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Employees Attendance Management using Face Recognition

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Abstract

Human face recognition plays an important role in applications such as video surveillance, human computer interface and face image database management. Our goal is to design a system that detects faces and facial features, and use these detected facial features as indices for identification. This system is developed by capturing real-time human faces.

In our project we are introducing new convolutional neural network method to tackle the face recognition to maintain a high accuracy while running in real time. This System can be used in Government Schools and Colleges to monitor and validate attendance. This process is carried out for every employee and is given attendance accordingly. The person will be enrolled to the database using their unique id (captured with persons audio) with sufficient number of face images each. The information will be stored in the folder. Image captured in the previous stage is taken as input in this stage. Face detection and recognition are performed followed by face alignment and the aligned faces are cropped. Local (LBP) and Global (HOG) features are extracted and trained using Haar Cascade Classifier for detection and SVM is used for face recognition.

After training the system on the database our system is placed in the room. Camera is adjusted in such a way that all the employees' faces are visible. Finally, for the captured image, Face Recognition is performed on stored database and attendance is recorded.

Keywords: Raspberry pi processor, Face recognition using CNN, Camera, LCD display, Buzzer and Microphone.

1. Introduction

Face and speech are the two most popular means of personal identification particularly when the person to be identified is physically present. Hence, these two modes become handy in machine effected personal identification using biometrics for automatic access control. Human face does not only provide information on personal identification but also information on gender, race, and age group. Speech conveys information on "what is said" and in addition information on the speaker identity, gender, accent, and age group. This project exploits the machine ability to recognize human face and the possibility of porting man's ability to recognize people by their voices to machine.

The block diagram Employees Attendance Management using Face Recognition is shown in Figure 3.1. Converts speech of the user to text as the user has to speak his/her name as the system asks. If the user's voice matches with the Id, then it will go onto the face recognition part otherwise the function will terminate by showing an appropriate message. If the Id is matched, Input color image is captured through webcam. The captured image is resized and converted to gray scale. Later the Gray scale image is passed through Haar cascade classifier. When a face is detected, feature extraction is done using HOG. The facial embeddings are verified with the previously present encodings present with respective to that Id. Finally, the attendance is

recorded. If more than one face or no faces are found in the frame then it will generate an error message.

2. LITERATURE SURVEY

J. Joseph and K. P. Zacharia also proposed a system which implements automatic attendance using face recognition. The system which can extract the object in the face such nose, mouth by using MATLAB with Principal Component Analysis (PCA). The system designed to resolve the issues of attendance marking system such as time-consuming. As the result of the experiment show that this paper, the system can recognize in case the dark background or difference view of the face in the classroom.

Jyotshana Kanti proposed a smart attendance marking system which combines two differencing algorithms such Principal Component Analysis and Artificial Neural Network. The purpose of the author is to solve the traditional attendance marking system and to resolve the time-consuming. In the system implement with Principal Component Analysis, it does an extraction and identifies the similarities of the face database and acquire images. Artificial Neural Network is used to solve the problem of the input data or learn from the input data, and the expect value. In the system implemented by the author using back propagation algorithm and combines with mathematical function to perform in that system. As a result, written by the author research, it shows that the system can use to recognize in a different environment.

Priyanka Thakare proposed a method using Eigenface and Principal Component Analysis which has the architecture as the following step. The camera needs to install in the front which can capture an entire face of the student inside the class. The first phase after the camera has been captured; the captured image was transferred into the system as an input. The image capture from the camera sometimes come with the darkness or brightness which need to do an enhancement on it such as convert to Gray image. The next step, Histogram Normalization is used in this system remove the contrast of the image. It is easy to recognize when has the student sit in the back row. The Median filter is used to remove noise from the image in case the camera is high-definition camera, but sometimes it still contains the noise. The author also implements with skin classification which changes all the pixel to black except the pixel are close to the skin.

3. Implementation:

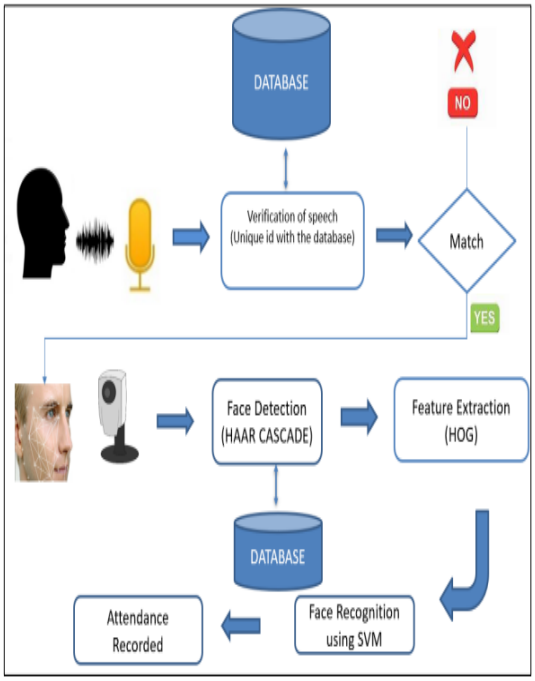

Figure:3.1 Employees Attendance Management using Face Recognition

The design part of the Employees attendance management system is divided into two fragments which consist of the hardware and the software part. Before the software part can be developed, the hardware part is first completed to provide a platform for the software to work. To enroll and recognize the faces we need to first connect the device to through the PC. To connect the device followings steps has to be done:

1. Firstly connect the camera and microphone to the raspberrypi through USB ports which are important for detection.
2. To supply power to the board connect the adaptor to the board
3. Connect the PC and the device using LAN cable
4. Now after the PC is connected to any network open the remote-control desktop on the computer and check for device with name as "raspberrypi".
5. Now open the app and enter username and password as "pi" and "123" to sign in.
6. The Project Works in 2 modes:

A. Enrolling Mode
B. Search Mode

A. ENROLLING:

First when the app is accessed if it's a new user it proceeds toward Enrolling step where the necessary details like ID, Department, Contact Info, Email-ID are entered along with the set login and logout timings and recorded. Next, the camera

is switched on and captures the images of the users and proceeds to store them in database. The enrolling step is now completed and the model is trained using the above-captured images.

B. SEARCH:

Now, the user data is already in the Database so Attendance verification is to verify if the current user is eligible for the attendance login/logout In this step first details are recorded through microphone and the camera captures a present picture and compares or verifies it using the 1*1 verification method, if the ID is matched then attendance login/logout is done depending upon the time if the face is not recognized then an error message is observed on the LED screen and the above steps are again repeated for another user this loop continues until we stop the execution of the code.

4. Related Work:

The brief introduction of different modules used in this project is discussed below:

A. Raspberry Pi 4:

Fig: Raspberry Pi Model 4 B

Raspberry Pi 4 Model B is the latest product in the popular Raspberry Pi range of computers. It offers ground-breaking increases in processor speed, multimedia performance, memory, and connectivity compared to the prior-generation Raspberry Pi 3 Model B+, while retaining backwards compatibility and similar power consumption. For the end user, Raspberry Pi 4 Model B provides desktop performance comparable to entry-level x86 PC systems. This product's key features include a high-performance 64-bit quad core processor, dual-display support at resolutions up to 4K via a pair of micro-HDMI ports, hardware video decode at up to 4Kp60, up to 4GB of RAM, dual-band 2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet, USB 3.0, and PoE capability (via a separate PoE HAT add-on). The dual-band wireless LAN and Bluetooth have modular compliance certification, allowing the board to be designed into end products with significantly reduced compliance testing, improving both cost and time to market.

Raspberry Pi processor is programmed using embedded 'Linux'. Linux is the best-known and most-used open source operating system. As an operating system, Linux is software that sits underneath all of the other software on a computer, receiving requests from those programs and relaying these requests to the computer's hardware.

B. LCD Display:

Fig: LCD Display

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multisegmented light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

C. MICROPHONE:

Fig: USB Microphones

USB Microphones are the easiest way of getting a microphone working with your Raspberry Pi. One of the most significant advantages of using a USB microphone is that it is plug and play. The Raspbian operating system will automatically detect the microphone when its plugged in.

D. CAMERA:

The cameras in modern mobile platforms allow users to capture still and motion video of their surroundings, and to use video and audio to communicate with other users over the Internet. The general goal of power management for a camera device can be described simply—the camera subsystem must be powered off, consuming zero watts, unless the camera is in active use. The camera module is connected to raspberry pi.

Fig: Camera

E. BUZZER:

A buzzer is an audio signalling device which is mostly used as an alarming device or user input feedback in devices. Buzzers can make beeping sounds in different frequencies and durations. Typical applications including siren, alarm devices, fire alarm. It is widely used in household appliances, electronic toys game machine and many more industries. The big advantage of a buzzer is the wide spectrum of volume.

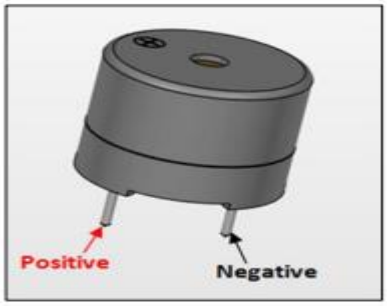

Fig: Buzzer

F. Face Recognition Using CNN:

Convolution Neural Networks are special kind of Neural Networks which helps the machine to learn and classify the images. Convolution is a mathematical operation that allows the merging of two sets of information. The main advantage of CNN compared to its predecessors is that it automatically detects the important features without any human supervision. For example, given many pictures of cats and dogs it learns distinctive features for each class by itself. CNN is also computationally efficient.

CNNs use image recognition and classification in order to detect objects, recognize faces, etc. They are made up of neurons with learnable weights and biases. Each specific neuron receives numerous inputs and then takes a weighted sum over them, where it passes it through an activation function and responds back with an output. Due to digital colour images having red-blue-green (RGB) encoding, CNNs mix those three colours to produce the colour spectrum humans perceive. A convolutional network ingests such images as three separate strata of colour stacked one on top of the other. A normal colour image is seen as a rectangular box whose width and 33 height are measured by the number of pixels from those dimensions. The depth layers in the three layers of colours (RGB) interpreted by CNNs are referred to as channels.

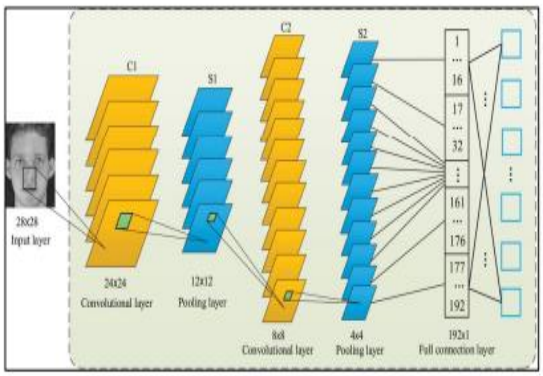

Figure-: Layers of CNN

4. CONCLUSION:

In the implementation of our system, we have used two Machine learning algorithms SVM and CNN, both of these gave an acceptable result. We have implemented SVM algorithm on real-time dataset and observed that SVM algorithm gave a recognition rate of "76.16%". The LeNet architecture for CNN is implemented on standard dataset of face recognition (AR database) gave an accuracy of "95.3125%". We can conclude that LeNet CNN architecture is more suited for our project requirements and has a better accuracy than SVM algorithm. The performance of proposed model Employees Attendance Management has highest recognition rate than compared with the existing model. Further proposed model is automated but most of the existing systems require semi manual interference.

With this project, we increase the level of security. If any one of face or ID (through voice) is not matched with the database then the person is denied for the next step or his/her face is not recognized.

5. ACKNOWLEDGEMENT

We would like to thank all the authors of different research papers referred during writing this paper. It was very knowledge gaining and helpful for the further research to be done in future.

6. RESULTS

6.1 ANALYSIS OF TRAINING AND TESTING DATA

Our dataset comprises of 39 distinct people with 8 different images each. Now these 312 images are used for training using SVM. For testing we have used 156 real-time images which are captured through the device. If the face is found, then face is processed by the given algorithm. After successful execution of code, the output is obtained.

Following are some recognized faces of testing:

Figure-6.1: Recognized Image 1

Figure-6.2: Recognized Image 2

Figure-6.3: Recognized Image 3

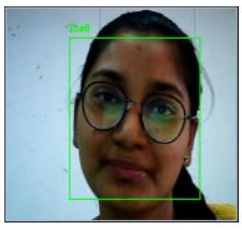

Figure-6.4: Recognized Image 4

The below shown picture is the android app information about the recorded attendance of the employees.

6.2 OUTPUT: To get an accurate result we have to use a good dataset consisting of different departments such as CSE, ECE, MECHANICAL, IT etc. 8 images are used for enrollment and, on an average 5 images are used for obtaining Hit percentage.

The Recognition rate is as follows:

Case	Faces Trained	Faces Tested	Faces Recognized	Hit Percentage
1	8	5	4	80
2	8	6	5	83
3	8	5	3	60
4	8	5	4	80
It1	8	4	3	75
It2	8	4	4	100
It3	8	4	3	75
It4	8	4	3	75
Ece1	8	5	3	60
Ece2	8	4	3	75
Ece3	8	4	4	100
Ece4	8	4	2	50
Ece5	8	5	3	60
Ece6	8	4	4	100
Ece7	8	6	4	66.6
Ece8	8	5	4	80
Ece9	8	4	3	75
Ece10	8	4	3	75
Mech1	8	4	2	50
Mech2	8	4	3	75
Mech3	8	5	4	80
Cse1	8	4	4	100
Cse2	8	4	3	75
Cse3	8	7	5	71.4
Cse4	8	5	3	60
Cse5	8	4	3	75
Cse6	8	4	3	75
Cse7	8	5	4	80
Cse8	8	4	3	75
Cse9	8	4	3	75
Cse10	8	5	5	100

Table: Hit Percentage for Real-time database

6.3 HIT PERCENTAGE FOR CNN:

Hit Percentage = (faces recognized / faces tested) * 100 The greater the Hit percentage, the accuracy of recognizing the faces is high.

Case	Faces trained	faces tested	faces recognized	Hit Percentage
Person -1	15	4	3	75
Person -2	16	4	4	100
Person -3	15	4	4	100
Person -4	15	4	4	100
Person -5	15	4	4	100
Person -6	16	4	4	100
Person -7	15	4	3	75
Person -8	15	4	4	100
Person -9	15	4	4	100
Person -10	15	4	4	100
Person -11	16	4	4	100
Person -12	15	4	4	100
Person -13	15	4	4	100
Person -14	16	4	3	75
Person -15	15	4	4	100
Person -16	15	4	4	100

Table: Hit Percentage Table for CNN

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