

Face Recognition Based Attendance System Using Deep Learning

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Abstract - Nowadays Educational institutions are concerned about regularity of student attendance. This is mainly due to students' overall academic performance is affected by his or her attendance in the Institute. Mainly there are two conventional methods of marking attendance which are calling out the roll call or by taking student sign on paper. They both were more time consuming and difficult. Hence, there is a requirement of computer-based student attendance management system which will assist the faculty for maintaining attendance record automatically.

In this project we have implemented the automated attendance system using Deep . We have projected our ideas to implement "Automated Attendance System Based on Facial Recognition", in which it imbibes large applications. The application includes face identification, which saves time and eliminates chances of proxy attendance because of the face authorization. Hence, this system can be implemented in a field where attendance plays an important role.

The system is designed using deep python platform. The proposed system uses Principal Component Analysis (PCA), OpenCv, Harcascode algorithm which is based on eigenface approach. This algorithm compares the test image and training image and determines students who are present and absent. The attendance record is maintained in an excel sheet which is updated automatically in the system.

Keywords: Face recognition, Attendance system, Eigen faces.

I. INTRODUCTION

One necessary component of every business system is recording employees' work hours and activities, despite the capacity of the system. This process could be time consuming if it is managed manually. As a result of a rapid growth in information technologies, automatic solutions have become a standard option for these types of business processes.

There are now plenty of systems which differ in many aspects: core technology they are based on, way of use, cost, reliability, security and etc. Many of those depend on employees having to carry specific identification devices. One of the common types of the attendance systems is Radio Frequency Identification (RFID) where employees have to carry appropriate RFID cards. There are also location based attendances tracking systems. The location of an employee can be determined via Global Positioning System (GPS). The presence is determined by calculating the proximity between an employee's and the company's location. Both of the above mentioned types of the attendance systems have weaknesses. Employees could forget the RFID card or the location device, or someone else could check instead of them. This could also be a potential security issue. Therefore, there are systems that exclude the usage of external devices for attendance purposes by exploiting the individual attributes: fingerprints, iris, voice, face and etc. These types of systems are heavily based on computer vision and machine learning algorithms. Recent advances in these areas, especially in deep learning, provide possibilities to use these methods searching for practical solutions. These solutions could be more flexible and could reduce human errors.

The method proposed in this paper provides solution for face recognition tasks combining various modern approaches and state-of-the-art crafts in deep learning. The rest of the paper is organized as follows: Section II presents the related work, Section III presents the methodology, Section IV presents the results and discussion, and finally, Section V holds the conclusion.

II. LITERATURE SURVEY

For our project we got motivation by the research carried out by the following people and their published papers:

"Eigenfaces for recognition" (Mathew Turk and Alex Pentland) [1], here they have developed a near-real time computer system that can locate and track a subject's head, and then recognize the person by comparing characteristics of the face to those of known individuals. The computational approach taken in this system is motivated by both physiology

and information theory, as well as by the practical requirements of near-real time performance and accuracy. This approach treats the face recognition problem as an intrinsically two-dimensional recognition problem rather than requiring recovery of three-dimensional geometry, taking advantage of the fact that these faces are normally upright and thus may be described by a small set of two-dimensional characteristic views. Their experiments show that the eigenface technique can be made to perform at very high accuracy, although with a substantial “unknown” rejection rate and thus potentially well suited to these applications. The future scope of this project was-in addition to recognizing face, to use eigenface analysis to determine the gender of the subject and to interpret facial expressions.

“Fast face recognition using eigenfaces” (Arun Vyas and Rajbala Tokas) [2], their approach signifies face recognition as a two-dimensional problem. In this approach, face reorganization is done by Principal Component Analysis (PCA). Face images are faced onto a space that encodes best difference among known face images. The face space is created by eigenface methods which are eigenvectors of the set of faces, which may not link to general facial features such as eyes, nose, and lips. The eigenface method uses the PCA for recognition of the images. The system performs by facing pre-extracted face image onto a set of face space that shows significant difference among known face images. Face will be categorized as known or unknown face after imitating it with the present database. From the obtained results, it was concluded that, for recognition, it is sufficient to take about 10% eigenfaces with the highest eigenvalues. It is also clear that the recognition rate increases with the number of training images.

“Face recognition using eigenface approach” (Vinay Hiremath and Ashwini Mayakar) [5], This paper is a step towards developing a face recognition system which can recognize static images. It can be modified to work with dynamic images. In that case the dynamic images received from the camera can first be converted in to the static ones and then the same procedure can be applied on them. The scheme is based on an information theory approach that decomposes face images into a small set of characteristic feature images called ‘Eigenfaces’ which are actually the principal components of the initial training set of face images. Recognition is performed by projecting a new image into the subspace spanned by the Eigenfaces (‘face space’) and then classifying the face by comparing its position in the face space with the positions of the known individuals. The Eigenface approach gives us efficient way to find this lower dimensional space. Eigenfaces are the Eigenvectors which are representative of each of the dimensions of this face space and

they can be considered as various face features. Any face can be expressed as linear combinations of the singular vectors of the set of faces and these singular vectors are eigenvectors of the covariance matrices. The Eigenface approach for Face Recognition process is fast and simple which works well under constrained environment. It is one of the best practical solutions for the problem of face recognition. Many applications which require face recognition do not require perfect identification but just low error rate. So instead of searching large database of faces, it is better to give small set of likely matches. By using Eigenface approach, this small set of likely matches for given images can be easily obtained.

“Face recognition using eigenfaces and artificial neural networks” (Mayank Agarwal, Nikunj Jain, Mr. Manish Kumar and Himanshu Agrawal) [4], this paper presents a methodology for face recognition based on information theory approach of coding and decoding the face image. Proposed methodology is connection of two stages – Feature extraction using principle component analysis and recognition using the feed forward back propagation Neural Network. The algorithm has been tested on 400 images (40 classes). A recognition score for test lot is calculated by considering almost all the variants of feature extraction. The proposed methods were tested on Olivetti and Oracle Research Laboratory (ORL) face database. Test results gave a recognition rate of 97.018%.

III. PROPOSED SYSTEM

Face Recognition Based Attendance System Using Deep Learning:

The present system of attendance marking i.e., manually calling out the roll call by the faculty have quite satisfactorily served the purpose. With the change in the educational system with the introduction of new technologies in classroom such as virtual classroom, the traditional way of taking attendance may not be viable anymore. Even with rising number of course of study offered by universities, processing of attendance manually could be time consuming. Hence, in our project we aim at creating a system to take attendance using facial recognition technology in classrooms and creating an efficient database to record them.

Block diagram:

The block diagram in figure 4-1 describes the proposed system for Face Recognition based Classroom attendance system. The system requires a camera installed in the classroom at a position where it could capture all the students in the classroom and thus capture their images effectively.

This image is processed to get the desired results. The working is explained in brief below:

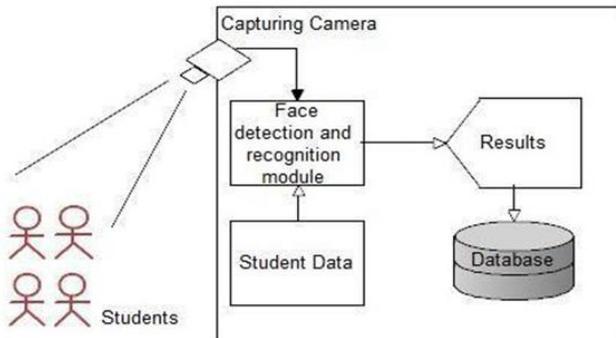


Figure 1: Proposed system

Capturing Camera: Camera is installed in a classroom to capture the face of the student. The camera has to be placed such that it captures the face of all the students effectively. This camera has to be interfaced to computer system for further processing either through a wired or a wireless network. In our prototype we use the in-built camera of the laptop.

Image Processing: Facial recognition algorithm is applied on the captured image. The image is cropped and stored for processing. The module recognizes the images of the students face which have been registered manually with their names and ID codes in the database. We use MATLAB for all the image processing and acquisition operations. The whole process requires the following steps:

Train Database: Initially we take facial image of the enrolled students. In our system we have taken three images each. This data is used later used in the facial recognition algorithm. It is done using Image Acquisition Toolbox of the MATLAB. All the cropped image of the face is resized to a 240 X 300 image.

Face Detection and cropping: The captured image of the classroom is initially scanned to detect faces. This is done using Computer Vision Toolbox by the function `vision.CascadeObjectDetector()`. This function work on the basis of Viola-Jones algorithm. This algorithm focuses more on speed and reliability. The detected faces are cropped and resized to a 240 X 300 image, same as the train database.

Face Recognition: For recognition, the feature locations are refined and the face is normalized with eyes and mouth in fixed locations. Images from the face tracker are used to train a frontal Eigen space, and the leading three eigenvectors are retained. Since the face images have been warped into frontal views a single eigen space is enough. Face recognition is then performed using the Eigen face approach with additional

temporal information added. The projection coefficients of all images of each person are modelled as a Gaussian distribution and the face is classified based on the probability of match.

Attendance Recording: We use Excel spreadsheet to store the recorded attendance for easy-to-use output format, which is also the software which is familiar to majority of the institution staffs. This is done using Spreadsheet Link EX toolbox. If a student is recognized, the corresponding cell is updated with '1', else a '0'. Using the formatting in the Excel, we can effectively retrieve the information effectively.

IV. RESULT AND ANALYSIS

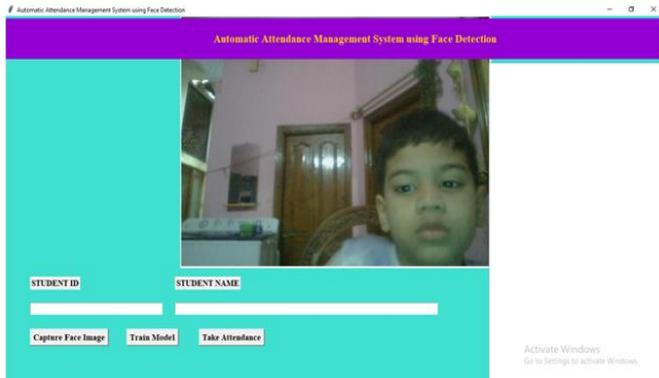
The attendance system has been implemented in a Lenovo laptop computer with the following specifications: Intel core i5-7200U CPU @2.50GHz, RAM 8.00GB, Windows 10 Pro. The system consists of three programs developed in Python 3.

The first program captures 10 face pictures for each student in the class. The second one compiles Face Net model and loads parameters. The third one generates the database based on the pictures captured by the first program, recognizes the face at the real-time web camera, and updates the attendance record in the excel file. Thus, all visible results are delivered by the third program. Fig.4.3 is a screenshot that shows the result of a face recognition.

The information of the result includes the frame identifying the location of the detected face, the recognized name (Amilie) at the up left corner of the frame, and the corresponding distance (0.4891317) to Amilie's face encoding in the database. This distance gives a confidence on how surely the person is "Amilie": the smaller it is, the more likely he/she is "Amilie". The bigger word "Amilie" at the top center is the result based on the 10 consecutive recognitions.

Fig. shows a portion of attendance record in an excel file created by the attendance system. In Fig.4.4 the first column is for students' names and the second is the attendance record. The number for a student is the number of recognitions among 10 trials. A blank for a student means that either the student did not check the attendance, or the number of recognitions is less than 5 (i.e. face recognition failed). In case of the failure of recognition, the student needs to inform the instructor for a manual attendance marking. The test results in one class with 28 students showed that the accuracy of face recognition is about 95%. However, the attendance system is sensitive to the changes of lightening and the distance between face and camera. Dramatical change of these conditions can significantly reduce the accuracy.

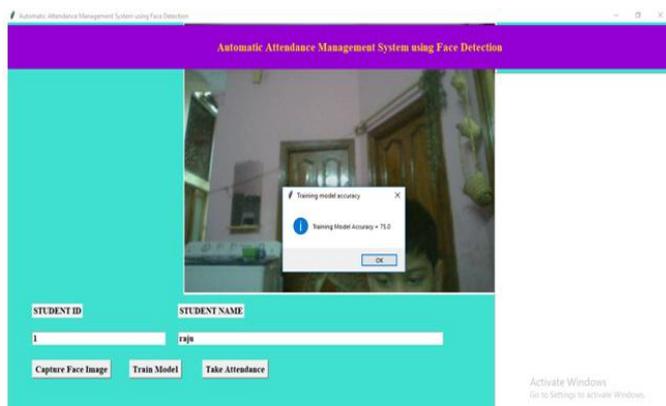
To run project double click on 'run.bat' file to get below screen:



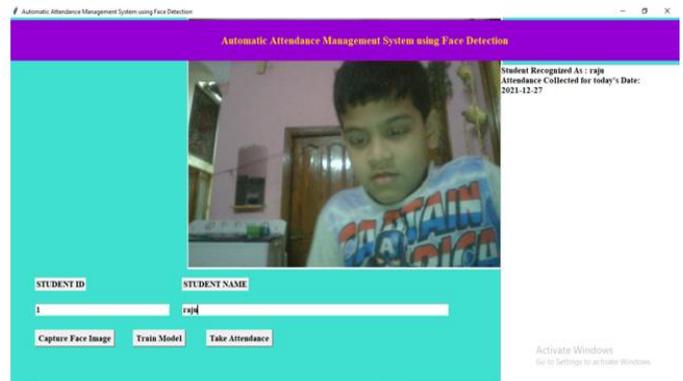
In above screen enter student id and name and then click on 'Capture Face Image' button to capture face like below screen.



In above screen face is detected and now clicks on 'Train Model' button to perform training like below screen.



In above screen training completed with accuracy 75% and then any time click on 'Take Attendance' to recognized student and mark attendance.



In above screen in text area we can see student identified as Raju. Similarly you can capture N student and take attendance.

Note: this application depend on camera clarity so identifying of student may be correctly recognized 5 times out of 10. This types of application need more refinement to build accurate model.

Note: to train model atleast two students must be added or registered.

V. CONCLUSION

The system we have developed has successfully, able to accomplish the task of marking the attendance in the classroom automatically and output is obtained in an excel sheet as desired in real-time. However, in order to develop a dedicated system which can be implemented in an educational institution, a very efficient algorithm which is insensitive to the lighting conditions of the classroom has to be developed. Also a camera of the optimum resolution has to be utilised in the system. Another important aspect where we can work towards is creating an online database of the attendance and automatic updating of the attendance into it keeping in mind the growing popularity of Internet of Things. This can be done by creating a standalone module which can be installed in the classroom having access to internet, preferably a wireless system. These developments can greatly improve the applications of the project.

Maintains Overall Records: An automated face recognition attendance system maintains the overall presence record of the students in the institution. Leaves taken by the students, date of absent each data is stored in the system.

Get Rid of Pen & Paper System: The newest technology helps in replacing the older paper register method efficiently. It also saves money that the organization uses to spend on the paper. Face-recognition time attendance system gives better maintenance of data as it supports the electronic medium of

data storage. Also the system gives a good impression about the organization in front of the business clients and other concerned people.

Financial Benefits: The face-recognition time attendance system helps in saving time, eliminates the manual mistakes and controls the overall system. Since the face recognition system controls every single event electronically therefore, reduces the possibility of error. The attendance is noted down electronically therefore it saves time of the lecturers which they can use efficiently in lecturing.

Easy Integration: Integrated Biometric facial systems are also easy to program into any computer system. Usually they will work with existing software that one has in their place.

High Success Rate: Facial biometrics technology today has a high success rate, especially with the emergence of 3d face recognition technologies. It is extremely difficult to fool the system, so one can feel secure about the system.

Proxy Attendance Is Eliminated: Attendance is taken automatically by the camera placed in the classroom therefore there will be no chances of proxy attendances.

Saves Time: In traditional attendance marking system Lecturer calls each student's name with respect to their ids which is a very much time consuming job this system restores the time consumed for calling attendance by automatically marking attendance.

Less Mistakes: here will be chances of making mistakes while manually marking attendances by lecturers, while taking attendance automatically there will not be any chances of mistakes since the system is computer based.

Virtual Classroom: Virtual classrooms are the class rooms without the lecturers to teach as students will be learning online. This system is very useful in virtual classrooms where there will be no lecturers to take attendances this system will automatically manage the attendances of the students.

Simple Algorithm & Flowcharts: This system uses a simple algorithm and flowchart which is easy to understand as there are no complicated sections, information flow is simple as there is less hardware's components used therefore each section is clearly understood.

We see the system have lot of advantages of the system. But as in most systems some drawbacks have been observed in the system.

Sensitive to Light – If the ambient lighting in the training images and the images taken during the processing varies,

there is a high possibility in face recognition incorrectly. Hence we need to keep in mind the lighting conditions of the classroom during the process of collecting the database of the students.

In this system we have implemented an attendance system for a lecture, section or laboratory by which lecturer or teaching assistant can record students' attendance. It saves time and effort, especially if it is a lecture with huge number of students. Automated Attendance System has been envisioned for the purpose of reducing the drawbacks in the traditional (manual) system. This attendance system demonstrates the use of image processing techniques in classroom. This system can not only merely help in the attendance system, but also improve the goodwill of an institution.

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