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Attendance System using Facial Recognition

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Abstract - *The value of a well-maintained recorded attendance system is very high. Although many models already exist, there are many ambiguities already existing. This paper introduces the automatic attendance management which will replace the manual method, which takes a lot of time consuming and difficult to maintain. The arrival system using face recognition consists of two stages, face detection and face recognition. On the detection front, deep learning-based algorithm has been used. Although, Viola Jones was compared but deep learning was preferred. On the recognition front, deep learning-based face recognition has been used. After comparing dlib using Convolutional Neural Networks (CNN) with dlib using Histogram Oriented Gradients (HOG), CNN was preferred as it detects faces from all the angles without any discrepancies. The system will capture the image, the faces are detected and then it is recognized with the database and finally the attendance is marked in an excel sheet.*

Key Words: **Face Recognition, Convolutional Neural Network, Histogram of Gradients, dlib, Deep Neural Network.**

1. INTRODUCTION

Marking and maintaining students' attendance is a very tedious work in various colleges. every institution has its own technique of taking attendance including the use of attendance sheet or with the aid of using some biometric techniques. However, those techniques consume a lot of time. in general student attendance is marked with the help of attendance sheet given to the professors. This consumes a whole lot of work and time. We do not understand whether or not the authenticated child is responding or not. Calculation of consolidated attendance is another most important and tedious work which may also cause errors. in a few different cases the attendance sheet may become misplaced or stolen by some of the students. to get rid of such troubles we're in want of automated attendance marking systems.

1.1 Literature Review

There are multiple Face detection and face recognition algorithms that are being extensively used and with accuracies of higher than eighty percent. In [1] Xiao Han et al have compared the performance of the Subspace method, Geometric Structure method, Local feature method and deep learning method of face recognition. The Subspace method deals with spatial compression i.e., transformation of high dimensional image to low dimensional which makes it easy to Clas sify the features. It includes various Face Recognition techniques such as Principal Component Analysis (PCA), Latent Dirichlet Allocation (LDA), and Independent Component Analysis (ICA). The local features method splits the face into a number of local features and then identifies the face using these features. The Deep Learning method is used to tackle the complexity of Face Recognition in which the machine can imitate the human brain structure and its thinking to complete its goal.

Paul Viola and Michael Jones proposed Viola Jones Algorithm for Face detection in [2]. The algorithm uses Haar features for Face detection and taking it up a notch it also uses Adaboost learning method to provide considerably higher accuracy.

In [3] Rafael Padilla et al have compared face detectors classifiers on two different face databases YALand FEI. The YALE database consisted 11 images of 14 individuals while the FEI database was a Brazilian database consisting 11 images of 280 individuals. Frontal face classifiers FA1, FA2 were used to analyze the databases. The FA1 provided better results with the YALE database while FA2 provided better results with FEI database.

In this paper, we propose a Face Recognition based Attendance system using deep learning to provide the sublimation speed. We have used dlib library which uses deep learning for face detection and recognition.

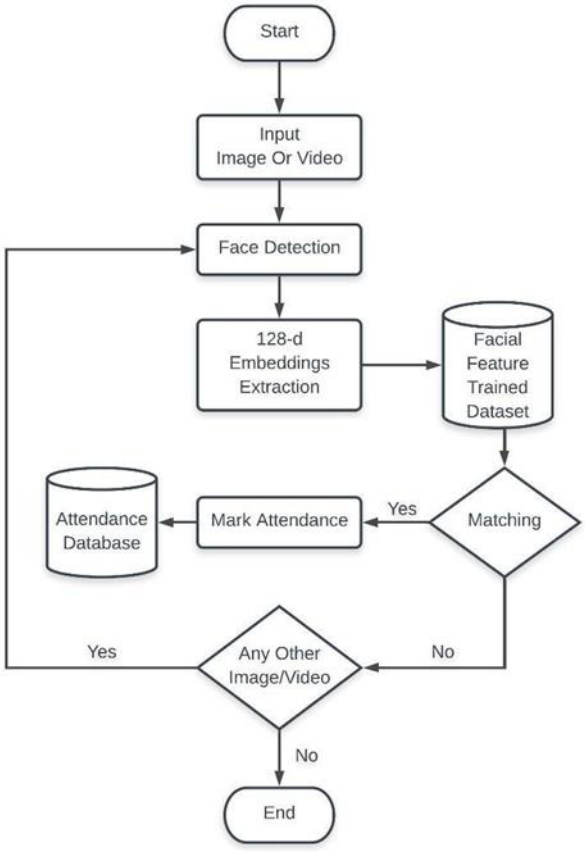
This paper is sorted in the following manner. The flow chart of the attendance system is explained in section II. Section III explains Viola Jones algorithm for Face detection and deep learning-based Face detection. Face recognition using dlib is presented in sections IV and V. Section VI includes simulation and results, simultaneously followed by the conclusion in section VII.

2. PROPOSED METHOD

The input to the attendance system is an image or a video provided by a suitable video source like a webcam followed by the first and foremost phase of the attendance system i.e. Face detection. Once all the faces are detected the process of Recognition starts. Using dlib the 128-d encodings are extracted from the face (Key factors include the distance between your eyes and the distance from forehead to chin. The software identifies facial landmarks — one system identifies 68 of them — that are key to distinguishing your face) and then the set of features obtained from the input is compared with the known encodings i.e., Trained features.

Once the recognition is done successfully, the attendance would be marked as present.

Figure -1: Flowchart

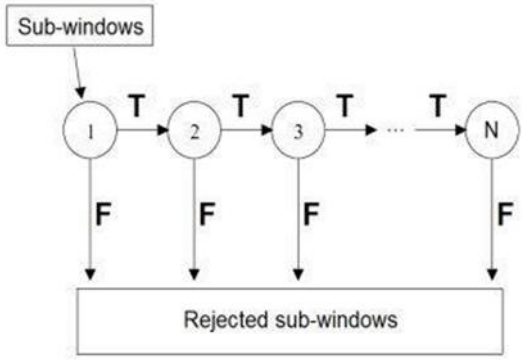


3. VIOLA JONES ALGORITHM

The Facial recognition-based attendance system consists of two phases namely, Face detection and Face Recognition. Many methods have been used for implementing these phases. the Viola Jones algorithm was carried out for face detection. This algorithm consists of cascading of Haar features and Adaboost.

All human faces have some similar identification properties. These similarities are matched in Viola Jones algorithm using Haar Features. a haar-like feature considers adjoining rectangle areas at a specific area in a detection window, sums up the pixel readings in every location and calculates the difference among these summations of the readings. this difference is then used to sort the subsections of an image. inside the detection phase of the viola jones face detection algorithm, a window of the goal length is moved over an input image, and for every subsection of the photo the haar-like feature is calculated. this difference is then in contrast to a learnt threshold that separates non-faces from faces. Because this type of haar-like feature is simplest a weak classifier so a massive quantity of haar-like functions is important to describe a face with sufficient accuracy. in the viola jones face detection, the haar-like features are consequently prepared as a classifier cascade to form a strong classifier. There are 1,60,000 Haar features on a single human face and it is difficult and time consuming to use all of that features for the detection of a single human face therefore we use Adaboost which combines all the weak features to make them as strong features or as a strong classifier.

Figure -2: The detection cascade with N stages



For Haar features and Adaboost working together, we use cascade amplifiers, increasing the speed of facial detection. These classifiers use Haar-like features that are applied over the image. Only those image regions, called sub-windows, that pass through all the stages of the detector are considered to contain the target face.

Figure 2 shows the detection cascade with N stages. The detection cascade is designed to eliminate a large number of objects other than human faces with the help of little processing.

4. DEEP LEARNING ALGORITHM

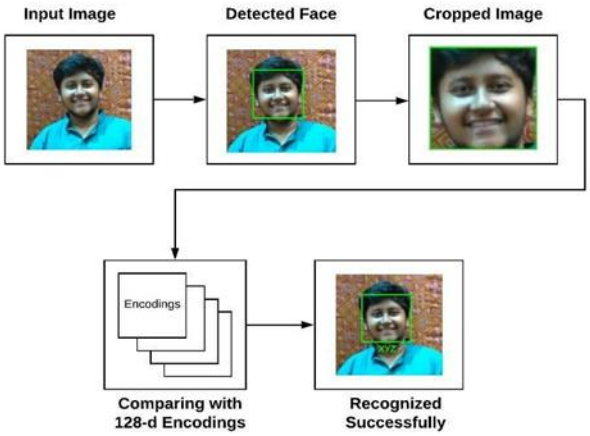
Deep Neural networks (DNN) combined with OpenCV are preferred for the main and most important of all the phases i.e. Face Recognition. The dlib library, included with Deep Learning is mainly used in conjunction with the face

recognition library for the detection as well as the recognition of faces in the provided image. The dlib library face detector consists of three recognition phases i.e. HOG, linear Support Vector Machine (SVM) and CNN. HOG makes the use of Central Processing Unit (CPU) and works to find the features of the face facing the camera, while CNN makes use of the Graphical Processing Unit (GPU) and can detect a face from all the angles suitable. We have used CNN for the detection, training and recognition phases because it is more efficient than HOG.

5. FACE RECOGNITION

Face recognition is executed using the face recognition library. step one of constructing a face recognition system is to detect the faces that is provided as an input, it is in the form of a static image format or a dynamic video source. those detected faces contained embeddings which are utilized by the system to apprehend the person or the faces detected. We extract these embeddings and it is learnt with the help of deep learning by the process of dataset training. Eventually, the faces were detected and recognised by the dataset in both static and dynamic formats

5.1. Work flow Of the Recognition phase



6. SIMULATIONS AND RESULTS

Face Recognition has been done before using various algorithms such LDR, PCA and DNN. We have used Deep learning using dlib and 128D encodings for face detection and recognition.
The accuracy obtained in the classical Face Recognition algorithm Eigen face is 60%.

We have implemented Face detection using Viola Jones algorithm as well as detection using dlib. Both the detection algorithms were easy to implement; however, Viola Jones algorithm can only be used for Face detection whilst it cannot fulfill the purpose of recognition. Also, Viola Jones algorithm needs too much iteration to detect faces in the provided image while on the other hand dlib does the detection faster as compared to Viola Jones algorithm. On the other hand, the dlib library-based functions provided both the solutions i.e. the detection as well as the recognition of faces. Although both the methods provided an accuracy of above 90%, due to the inadequacy of Viola Jones algorithm for purpose of face recognition, dlib Library was preferred. It was observed that in the recognition phase of the working, the images had to be trained for the machine to learn about the facial features of the given person.

Figure -4: Input Image

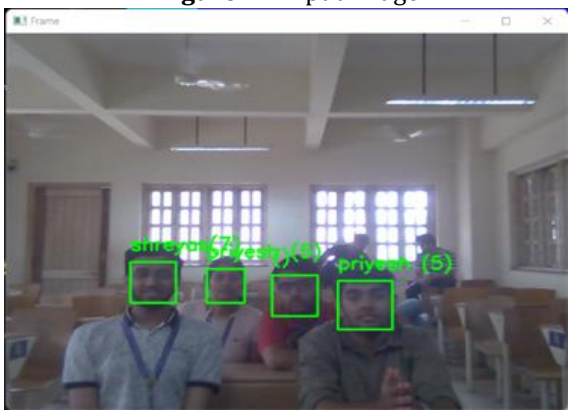


Figure 4 is the Input Image for which detection and recognition takes place. Various operations of face detection and recognition were carried out using all the methods specified.

Figure -5: Face Detection using Viola Jones

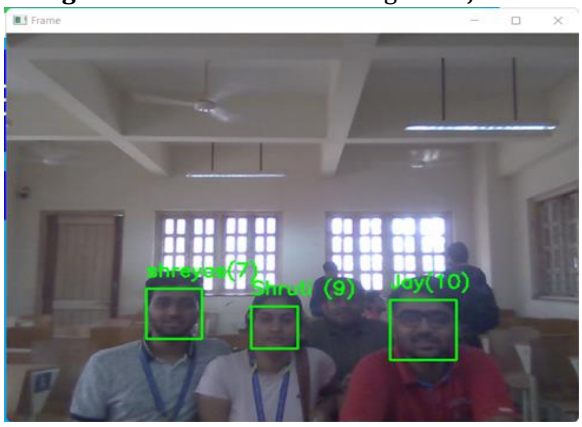


Figure 5 shows the face detection using Viola Jones Algorithm and the Figure 6 shows the face detection using dlib. The detected faces have a rectangle around them indicating that the process of face detection was successfully implemented and observed

Figure -6: Face Detection using dlib

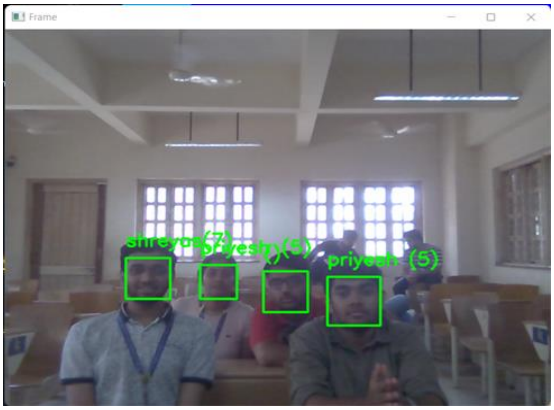


Figure 6 shows the face detection using Viola Jones Algorithm and the Figure 6 shows the face detection using dlib. The detected faces have a rectangle around them indicating that the process of face detection was successfully implemented and observed

Figure -7: Output Image

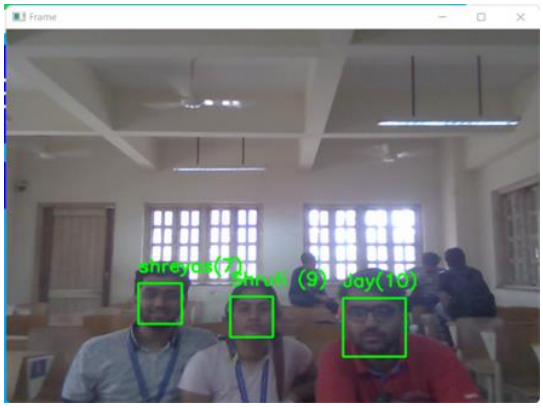
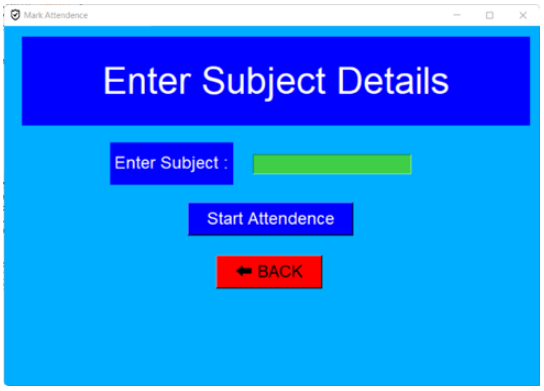
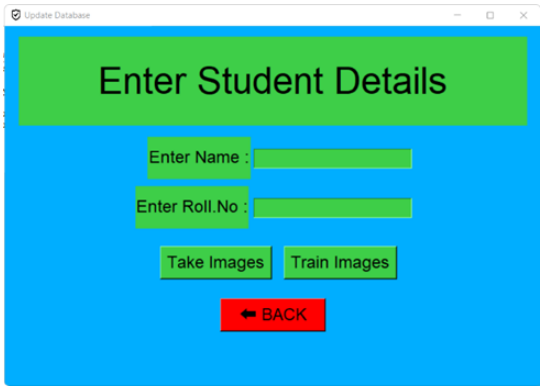


Figure 7 represents the result of face recognition. Since only the datasets of Jay, Shruti, Shreyas, Priyesh were trained; only those faces were recognized. The remaining faces were not trained and hence were not recognized and therefore categorized as Unknown.

Figure -8: Output Screen





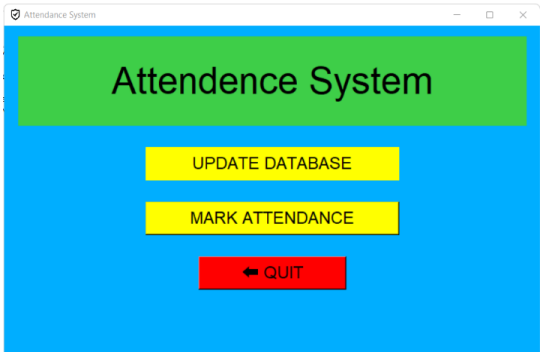


Figure 8 represents the results of output of face recognition. Since only the datasets of Jay, Shruti, Shreyas, were trained; only those faces were recognized. The accuracy obtained during this process was found out to be in range of around 85% to 95%. An extra test case was also implemented which consisted of image with dim environment where the accuracy of around 70% to 80% was obtained

Figure -9: Attendance Record

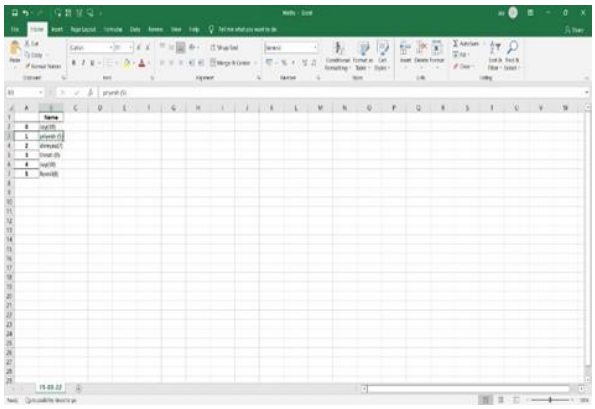


Figure 9 depicts the attendance recorded using excel which can be used by the teachers to track the students' attendance.

6. CONCLUSION

In order to reduce the efforts taken by the teachers and gain more time for teaching, we proposed the automatic attendance system using face recognition.

Deep Learning based detection was preferred over Viola Jones algorithm for face detection. The face recognition using dlib was implemented and the best of results were obtained even with the imperfection in the provided input image. Thus, the system is fairly reliable. The attendance entries have been recorded in an excel sheet to keep track of the student's attendance.

From the performance of both methods of face detection, it was observed that though the results obtained using the Viola Jones Algorithm are satisfactory, it is slower as compared to CNN based detection. It also lacks the feature of recognition of faces which is the key ingredient in the process of automatic attendance system.
The accuracy of face recognition was obtained to be around 85-95% in normal environmental conditions and 70-80% in dim environment.

The future work will involve implementation of a database with the entries of all the students for easy updating of attendance. Also, a Graphical User Interface can be made for ease of access and for better appearance. This will include automatic entries into the database and updating the attendance as and when the faces are recognized making the whole of the system automatic.

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