images. A positive image is an image that contains the desired object to be detected, in our case this object is a face. A negative image is an image that does not contain the desired object. After the model is trained, it is able to identify face features, which is later, stored on a XML file. A problem faced during this process was the large number of false-positives: objects mistakenly detected as faces. This was not such a big issue for us, since a false-positive does not result in a positive identification during the recognition phase. Becauseof this, we lowered the detection threshold, so all facescould be detected. After a face has been detected, the rectangle enclosing this face is cropped and processed later by the face recognition module. This rectangle represents a single face, and after being cropped as an image is transferred on server. Each file transferred is renamed to have a unique ID.



D) Face Recognition

Recognizing a face means to identify that particular face from a list of faces on a database. In this project the images of all the students in the class are stored in a database. Same as in face detection, there are many existing algorithms used to identify a face. Our system implements a server-based module, programmed in Python which takes benefit of eigenfaces to identify a face. This algorithm has many drawbacks: it depends on scale, pose and the color of the compared images. However, the algorithm is very fast, and can compare only to images, thus we do not NEED to have multiple images of a person to train our system. Since our system is setup to capture only frontal images the pose of the face in not an issue. When a face is captured during the face detection phase, it is converted into gray scale. The same conversion is applied to faces on our student image database. We also do background subtraction on our images so other objects do not interfere during the process. Another issue is that faces are subject of change during time (facial hair, eyeglasses etc.). Whenever we successfully identify a face, a copy of that face is stored in the database of faces for that student. Together with the image we store the time and date when this image was taken. This way even if a student gradually changes his appearance (e.g., grows a beard) the system is still capable to identify him, since it has multiple images of the same person. On each consequent scan for a student, the recognition module starts comparing images from this database, sorted by date in descending order. This approach was chosen since the latest image of a student on our database is most likely to be more similar to the current captured image. Of course, a drastic change on a student's look causes the system to not identify that particular student. To solve this issue, we have included a module, which lists all unidentified faces and the teacher is able to manually connect a captured face with a student from the list. This image is also stored on our database, as an updated picture of this particular student. This manual recognition process is performed only once. In a subsequent scan, this student is identified



E) Email interfacing using IOT

Images are captured using a module that is a raspberrypi camera module and send to concerned person using email of that concerned authority with the help of SMTP protocol. Respective person can get attendance anytime because it was stored on email and save lot of wastage of time and hard work. It is the best application of IOT phenomenon.

ADVANTAGES

1. It saves their time and efforts.
2. The software stores the faces that are detected and automatically marks attendance.
3. The system is convenient and secure for the user.
4. The software can be used for security purposes in organization and secured zones.

DISADVANTAGES

1) It can only detect face from a limited distance
2) The system doesn't recognize properly in poor light somay give false results.

CONCLUSION

This face recognition-based attendance management system provides accurate attendance information of the students in easy way and email the attendance to the teacher using IOT. This system eradicates the wastage of time while taking manual attendance and also provides correct information. Security system gives high secure for any type of systems instead of using fingerprint or RFID. This system is convenient to user, easy to use and gives better security. When number of student faces increases the accuracy will decrease slightly. This system gives the student details as output to a storage device and sends an email to the person who manages the corresponding attendances.

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