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CLOUD INTEGRATED FACE RECOGNITION BASED ATTENDANCE SYSTEM

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Abstract
With the advancement in technology, a large number of tasks are showing a stunning improvement of accuracy. We tend to inspire the same results for attendance system with our project. It is a demonstration of high level of utility that can be offered by technologies like AI and Cloud. We are employing AWS cloud services in this project for saving and querying data. In this project, we used a simple yet powerful facial recognition algorithm which uses the HOG method to detect faces on the given picture. The next step was to construct Deep CNN which identified facial encodings that help us uniquely identify the facial features. When the face is identified and recognized, we mark the attendance and upload the results on S3 Bucket inside an object file. The file is saved inside the directories of year, month and date (necessarily in that order) so as to enable users a proper way to find the files containing attendance within one click.

Keywords: Cloud, AI, HOG, Deep CNN, facial Encodings, S3 bucket, AWS, Cloud Attendance System.

I. Introduction

Higher education institutes prioritize attendance of students for exams. Attendance is a significant problem in schools and colleges even in a pandemic condition. Calling out the roll call or having students sign a piece of paper are the two main traditional ways to record attendance. Both of these required more effort and time. Consequently, a computer-based student attendance management system is needed, which will let the faculty keep track of attendance automatically.
Using "CV2" and "PYTHON," we created an automated attendance system for this project. We have implemented an "Automated Attendance System Based on Face Recognition". The application uses face recognition, which saves time. Additionally, because it is entirely software-based and uses no paper, it can be deemed environmentally beneficial. Because this system uses facial recognition as a biometric for verification, it also reduces the possibility of false attendance.
The algorithm used in the system is based on image comparison based on the encoded values of the face from the image from database with the image recorded by the system in run time. The system has output in the form of csv excel sheet.

II. Literature

In the dissertation titled "Cloud based Attendance Management and Information System", a cloud-based approach for maintaining and managing attendance is very well described. It describes various functionalities that can be added into attendance system if integrated with cloud [6]. However, this approach doesn't include any facial recognition system. Reference [7] mentions a very reliable and powerful approach by including ResNet which is a CNN based architecture for a neural network. Like our paper this paper also mentions HOG to extract facial features from an image, nonetheless no mentions of cloud technologies. They have used a threshold of 0.5 for minimum distance and on success, the attendance is marked on the database. According to the paper "An Attendance Marking System based on Face Recognition" [8], a PCA analysis was adopted for facial recognition followed by a creating a dataset with participation(attendance) details. This dataset was then transferred to a MySQL database so the details were available on a web server.

In the paper "Face Recognition Based Attendance System Using Machine Learning Algorithms"[9], a brilliant comparison between various machine learning algorithms is mentioned for the purpose of facial recognition. This paper shows CNN to be triumphant in the task with a striking accuracy of 98% followed by SVM at 87% and MLP at 86.5%. Here, DNN was used for detection of faces. While in CNN based approach, a feature vector was directly fed into the module, in case of SVM PCA was used for feature extraction and in case of MLP, LDA was used for feature extraction. Another paper [10], mentions the use of techniques like 2D-DWT and DCT for feature extraction and a Radial Basis Function Network for training a model with images. RBFN is a Multi-Layer Perceptron (MLP) Network with key difference being in the output node having a radial basis function [10].
As mentioned in the paper [13], many institutes started adopted many other approaches for recording attendance like use of Radio Frequency Identification (RFID) [11], iris recognition [12], fingerprint recognition, and so on. However, these approaches are queue based which makes them less efficient.[13]
In reference [11], a technique called Radio Frequency Identification (RFID) is used for verification of the students and a separate module for recognizing them, maintaining a count as they go in and out from the classroom.
Reference [12] mentions an attendance system which uses iris biometrics. Initially, the details of the attendees were recorded along with their unique iris template. In the classroom, the system automatically recorded the attendance by capturing the eye image of each attendee, recognizing their iris, and searching for a match in the created database. The prototype was web based.

III. Methods

1. The experimental setup was a coding and cloud environment.
2. The language used was Python.
3. The IDE used were PyCharm and VS Code.
4. All the IDE were set-up for Python and Computer Vision Libraries like CV2, dlib etc.
5. The storage facility was enabled by Amazon S3, which stores all the experiment data and the resulting attendance using boto3 SDK.
6. Repository created on Github.
7. AWS console and Python SDK used for cloud integration.

IV. Procedure

This project mainly focuses on taking face attendance using ML and AI so as to improve the overall quality of academics in the school environment. This task is achieved by using Python as the coding language. The major steps were, to have a good facial recognition system and build a hierarchal storage directory pattern. We achieve this task by using Python libraries OpenFace, boto3, csv and dlib. We started by providing our AWS User Access key ID and Secret Access Key (used to connect with AWS). It is the same account having the existing database in S3(pre-stored images of the attendees). In order to optimize the storing and retrieving of the files, we created the date pattern hierarchal format folders by defining the functions like year, month and date (in that same order). While creating the new folders, it also checks the existing presence.

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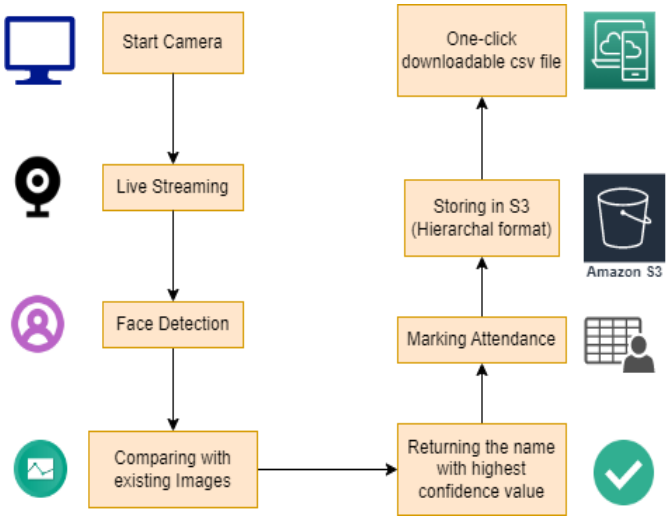

Figure 1- Working of System

The task is to detect faces so that we can pass the embeddings to our pipeline. For this task, Histogram of Oriented Gradients is used. As explained in reference [2], HOG is a faster and more reliable. We convert the image into grayscale to avoid excessive useless information and look at the picture, pixel by pixel. Next step is to find the face embeddings which is achieved by an algorithm called face landmark estimation [3], to locate 68 specific landmarks on the face.

After this, 128 facial encodings were detected, which helped in uniquely identify the facial structure. This task is accomplished by the OpenFace Library. These encodings are compared to already existing facial encodings using a machine learning algorithm(the best suited algorithm can be determined by hit-and-trial from a set of classification algorithms like SVM, XgBoost, RandomForest, Logistic Regression etc).

After machine learning model recognizes the faces, we start appending it to a list which is an efficient and automated way of managing attendance records. This is a temporary data structure for storing the attendance as it will be uploaded to cloud periodically and not constantly. Constant connection to cloud is redundant in this case. Ideally, attendance should be updated to cloud after the all the classes are over, but we are employing this periodic approach for better reliability.

To ensure that the attendance data is secure and accessible (even in the event of system failures), the script that sends the data to S3 storage in the form of a CSV is run periodically. Once the data has been successfully backed up to S3, the list is dissolved of all the information, ensuring that the next set of attendance data is recorded afresh. This approach ensures that the list doesn't become too large and unwieldy, which can slow down the system.

V. Conclusion

This project holds great scope for future as it goes well with other professional work environments also. Trending technologies like cloud and Deep Learning are integrated together. The attendance is taken via webcam (Figure 2), compared with the pre-stored images in database(S3), classified according to highest confidence level and then stored in the most reliable and secure manner within the AWS(cloud). These CSV files are easily retrievable any point of time (Figure 3).

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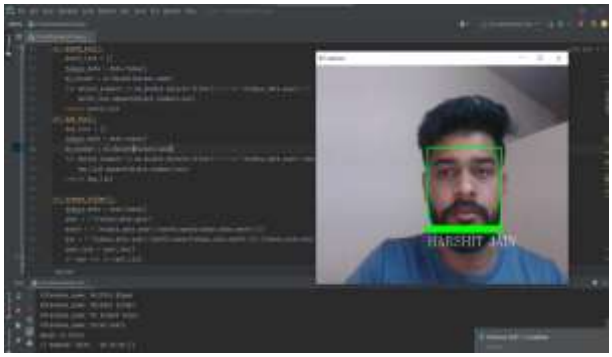

Figure 2- Attendance Being Captured

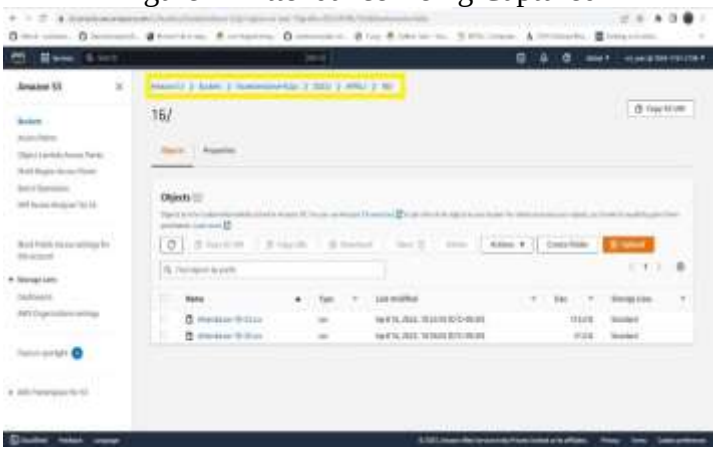

Figure 3- S3 Bucket folder structure

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