Project Report
on
Attendance System using Facial Recognition

submitted in partial fulfillment of the requirement
for the award of the Degree of

Bachelor of Engineering
in
Electronics & Telecommunication Engineering

by

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June 2020

Certificate

This is to certify that the Project entitled "Attendance System using Facial Recognition" has been completed successfully by Mr. Aashay Phirke, Mr. Sudhanshu Lodha and Ms. Upasana Thakuria under the guidance of Dr.Rajendra Sawant for the award of Degree of Bachelor of Engineering in Electronics & Telecommunication Engineering from University of Mumbai.

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Project approval Certificate

This is to certify that the Project entitled "Attendance System using Facial Recognition" by Mr. Aashay Phirke, Mr. Sudhanshu Lodha and Ms. Upasana Thakuria is approved for the award of Degree of Bachelor of Engineering in Electronics & Telecommunication Engineering from University of Mumbai.

External Examiner **Internal Examiner**

(signature) **(signature)**
Name: **Name:**

Date: **Date:**

Seal of the Institute

Contents

Abstract

The administration of the participation can be an incredible weight on the lecturers on the off chance that it is finished by hand. To determine this issue, savvy and auto participation the board framework is being used. The shrewd participation framework is commonly executed with the assistance of biometrics. Face acknowledgment is one of the biometric techniques to improve this framework. Being a prime component of biometric confirmation, facial acknowledgment is being utilized colossally in a few such applications, similar to video observing and CCTV framework, an interaction between computer and humans and access systems present indoors and network security. By utilizing this framework, the problem of proxies and students being marked present even though they are not physically present can easily be solved.

Chapter 1

Introduction

1.1 Introduction

To verify the student attendance record, the personnel staff ought to have an appropriate system for approving and maintaining the attendance record consistently. By and large, there are two kinds of student attendance framework, i.e. Manual Attendance System (MAS) and Automated Attendance System (AAS). Practically in MAS, the staff may experience difficulty in both approving and keeping up every student's record in a classroom all the time. In a classroom with a high teacher-to-student ratio, it turns into an extremely dreary and tedious process to mark the attendance physically and cumulative attendance of each student. Consequently, we can execute a viable framework which will mark the attendance of students automatically via face recognition. AAS may decrease the managerial work of its staff. Especially, for an attendance system which embraces Human Face Recognition (HFR), it normally includes the students' facial images captured at the time he/she is entering the classroom, or when everyone is seated in the classroom to mark the attendance.

In today's automation era, every information is being processed by the machine with artificial intelligence and used in many sophisticated applications. Biometric-based technologies include the identification based on physiological characteristics: face,fingerprints,finger geometry, hand geometry, hand veins, palm, iris, retina, ear, voice and behavioral traits such as gait, signature and keystroke dynamics. Almost all the biometric technologies require some voluntary action by the user,i.e. the user needs to place his hand on a hand-rest for finger printing or hand geometry detection and has to stand in a fixed position in front of a camera for iris or retina identification. However,face recognition can be done passively without any definite action or participation on the 2 part of the user, since face images can be acquired from a distance by a camera, and hence it is more appropriate for security and surveillance purposes. Further, data acquisition in general is fraught with problems for other biometric techniques that rely on hands and fingers. Expensive equipments are required for the iris and retina identification, and these methods are more sensitive to any body motion. However, facial images can be easily obtained with a couple of inexpensive fixed cameras. They cannot be modified or forged, and they are not affected by background sound noise. Face recognition algorithms with appropriate preprocessing of the images may compensate for noise, slight variations in orientation, scale and illumination.

1.2 Motivation

1. Need for Smart Classes: This methodology can be influenced by the need of smart classrooms and reduce the human intervention in the classroom management.

2. User Friendliness: The system is fully user friendly with minimal intrusion of the beneficiary with the system required.

3. Time efficient: This project will help increase the focus in learning process and reduce the time taken for attendance by 20-25 percent.

4. Cost effective: The entire functioning relies upon a CCTv camera which is present in almost all the classrooms which is then connected to a circuit acting as a processing unit.

5. Make in India: Help our country to be rich in technological aspects and build the product thus generating revenue for the nation.

1.3 Objectives

The objectives are as stated below:

1. To maintain student attendance record by reducing human intervention in the process.

2. To create a user friendly solution which eliminates the time spent in banal tasks every lecture.

3. To enable real time CCTV surveillance and thereby keep an eye on the student during the class.

4. Increase the efficiency of the lecture in classroom.

5. To get alerts and automated attendance reports after a specified mentioned interval.

6. Nullify the proxy attendance which can manipulate the entire student record in the institution.

1.4 Organization of Thesis

The organization of this thesis is as follows.The initial sections of Chapter 3 focuses on the survey of present technologies as well as products in our domain of expertise. The next few sections are concerned with the particular application of our product solution as well as other possible and viable fields of application. The last sections aim to determine the technical gap observed on reviewing other related models, and show how our work is distinguished from other works.

Chapter 4 elaborates on our problem statement in detail and posits our objectives for this product. Chapter 5 introduces the proposed solution. The hardware model is discussed in detail. We describe the architectural model that our communication model is built on, as well as provide a breakdown view on how data flows through this architecture. In Chapter 6 we discuss the results of the simulations carried out till date and their implications on the development process of the product. Towards the end, Chapter 7 gives a summary of the development so far as well as discusses on directions for future work.

Chapter 2

Literature Review

2.1 Introduction

The following presents any analysis of the available established technologies as well as competing products in the market of our domain. This survey aims to study the present solutions and determine the technical gap. The same is further used to mould the development process of our proposed technological solution.

2.2 What are the technologies already available and its drawbacks?

1. In 2005, Kawaguchi, proposed a model in which the faces are compared to the images in a database along with the fixed seating positions. This is a method of continuous examination which uses video streaming camera to sense the presence of the students in the class. They even estimated the seating arrangements using several different types of calculations. It is a very common architecture, which implemented using two different cameras, one is used to sense and the other one is used to capture images.This process is repeated continuously and is known as "continuous Observation".

2. Muthu Kalyani proposed a different approach to this, by using Android Devices to accomplish this task. This was done by the linkage of the android phone to the CCTV camera. After the picture being captured in the camera, it was then exposed to 3D modeling and canonical techniques were used on the pictures for the comparison.

3. The fixed seating model by Visar guaranteed the marking of attendance which used real time face detection using LMS (Learning management System). The idea here was to fix the seating arrangement of the students, detect and ten mark the attendance. Two camera's one in the front, and the other on the roof captured the image and compared with the one in record to register the attendance.

4. Abhishek Jha proposed a model wherein they used statistical techniques PCA and LDA which also matched the image taken with the stored one. They

elaborated on the lengthy and error prone processes which may affect the record of the student. They made a system which uses match scoring generated by extracting the features of the face, eyes and nose etc. Higher the score greater the chances of getting attendance marked.

5. Muthu Kalyani proposed a different solution in which she uses android based smart phones different than prior solutions. The android mobile acted as a CCTV camera which captured the image and created a 3D model out of it. The processes like 3D modelling and canonical techniques were applied and then matched with the stored database. If the image is not recognized, it is stored in the stranger database which further enhanced security.

6. The model proposed by Marko Arsenovic makes use of the topmost advancements; Convolutional Neural Networks cascade to implement face detection and Convolutional Neural Networks for the face embeddings. CNNs accomplish the best outcomes for bigger datasets, or, in other words, case underway condition, the primary test was applying these strategies on small datasets. The general precision was 95.02 percent on a little dataset of the first face pictures of workers in the ongoing condition.

7. Francisco in his research used statistical technique known as LBA (local binary algorithm) and weighted mask. This method uses facial features to identify faces in an image captured. Facial features such as nose, eyes and mouth etc were extracted. Face recognition was done by local binary patterns were used to build up the masks through which the areas to be matched were separated. These masks were the applied techniques of data mining, from which weighted masks were got. These weighted masks show that the grayest area had the more significance to recognize the face which basically focuses upon the main features of the face such as nose, eyes, lips, cheeks and forehead etc.

8. Nusrat Mubin Ara in their paper have discussed about the developments in the field of technology they used, such as face detection, normalization, face recognition, and neural networks. The authors also wrote about the methodology in which face detection is done using History of Oriented Gradients, Face Alignment using face landmark estimation, extracting features using Convolutional Neural Network and lastly generating embedding. Although their system found some false predictions, they achieved an accuracy of more than 95 percentage. Samuel Lukas in their Student Attendance system integrated the recognition system with Discrete Wavelet Transform (DWT), Discrete Cosine Transforms (DCT) and Radial Basis Function Network (RBFN), along with their respective mathematical equations. They have represented the system design of their proposed framework with the help of a block diagram to show the process flow. According to their experiment result, they attained an accuracy of 82 percent as some students were recognized as others.

2.3 Why Choose this Technology?

Many attendance management systems have been introduced in recent years to resolve the problem of attendance monitoring. Jain [5] developed a desktop based application in which students are given attendance by clicking a checkbox next to their name and then by clicking the register button to mark their presence. In 2013, Bhalla [6] have proposed blue-tooth based attendance system. Application software installed in mobile phone enables to register the attendance via blue-tooth connection and transfer the notification to the instructor. Works of [7] propose a system for employee attendance based on the fingerprint. The system compares one fingerprint template with all previously stored in the database. In [8], Joardar has developed an attendance system based on the palm dorsal subcutaneous vein pattern of individuals. However, most of these systems have respective limitations in portability, accessibility, authenticity or cost. So an endeavour to overcome the shortcomings of the respective systems leads to the development of a Smart Attendance Monitoring System.

Chapter 3

Methodology

Face Recognition involves basic four steps :

1. Data Gathering and collection : Collect the data of multiple faces and store it in separate folder.
2. Face Detection: Detect an face from the captured image and plot proper contours around the face.
3. Train Recognizer: Train the model using various face recognition algorithms.
4. Face Recognition: Recognition of the correct face of the student in classroom.

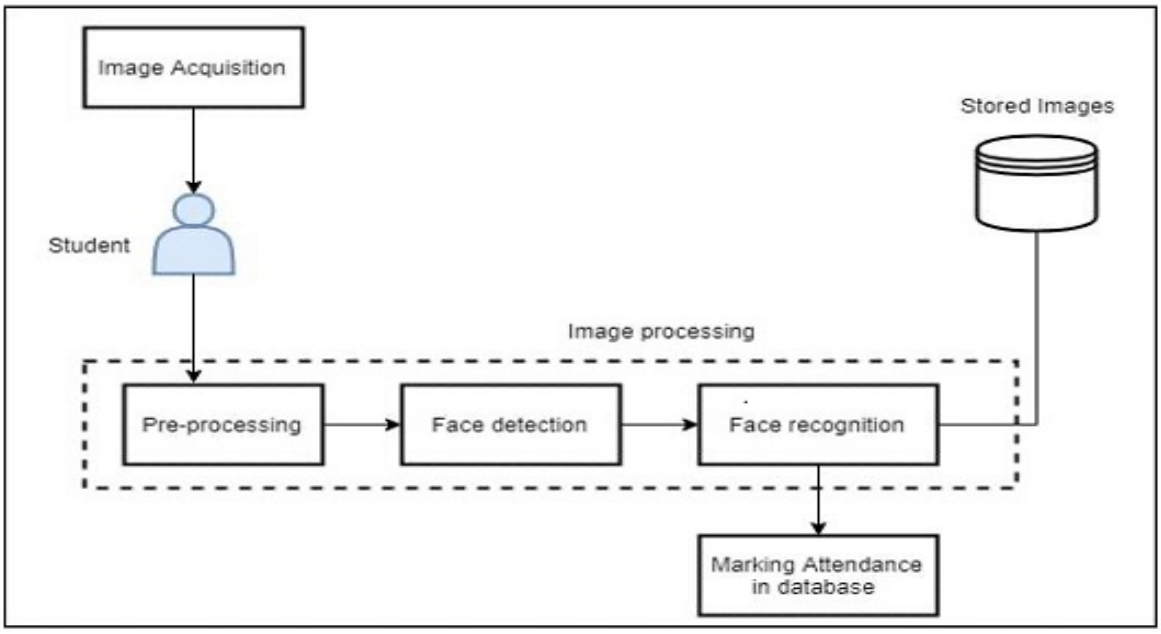

Figure 3.1: Steps involved in face detection

3.1 Capturing

Face recognition systems use algorithms to select out particular, one-of-a-kind details about someone's face. This information, inclusive of distance among the eyes or form of the chin, are then transformed right into a mathematical representation and compared to records on different faces gathered in a database. The statistics about a particular face is often known as a face template and the info can be used to differentiate one face from another.

3.2 Detection

To recognize faces in a photo, the picture can be black and white due to the fact image need not have shade records to detect faces. To account for this, every picture is warped just so the eyes and lips are constantly within the sample area within the picture. this may make it quite easy for us to examine faces in further steps.

This technique can provide you with 68 particular factors known as landmarks which are present on each face, the pinnacle of the chin, the distance between eyes etc. by way of coaching the pix system-learning set of guidelines so that it will find those sixty-eight specific elements on any face 128 measurements for every face are

Figure 3.2: 68 Landmarks Present on the face

generated using Deep Convolutional Neural Network.This technique works by means of searching 3 facial images at a moment:

- search for learning face image of a recognised human
- search for some other photo of the equal acknowledged human
- search for a photograph of a totally unique human

After repeating this step for every person in our dataset, the learning part of the neural network begins where it learns to generate 128 encodings for each human face. These measurements are known as embeddings. The complex raw statistics is then converted into a set of matrices which thus helps in training and recognition process of finding the person's name from the encoding.

To recognize the name of the man or woman in our database of acknowledged individuals who has the closest measurements to that of the given image we need any system learning type algorithm where linear SVM classifier is implemented. The input to this classifier is measurements from the image we need to recognize and output would be which known man or woman is the nearest match.

3.3 Recognition

According to [1] human faces can be detected by four methods. Four of them being Knowledge based, Feature Based, Template Matching and Appearance based. Among them all Neural Network in Appearance based detection model give the highest accuracy. Deep learning in neural networks is distinguishable by the depth data must pass for patten recognition.In deep-learning networks, every layer of nodes trains on a given set of functions based totally at the preceding layer's output. The further you increase into the neural net, the greater complicated the functions your nodes can recognize.

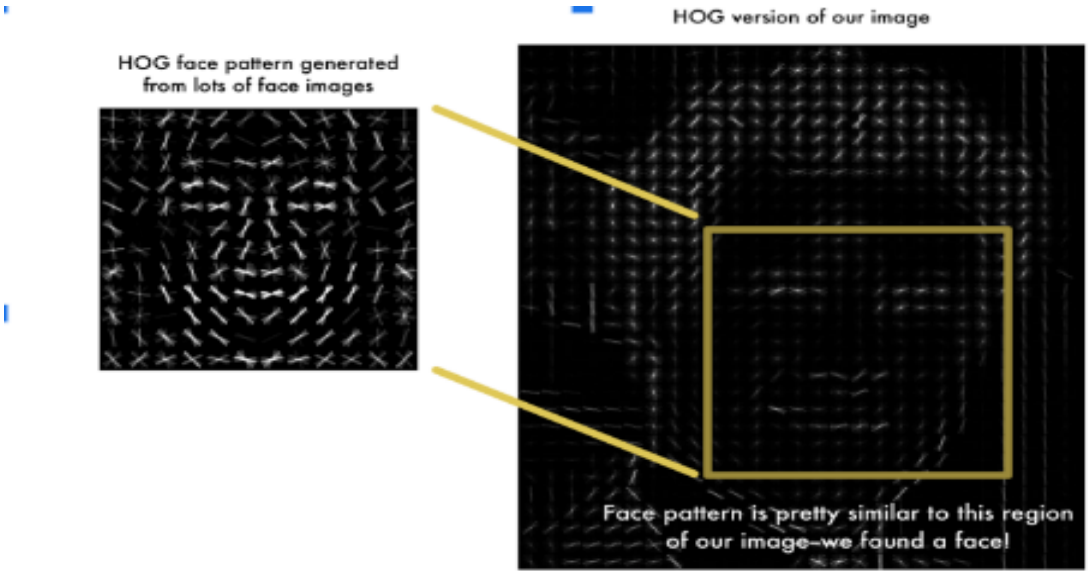

Figure 3.3: Histogram of Gradient

To obtain better accuracy HOG (Histogram of Gradient) acquires information about every single pixel in an image. A HOG descriptor is computed by way of calculating photo gradients that considers contour and silhouette statistics of grayscale images. Gradient information is converted into a 1-D histogram of orientations, thereby remodeling a 2-D photo into a much smaller 1-D vector which acts as an input for system mastering algorithms which includes support vector machines, random forests or logistic regression classifiers.

3.4 Implementation

Face recognition model use deep metric learning techniques to recognize images. To train the model we used Jurassic Park (1993) characters where 128-d embeddings were done for each face. These embeddings were used to recognize face in images as well as video input or real time camera input.

The library used for the purpose of training is 'dlib' which was trained to create 128-d embeddings on a dataset of 3 million images.Next step is to run the pickle file where all the encodings are stored.

3.5 Hardware

We have created a very scalable hardware structure which can be applied to any institute or any other infrastructure. The heart of this structure is a hub. This is the place where all the CCTV cameras are connected. Hub is connected to a database where the images and recording are stored. Raspberry pi is connected to hub and database it grabs images and the python code is applied in order to grab the detected faces from the image further the faces are recognized and attendance is marked on the google spreadsheet

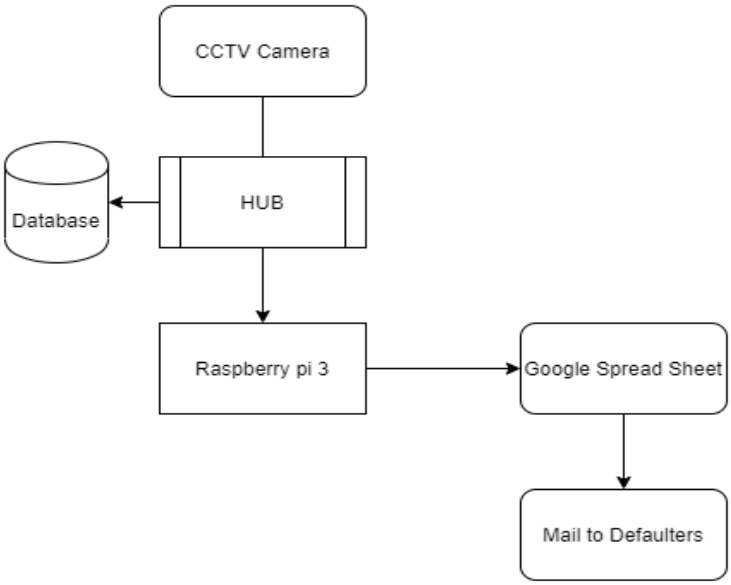

Figure 3.4: Hardware

Chapter 4

Working

The database of the students in each class is maintained systematically in the beginning of each year when the institute begins. Each student's picture is trained and encoded in a numerical vector format in the processor . At the beginning of each classroom lecture the CCTv camera placed inside the classroom captures the image after a specific interval. The interval is set by the users suitable to them. Image captured is sent to the Raspberry pi Processor where the image is converted into encodings which are further compared with the trained encodings and it sends the data of students present in the lecture to google spreadsheet using api.

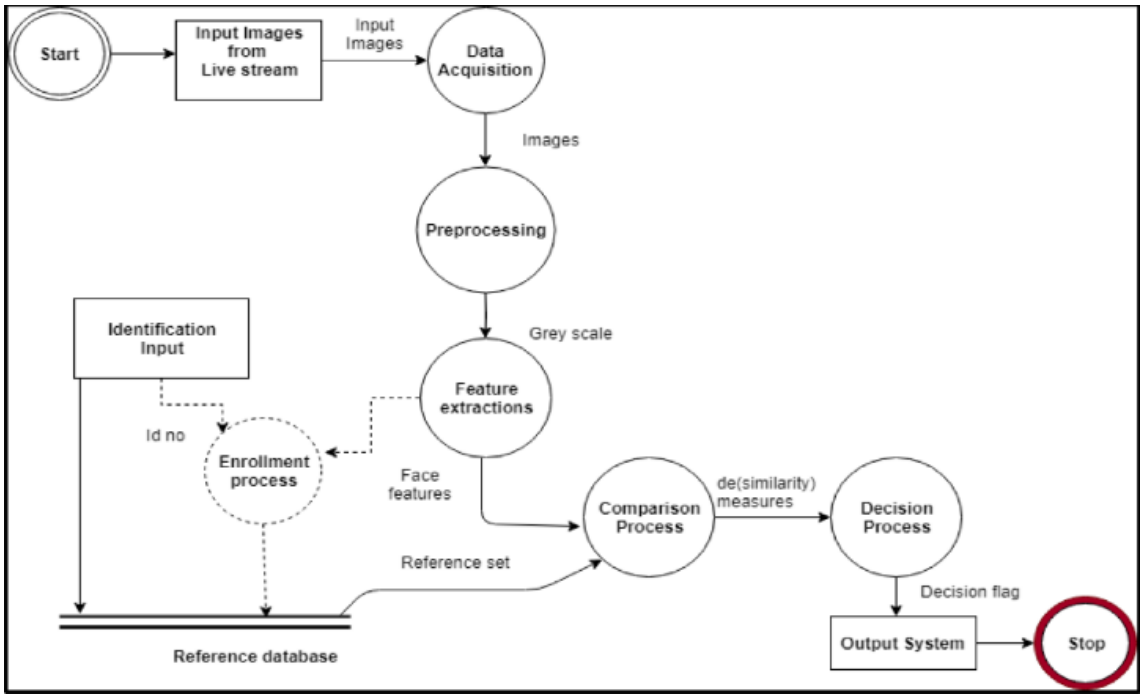

Figure 4.1: Flow of the data

Chapter 5

Results and Analysis

First we have to prepare the dataset by training them for our classifier. We have used Dlib as face detection library that detects and captures the real time face of the person.Those captured images are stored in the training folder for feature extraction and training purpose.First the system asks the user to enter his name along with his ID.Then the camera will automatically capture 30 images of the user and store it.The name and Id of the user is stored into the google spreadsheet. After storing information of multiple users into a dataset. Then we have to train our model for new encodings.

5.1 Face Recognition Output

Figure 5.1 is the output of face recognition.We have extracted the features using Resnet50 model and facerecognition modules and trained using SVM classifier. Figure

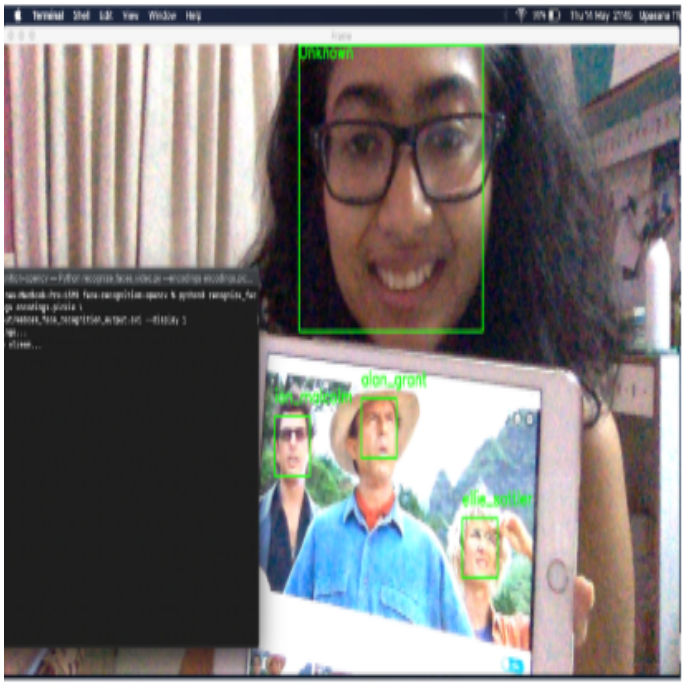

Figure 5.1: Output of trained model

5.2 is the output of face recognition.We have extracted the features using Resnet50 model and facerecognition modules and trained using SVM classifier.

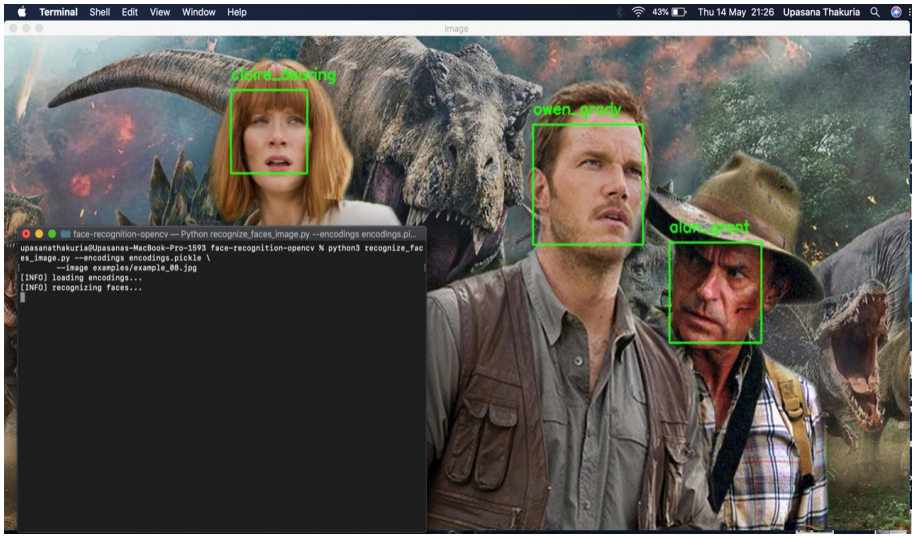

Figure 5.2: Output of trained model

5.2 Attendance Output

figure 5.3 shows the attendance sheet generated after the model has recognised the faces.This record is automatically updated only when the system recognizes the correct face.

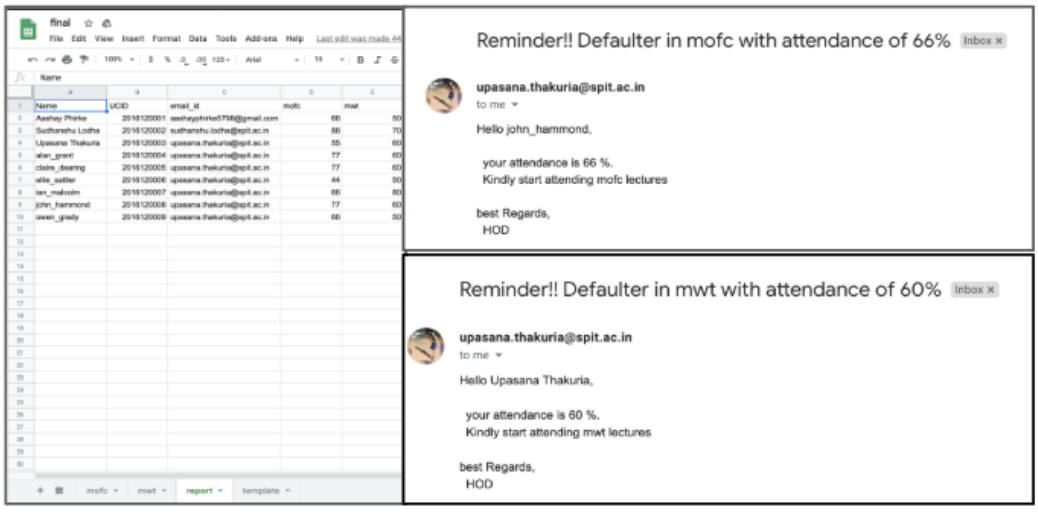

Figure 5.3: Output of attendance record

Chapter 6

Applications and Uses

- Classrooms: It can be of utmost help to the lecturers as they can fully concentrate on the teachings throughout the lecture.While The smart attendance system takes care of the records of the students to be taken.
- Corporate offices: It can be used to keep a watch on the employees during their work. It can help the manager to calculate the number of work hours and leaves with accuracy.
- Factories: It will tell the owners number of hours of work done by the labourers and thus can pay them accordingly.

Chapter 7

Limitations and Issues

- Security: Your facial data can be collected and stored, often without your permission. It's possible hackers could access and steal that data.
- Safety: Facial recognition could lead to online harassment and stalking. How? For example, someone takes your picture on a subway or some other public place and uses facial recognition software to find out exactly who you are.
- Mistaken identity: Say, for instance, law enforcement uses facial recognition to try to identify someone who robbed a corner store. Facial recognition systems may not be 100 percent accurate.
- Freedom: Government agencies and others could have the ability to track you. What you do and where you go might no longer be private. It could become impossible to remain anonymous.
- Ownership: You own your face — the one atop your neck — but your digital images are different. You may have given up your right to ownership when you signed up on a social media network. Or maybe someone tracks down images of you online and sells that data.
- Prevalence: Facial recognition technology is becoming more widespread. That means your facial signature could end up in a lot of places. You probably won't know who has access to it.

Chapter 8

Future Scope

The system we have developed has successfully able to accomplish the task of detecting faces and marking attendance in the working area automatically and output obtained in google spreadsheet as desired in real time. Another important aspect where We can work towards creating an online database of the attendance and its automatic updating, keeping in mind the growing popularity of the Internet of things. Also we have face many difficulties while face recognition like face orientation,lighting variations and pose variations.These difficulties can further be improved.We have used local binary pattern histogram algorithm which gives a decent accuracy of classifying images but we can further improve that by implementing deep learning methods like artificial neural networks

Chapter 9

Conclusion

Automated attendance control targets at solving the issues of manual errors of existing situations. We've used the concept of face recognition to implement a device that marks the attendance of a selected person by using detecting and spotting the face. The system worked even with different facial expressions, lighting and poses of the person. There is still more development needed as its not possible to achieve full accuracy in the classroom. We've made the device transportable for smooth use even if the classes are on, without annoying the class. There is more scopes to make a more compact ergonomics to make it a greater user-pleasant product to make an impact in building an extra effective academic environment.

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