

FACIAL RECOGNITION BASED ATTENDANCE SYSTEM USING CONVOLUTIONAL NEURAL NETWORK

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ABSTRACT

The auto attendance management system is being utilized in various organizations. But authentication is a significant issue in this system. Face recognition is one of the biometric methods to improve this system. Also, facial recognition is being used enormously in several such applications, like video monitoring and CCTV film framework, an interaction between robot and its actuator's and network security. The principle execution steps utilized in this sort of framework are face recognition and perceiving the recognized face. This paper proposes a system for implementing an automated attendance management system for students of a class by making use of face recognition technique, by using Dlib, and Deep Convolutional Neural Network (CNN). After these, the association of perceived countenances should be possible by contrasting and the database containing student's images. This model will be an effective strategy to deal with the participation and records of Students.

Keywords-Real-time Face Recognition, Histogram of oriented gradient, SVM, Face Recognition, attendance management system.

I. INTRODUCTION

The attendance is one of the key feature of every profession. It is mandatory for each person to maintain regularity and punctuality to keep the working environment healthy. There are different attendance policy every organization has but the basic way of maintaining it is same, either manually (hazy and cumbersome) or Automatic (systematic and robust).

Recently in the last decade, with a rapid revolution in technology, embedded systems designed for automatic attendance monitoring become more advanced and accurate. The figure below illustrates the flow of data in automatic attendance system(AAS).

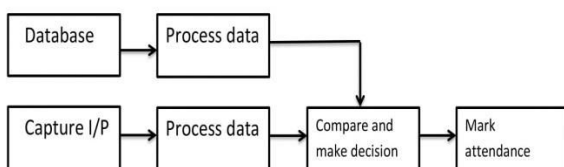


Figure 1: Flow of data in AAS

There are lots of systems available with different aspects: technology used for implementation, cost, reliability, response, throughput, security. There are systems like Radio-frequency identification (RFID), Global Positioning System (GPS) [4]

based, and Barcode / QR code based but the demerit is that user has to carry the identification device, also risk of proxy or frauds are increases which compromise the security. Therefore, some system are available which eliminate the use of external devices for attendance purpose by providing a common system for everyone like voice recognition, fingerprint recognition [5], face recognition, Iris recognition. These systems are based on Artificial intelligence, deep learning, neural network algorithms which make their practical implementation possible. These solutions could be more flexible, but they all have their own flaws and also they are not 100% precise.

The system proposed in this paper is robust and stable to record the attendance and generate a report in just one click. It provides solution for face recognition tasks with various modern approaches like Convolution Neural Network, Dlib state-of-the-art face recognition [1]. The system has an accuracy of 99.38%.

The rest of the paper is organized as follows: Section II presents the literature review, Section III presents the methodology, Section IV presents the results and discussion, Section V presents the conclusion, Section VI present the future scope, and finally, Section VII holds the references.

II. LITERATURE REVIEW

Woodrow Wilson Bledsoe was the founder of face recognition (1966), who later founded Artificial intelligence (1977), followed by several researchers, develop this technology accurate enough to recognize fast moving objects.

There are various face recognition and facial features extraction algorithms available in Open CV like eigen faces, Fisher faces, local binary pattern histogram(LBPH),speed up robust feature, the scale invariant feature transform, Convolutional neural networks (CNN) etc. These algorithms are widely used in experimentation to evolve more advanced techniques.

The system proposed by V N Prudhvi Raj [2], is an Attendance management system which is built using different types of algorithms like local binary pattern histogram (LBPH), SVM.

This model uses Raspberry Pi 3b+ and Open CV for its implementation. Extraction of facial highlights is done as a determination on the face which is performed using pattern recognition.

In another implementation of similar systems, Shreyak Sawhney[3], designed a system in which Ada Boost algorithm for face detection and Principle component analysis(PCA) for face recognition is utilized. This model needs a continuous response from high quality video camera. It has two cameras, one outside the classroom for examining enrolled students and another inside the classroom for assigning attendance. It has two databases. One is students database, for storing their information and other is attendance database, for storing attendance.

Marko Arsenovic and their fellow [4], implemented further for another advanced system, Convolutional neural network (CNN) for face detection and recognition. Convolutional neural network (CNN) requires big pre-requisite datasets for acquiring more efficient outcome in other words datasets is directly proportional to the efficiency of the system. The author tested this system for 3 months with datasets of 5 people and the results are accurate up-to 95.02%. Some other methods are [7-9].

III. METHODOLOGY

To build up the Attendance management system, a few stages are required to be followed for achieving this undertaking effectively. The steps can be characterized in the following manners:

- Registration
- Spatial Enhancement
- Face Detection
- Face Recognition
- Attendance Marking

A. Registration

In this progression, the student is registered in the student database. General information like Name, Enrolment Number, Department, and Class are stored in the database. Along with this data, photos of the Students face from every conceivable angle showing up in the camera window are additionally stored in the student database.

With the assistance of the considerable number of images stored in the student database, facial recognition can be performed for all the students are coming to the class.

B. Spatial Enhancement

The captured frames have to be resized (Resize frame of video to 1/4 size for faster face recognition processing) and convert the image from BGR color format which OpenCV uses to RGB color which is employed by face recognition. Also, grayscale conversion is beneficial as it increases the system performance ratio.

C. Face Detection

For detecting the faces, we will be referring to the Dlib's state-of-the-art face detector. This method built by Davis King. Dlib is the toolkit used in computer vision and many projects (especially for object detection).Dlib uses facial landmarks to detect faces in the image. The CNN based detector available in Dlib can detect faces in all conceivable angles. Then, Facial extraction technique is used that reduce the image to a size in which face is available, the image is decreased to a size of 150x150.When the detection part is effectively finished, we will be proceeding onward to the following stage. The next stage in this framework is Face Recognition.

D. Face Recognition

For facial recognition, We will make use of face encoding. This method is used to generate an array of the detected face in the above stage and that array is compared with the array of the students face available in the database. The result of the comparison will be a Boolean value depending upon the tolerance level set in the program. This process is very fast and took only 0.36Sec.

If the students face is not available in database, system will send the image of the unknown person to official's and inform them every time the process of attendance carried out to enroll this person in the database

E. Attendance Marking

At the mid of the lectures, the process of the system start and recognize the face of all the students attending the lecture. With the help of this, attendance for that lecture will be marked in the attendance database and total student students present in the lecture is displayed on the LCD screen outside the class (bulletin board).

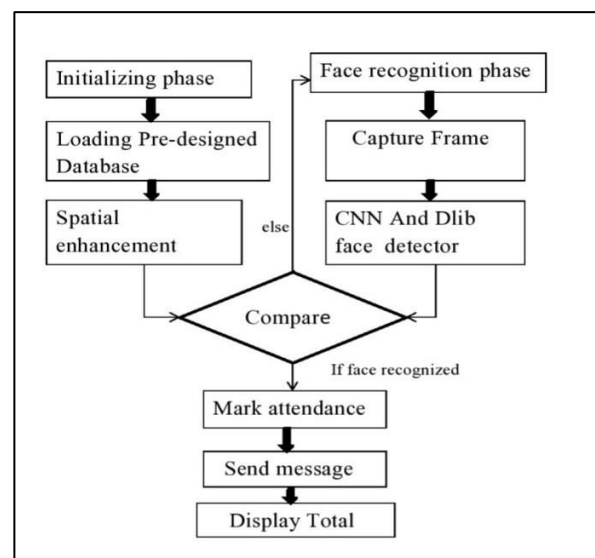


Figure 2: Algorithm

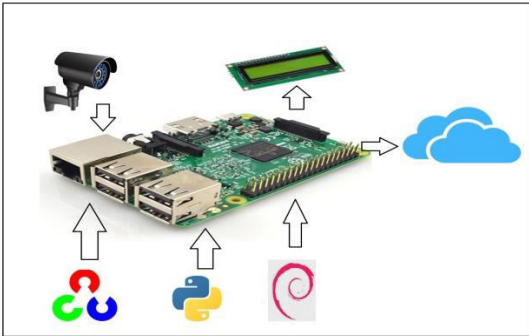
IV. HARDWARE AND SOFTWARE USED:

A. Hardware:

Raspberry Pi 3b: a Broadcom BCM2837B0 quad-core A53 (ARMv8) 64-bit processor, 1GB SDRAM, Micro SD slot, 4xUSB ports, CSI camera and display port etc.

LCD Display: A 16x2 LCD display is a very basic module, it can display 32 characters, each character is displayed in 5x7 pixel matrix.

Camera: A high resolution camera located at a point from where every student is clearly visible.



B. Software:

Raspbian, OpenCVlibrary, Dlib Library, NodeRed etc.

V. RESULT

The Advanced Attendance system was implemented as a hardware with Python as a backbone, Node Red and Excel (for the database) on a Raspberry Pi 3B+ with a Broadcom BCM2837B0 quad-core A53 (ARMv8) 64-bit processor and 1GB RAM running Raspbianos. The camera for this study is 8MP Pi camera and 16x2 LCD display. The graphical user interface (GUI) for different activities are provided in Figs. 3-5



Figure 3: Face detection and recognition

Face detected and once recognized, name of the student is displayed at the bottom label of the face.

	A	B	C	D	E	F	G	H
1	Roll No.	Name	1/2/2020	2/2/2020	3/2/2020	4/2/2020	5/2/2020	6/2/2020
2	133EC001	Ajay Kumar	present		present	present	present	present
3	133EC002	Aman Rajput	present		Absent	present	present	present
4	133EC003	Gaurav Singh	present		Absent	present	Absent	Absent
5	133EC004	Harry sinha	present		present	present	present	present
6	133EC005	Jay	Absent		present	present	present	present
7	133EC006	Mohit	present		present	present	present	present
8	133EC007	Nimesh	present		present	present	present	Absent
9	133EC008	Rohan	present		present	present	Absent	present
10	133EC009	Shubham	Absent		present	present	present	present
11	133EC010	Varun	Absent		Absent	present	present	present

Figure 4: Record in excel sheet

Attendance record of students generated in the month of February.

Shell	
Total countours found:	2
Total countours found:	3
Total countours found:	3
Total countours found:	3
Total countours found:	1
Total countours found:	1
Total countours found:	1

Figure 5: Total No. of moving objects in a room

The testing part of this system is carried out in a class of fifty students for a period of 30 days. The attendance report [Fig 4] is matched with manual attendance report and the output is exactly same.

VI. CONCLUSION

The designed attendance monitoring system is performing well accurately with a load of 100 people and its efficiency will increase if dataset is reduced. The system is using HOG and SVM algorithms for face detection and face recognition. There are many algorithms available which can do this work more precisely. Also, This solution does not depend on highly sophisticated hardware's which make its implementation economical. Only A CCTC camera, A Raspberry Pi and database are sufficient for constructing the automated attendance system.

VII.FUTURE SCOPE

As the people covering faces cannot be identified, this issue can be solved by having facial fiducial points of the faces through which attendance can be marked. It will be done on the basis of the statistics gained about the eyes of the people. It is established that the problem exists so in future, So work on this should also be done to solve the problem. Also, in some cases the poor lighting state of the room may influence picture quality which by implication degrades system performance, this can be overcome in the further stages by improving the nature of the video or by utilizing algorithms.

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