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Smart Attendance using Real-Time Face Recognition

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Abstract

One of the most beneficial developments in deep learning is face recognition. As part of this innovation, a model is fed to the computer so that it may analyse it, learn from it, and compare it to real-time data then determining if it corresponds with the example. The world has benefited much from programmed facial recognition, and it operates reliably. The attendance innovation we employ deals with the routine tasks of the student attendance framework and may be the finest solution for practical problems. The course of face recognition is employed in the attendance framework with facial recognition to record student attendance. Here, high-quality pre-recorded observation video and other innovations make use of the facial biometric invention. All the photographs we get from the camera of the telephone or PC will be handled precisely, and the system will naturally do all that without any preparation. Numerous calculations and methods have been created to work on the presentation of face identification, yet the idea we used is "deep learning." It assists with changing over outline-by-outline video into pictures so that student presence can be handily distinguished and the attendance data set can be effectively and naturally returned.

Keywords: Face Recognition, Face Detection, Deep Learning, Python, Database

Introduction

We have chosen this undertaking because of the many issues that speakers and students are looking for with their ongoing ordinary attendance frameworks. Clickers, Swiping the Id cards, and taking notes down the students' names on a sheet are the techniques currently being utilized in many schools and universities as answers to the participation issue (Kar et al., 2012) (Acharya & Ray, 2005). We have no aim of dispraising the strategies referenced previously. Our fundamental intention is to fabricate a significantly more proficient, simple to utilize, efficient and quick strategy as the previously mentioned techniques are tedious, erroneous (can be taken advantage of), and causes turmoil in the study halls. However, the arrangement that we have accompanied is the answer to these issues (RoshanTharanga et al., 2013). Involving face detection with the end goal of attendance is the sharpest way among every one of the strategies; it is a more exact and quick strategy. This will not just improve controlling the classroom but also decrease the chances of intermediary attendances being endeavored by students.

Our savvy attendance utilizes inactive distinguishing proof, in which the person being recognized requires no activities to be distinguished. Our shrewd participation framework is partitioned into two stages. The initial stage is recognizing the face; the subsequent stage is to contrast the identified face and the information of the data set. There are many face recognition and detection strategies presented. Face recognition should be possible either by utilizing an appearance-based approach that covers elements of the entire face or a component-based, which covers the geometry of the highlights like jawline, temple, eyes, nose, foreheads, and cheeks to perceive the face (Selvi et al., 2014) (Joseph et al., 2014).

We use an appearance-based approach to decrease the defects of the existing system with the help of ML, and we require a good quality camera to take high-resolution photos. For the detection phase, we have used "Histogram-Of-Oriented-Gradient." Furthermore, the recognition phase is performed by "Deep-learning." For the front-end (user side) or the graphical user interface is created in JavaScript (Electron) and the backend is programmed in python, an Inter Personal Communication (IPC)

bridge is developed to communicate between JavaScript and python for more and better analysis, the photos that are being captured in the real-time is sent to the system, and then this photo is compared with the database of photos which is containing many reference photos of each student after that the attendance is marked.

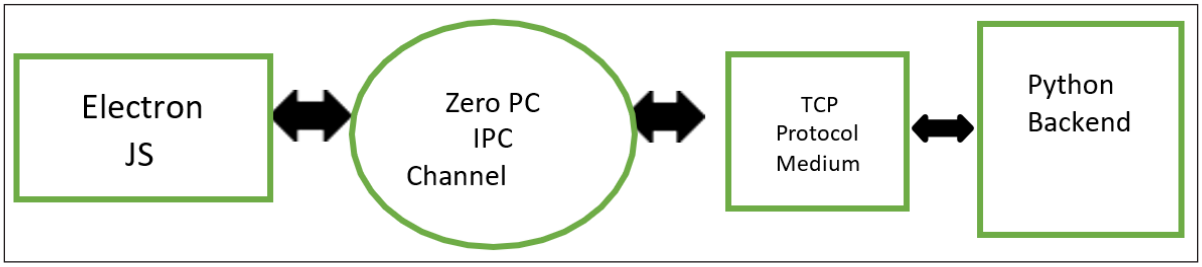

Fig. 1: A Communication System between Client-Side and Server-Side

Popular Methods Used

Machine Learning based Attendance and Subject Rating

With the use of machine learning, the two key systems—the attendance and feedback systems—have been merged and put into place in this instance. The programme will automatically determine how well pupils perform and keep track of their presence and subject comments (Voila & Jones, 2004). Students can indeed take classes by identifying faces. Following recognition, we can collect specific notifications on participation and student performance (Patil & Shukla, 2013).

Automatic Face Identification Attendance System

It is a technique based on facial detection algorithms and facial detection technology. When a person enters the classroom, the system will immediately identify their face. The technology will automatically indicate attendance after the face has been spotted and recognised. This system employs a method called "Viola-Jones," which is widely used algorithms for this purpose (Kanti et al., 2012). This system uses "cascade classifier" to identify individuals' faces. We can comprehend the system's effectiveness and raise the effectiveness of class monitoring by contrasting it with other standard and conventional attendance methods (Muthukalyani & Veeramuthu, 2013).

Iris-Detection

For attendance purposes, this method mandates that the students line up in front of a complex and expensive camera. The methods employed for this purpose are "Gray-Scale-Conversion" (Deshmukh et al., 2014), "Six-Segment-Rectangular-Filter," and "Skin-Pixel-Detection." They identify the iris, interpret the data, and allow the system to accomplish this goal and avoid proxies. This system's biggest drawback is that it requires a lot of time to use because only one person can use it at a time, and they must wait in line (Wagh et al., 2015). The system's efficiency will be drastically decreased as a result.

Face Identification Lecture Attendance System

The attendees that were determined through ongoing surveillance will be recognized automatically by the system. Estimating and improving attendance rates is made possible by constant monitoring (Bhattacharya et al., 2018). To record attendance, students' whereabouts and face photographs were taken in the classroom.

The system determines each student's estimated seat placement for the purpose of calculating attendance through ongoing observation and recording. This approach relied on figuring out the various weights of each focal seat based on location. It is also being discussed whether or not photos are valid so they can be identified more rapidly.

Proposed System

The approaches we have described above are some of the finest for automating attendance, but each has pros and cons. To achieve a better outcome and more effective system, it is preferable to integrate several strategies. Based on deep learning, we adopted the system for our attendance tracking system. Here, the student's computer, laptop, or other device simply requires two things: an operational webcam, and the software that we have created. The camera will record live photos, which will then be processed and compared to the image database; if a match is made, that specific student will be noted as being there.

The automated attendance system's goal is to eliminate existing systems' shortcomings by automating the attendance process. The educator must manually input the student information, subject name, and maybe the time and date of each subject because the attendance will be recorded "subject-wise. When the specified moment arrives, the software will begin capturing images automatically, which will then be analysed to detect and identify the face in the photos. In "Histogram-of-Oriented-Gradient" is used for detecting the face and "deep learning techniques" for calculations and comparisons of 128 facial features for the "face-recognition" phase. The systems will note the attendance of the pre-identified variables after identifying the faces from the current face database. The system will then generate a "excel-sheet."

Data Acquisition

Image Acquisition

Pictures are acquired through the system's webcam; this sensor is supposed to be a superior camera capable of capturing high-quality images for better face recognition and identification. This photograph gets fed into the system.

Creating Dataset

Constructing the dataset during the initialization phase, before the systems begins detecting and recognising phase. The purpose of this training the mechanism is for it to identify which data belongs to particular student. We have currently developed a dataset for ten students that contains their Names, System Ids, and Courses. Being more precise, 20 images of each pupil from various angles and poses were taken. Deep learning methods will be applied to each and every face in the initial phase of producing the dataset and will produce a 128-d "facial feature" this data will be kept in the face database and will be utilised in the recognition phase of attendance. During the registration phase, we should go through the similar procedure with each student.

Face Recognition

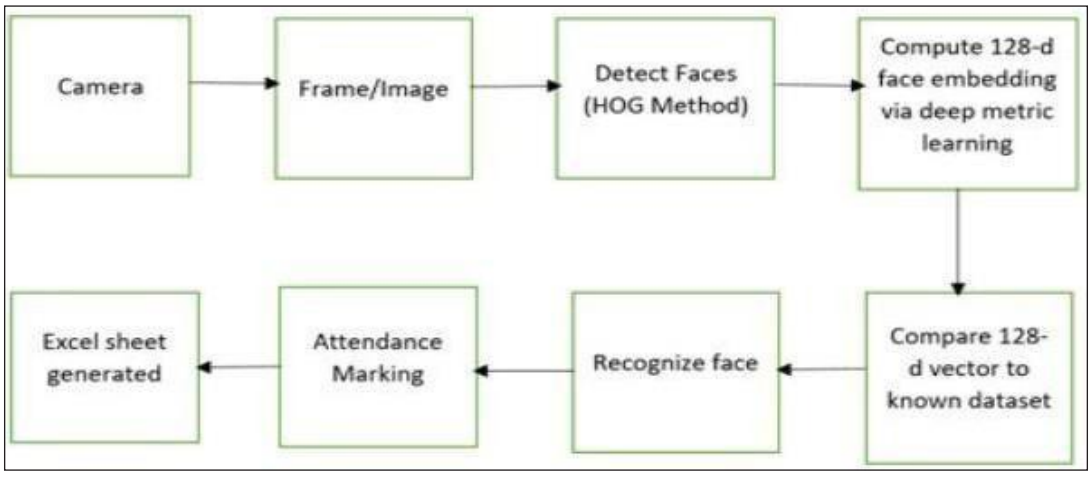

Fig. 2: Face Dectection Process

Finding the Face

The initial phase in our method is to detect the faces. But first we must detect the face in a snapshot before we can recognise the individual in the photograph.

As previously mentioned, the phase detection phase is the most critical phases of this complete systems since it provides the inputs to the system, "face- detection-algorithm" which is applied to every image to identify the human face in the given photo. There are several "image-processing-algorithms." We utilised the Histogram-Of-Oriented-Gradient method for identifying human face in a photograph.

As we don't require colour photographs for identification of face and recognition process, it is best to start by transforming the image to black and white.

Postures and Projection of Face

Every human face has 68 (Samet et al., 2017) specific points; so, we can call them 68 face landmarks. This step's scalability detects faces' landmarks and positions the images. The tasks of automatically and rapidly detecting the faces landmark is done efficiently using a Python scripts without distorting the image.

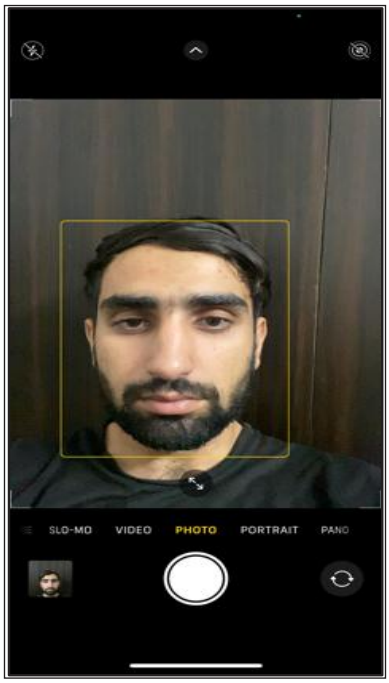

Fig. 3: Face Detection

Fig. 4: Black and White

Face Encoding

After the face is recognized in a photograph, the subsequent advance will distinguish the face's unique features that make it not the same as others. Fundamentally, while making the informational collection, our primary objective is over the 128 principals or central issues of the face. These 128 focuses are removed from the photograph and stored in a data set. Again, while looking at these images, we think about 128 marks of the ongoing photograph with the 128 places of the data set. These 128 focuses are exceptionally precise. They are the primary key to the whole participation framework.

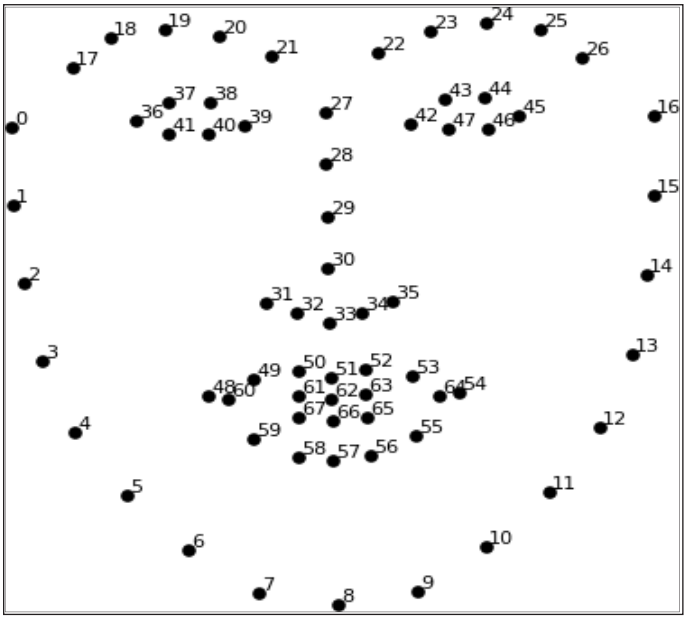

Fig. 5: 68 Points of Human Face

This data training procedure necessitates a large amount of data and computing resources.

Face Matching

The last phase of facial recognition is face-coordinating. The most effective method for face recognition intention is "deep metric learning" (Li et al., 2017). Its exactness is exceptionally high and is also capable of "outputting-real-value-feature-vector" many such methods have been involved in this procedure in our attendance framework. The framework "sanctions" appearances, building "128-key points of the face" (Arsenovic et al., 2017) inserted for every single photograph; and afterward ("analyze faces-work") is utilized to figure the "Euclidean-distance-between-face-in-picture" (Slavković & Jevtić, 2012) that of the relative multitude of countenances put away in the dataset. "If the ongoing picture is coordinated with the 60% (edge) (Rekha & Kurian, 2014) with the current dataset, it will move to participation stamping".

Marking of Attendance

As one of the faces matches one of the facial photographs from the database, python software will produce and return that student's "volume number." When the output data is generated, the system creates "attendance rate" tables, that contains (Name, volume, velocity number, time and date, and subject's name). The plethora of these information will be transferred to the Python tables for storage in the "excel sheet," with each of the worksheet dependent on the subject's code entered by the instructor. "For example, when the system generates an excel worksheet by sending the compiled worksheets in the array to python. Python first checks whether there are any excel worksheets for that date, and if so, it creates a separate work by subject ID Table to distinguish attendance rates for different topics".

Experiments and Results

The Smart Attendance Management System is a relatively easy-to-use tool that performs admirably. According to the study's findings, incorporating deep learning algorithms into the attendance system increases the system's accuracy and effectiveness because deep learning algorithms have a 95% efficiency rate from a variety of viewpoints (Kwolek, 2005). With 94% accuracy, a maximum distance of 7 feet may be identified (Ashwini et al., 2018), which makes it a effective and valuable method. After the teacher registers every student initially and the dataset is created, the system can work automatically.

The front-end or the Graphic User Interface of the project consists of the following three main parts:

- Enrollment
- Recognition and Identification of face.
- Addition of the subject name along with date and time.
- Generation of Attendance Sheet and exporting the result it to Excel Worksheet.

Teacher or instructor must submit the student (name, roll number, course) as well as 20 images of every individual from various angles and perspectives as a training dataset which is required during the initialization phase. This Attendance-system is capable of recognising photographs from various angles and lighting situations. Individuals whose face doesn't appear in the dataset will be labelled as unknown (Karnalim et al., 2018). In the meantime, the "attendance" of the recognised students is recorded. Furthermore, the system will automatically export and store the resulting Excel sheet.

Fig. 7: Face Detection to Record Attendance

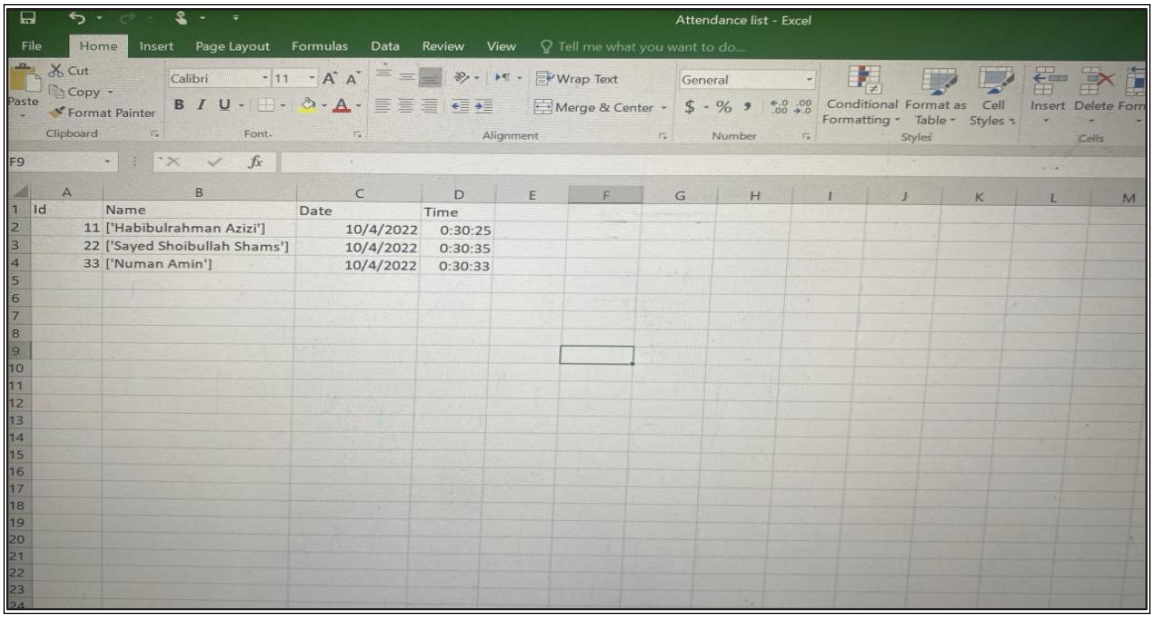

Fig. 8: System Generated Excel Sheet

Conclusion

The Histogram of Oriented Gradient for face detection, as well as deep learning approaches to compare and compute 128-d face attributes for identification of face, significantly improved the attendance system's accuracy. It can detect the face from diverse angles with 95% accuracy and 7 ft maximum distance with an accuracy of 94%, making it a significant and essential tool. The primary objective of this study is to make the attendance system totally automated with less human intervention and more accurate, so that problems with present attendance systems do not affect faculty and individuals. We accomplished this by reducing the probability of mistake and failure by employing these two procedures (Histogram of Oriented Gradient and deep learning approaches).

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