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Face Recognition Based Attendance Management System using DLIB

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Abstract: ***Real time face recognition technology has become a prominent tool for addressing solutions to many complex problems. Such as identification and the verification of identity. Face recognition technology also addresses the time consumption issue that arises in other biometric systems. Taking Attendances manually is always a monotonous job and it additionally consumes heap of our time. The prevailing biometric attendances wastes a great deal of our time and these systems can be cheated easily. In our proposed system the attendance is recorded by using a camera that is attached in front of classroom which is continuously recording but the system will never store any recorded files. And the features obtained from the detected images are compared with the features stored in the database and the system mark's the attendance. This paper aims at automating the whole process and implementing a system that can't be cheated. The entire system is built by using a machine learning tool called DLIB.***

Keywords- DLIB, Biometric, Attendance, Face Recognition.

I. INTRODUCTION

The Face Recognition technology is an application of image processing that performs 2 major tasks of detecting and identifying a person from a digital image or a video frame from a video supply. There are unit multiple ways in which face recognition systems work, however generally, they work by examining chosen face expression from given image with already stored facial features that are stored within a database.

Fig: 1 Face Recognition

Taking attendance is mandatory in several places such as schools, colleges, industries, companies etc. Several methods have been employed to reduce pen and paper work in the process of taking attendance. some of the systems that have been employed previously are as follows: Biometrics and RFID. The problem that arises from above systems is that even though these systems are accurate in measuring the attendance, but these systems can be tricked to grant attendance for an individual so we solve these problems by using face recognition technology, where we use convolutional neural networks which is a class of DLIB to recognize the individual. The accuracy of this model is 99.38%, that is given two faces it can classify these faces accurately 99.38% of the time.

The reason for obtaining such accuracy is because of CNN which is abbreviated as Convolutional Neural Networks [1,2]. Convolutional neural networks (also referred to as Conv Net) leverage spatial information and are therefore best fitted for image classification. These neural nets use an ad hoc design which is completely inspired by biological information taken from physiological experiments done on the visual cortical region.

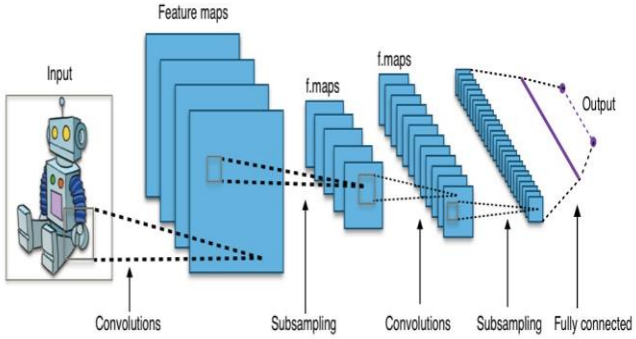

Fig: 2 Convolutional Neural Network[11]

These machine learning algorithms are integrated within a library called DLIB which was developed by Davis E. King. DLIB is a trendy C++ toolkit containing machine learning algorithms and tools for making complicated software package in C++ to unravel global technical issues. It's employed in both industry and academia in an exceedingly wide selection of domains together with AI and robotics, embedded devices, mobile phones, and enormous high, performance computing environments. Since parent's are more concerned about the attendance of their children our system automatically sends the attendance details to both students as well as the parent. Our system is entirely different from other proposed systems as our system is smart enough to identify weather a student is present in theclass or not. The system keeps count of every individual present in the class and notifies the students/parents when the count value of a particular student is less than the specified threshold value.

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Further this paper is organized as follows, In Section II we describe about the Steps to follow in Face Recognition, In Section III we describe about the proposed methodology, In Section IV we describe about the parameters to be considered. In section V we discuss about results. In section VI we describe about the Conclusion and Future scope.

II. STEP'S TO FOLLOW IN FACE RECOGNITION

1. Firstly,Identify total faces present in a particular video frame or from an image.
2. Secondly, concentrate on every face and be able to perceive, that even if a face is turned in a weird direction orin the case of extreme or poor lighting conditions, it's stillthe image of same person.
3. In this step, gather distinctive features of the face that you will use to inform it aside from alternative people-like howlarge the eyes are, how distinct the face is, etc.
4. In the end, compare the distinctive features of that face to all the known people facial features stored in a database to determine the person's name.

III. PROPOSED METHODOLOGY

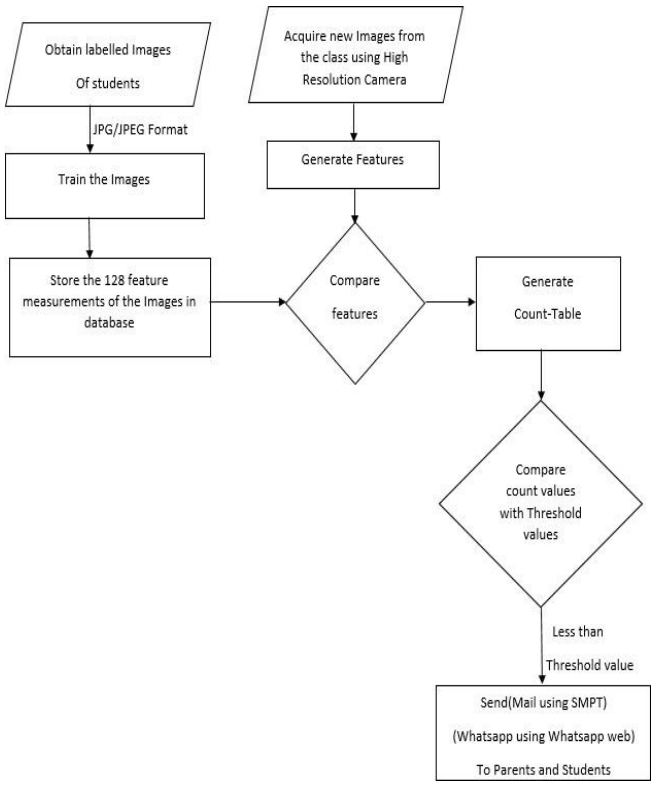


Fig: 3 Flow Chart of Proposed system Proposed

System Architecture

STEP1: Obtain labelled images of the students.
STEP2: Train the images
STEP3: Store the 128 feature measurements of the images in a database.
STEP4: Acquire new images from the class using high resolution cameras.

STEP5: Convert the obtained images into a feature vector of 128 measurements.
STEP6: Compare these measurements with those stored in the Database.

STEP7: Generate the count table where the total count value of each image is calculated.
STEP8: Compare the obtained count values with the specified
threshold value.
STEP9: Send (Mail using SMTP) or (WhatsApp using WhatsApp WEB) to respective parents and students
if the count value is less than the specified threshold value.

IV. PARAMETERS

1. HOG: which is abbreviated as Histogram of oriented gradients. HOG is a feature extractor that is applied in image processing applications for the sake of object recognition [3,4,5,6]. The technique counts occurrences of gradient orientation in localized parts of a picture. Since it operates on native cells, it's invariant to geometric and photometrical transformations. The HOG descriptor is notably fitted to human detection in pictures. Using this technique, we can easily find faces in any imagewithout bothering about the Lightness/Darkness conditions we can see the fundamental pattern of the image.

2. Block normalization: Also called as Histogram Stretching or Contrast stretching the main objective of block normalization is to realize consistency in dynamic range for a group of information.
Let v be the non-normalized vector containing all histograms in a given block, ||v||k be its k-normal form, for k = (1,2) and let e. be some tiny constant. Then the normalization factor can be one among the following:

$$L2-norm: f = \frac{v}{\sqrt{\|v\|_2^2 + e^2}} \quad (1)$$

$$L1-norm: f = \frac{v}{\sqrt{\|v\|_1 + e}} \quad (2)$$

These methods show very significant improvements when compared to the non-normalized data.

3. Sharpness: During image processing its common to have some blurry images because during recording the human faces are [7] in constant motion so it's necessary to have this specific feature in face standard estimation. Sharpness of the picture can be found, using variance of the image Laplacian formula. Which is represented as follows.

$$Sharpness = \sum_{(i;j)\in\Omega(x,y)} (\Delta I(i,j) - \Delta\bar{I})^2 \quad (3)$$

Where $\overline{\Delta I}$is the mean value of image, Laplacian within Ω(x, y).

In case if the variance value is less than the predefined threshold value then that particular picture is treated as a blur picture. The threshold value completely depends on working environment, and we can predefine the value depending upon the environment conditions. We can then normalize the sharpness with pre-defined threshold value.
Normalized Sharpness (4)
(NS)= Image sharpness/predefined threshold value

4. Resolution of the image: In the concept of face recognition technology we are able to detects the human face as long as it's present within the specified range of the video source, when the face [7] is far away the video source, we will not be able to detect the faces accurately. Using the facial landmark detection, we tend to calculate the position of the eye corner at left and position of the eye corner at right in a face. Let (XL, YL) be the coordinates of the left eye corner and (XR, YR) be the coordinates of the right eye corner. of the face then the space between the eye coordinates is given by:

$$Resolution = \sqrt{(x_L - x_R)^2 + (y_L - y_R)^2} \quad (5)$$

Wenormalizetheobtainedresolutionasshownbelow:
Normalized-Resolution (6)
(NR) = Image Resolution/predefined threshold value
Greater the separation, lesser would be the size of the face and hence, the resolution would be minimum.

5. Brightness Level: In real time face recognition the most common problem is to deal with the brightness lighting conditions, so it will be easier to apply local feature extractor to obtain the facial feature. In order to get this result, we calculate the means of all the intensity of the available color channels (Blue, Green, Red) in the image.

Brightness = (BLUE + GREEN + RED)/3 (7)
Normalized Brightness = Brightness/100 (8)

V. RESULTS AND DISCUSSION

1) Acquire the images and store in the database.

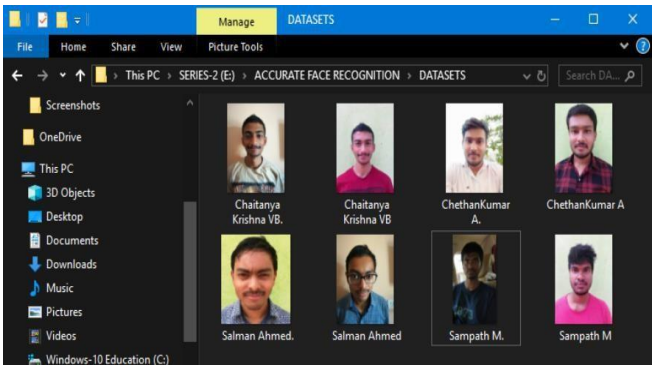


Fig: 4 Image Data Base

Store the labelled images in the database and make sure that image names belong to the respective student. Here we are considering set of two images for four students for training.

2) Train the images.

Fig: 5 Training the saved images

3) Deleting the stored images to save the memory

Fig: 6 Deleting Images

Once the training is completed on given set of images. we delete the images to save disk space and also to maintain privacy. The 128-feature measurements of all images are saved in a database.

4) Saving the 128-feature measurements of all images in database.

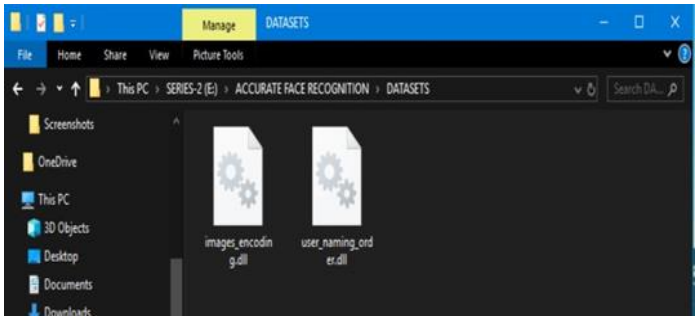


Fig: 7 Saved database files

5) Screen shot of identified students.

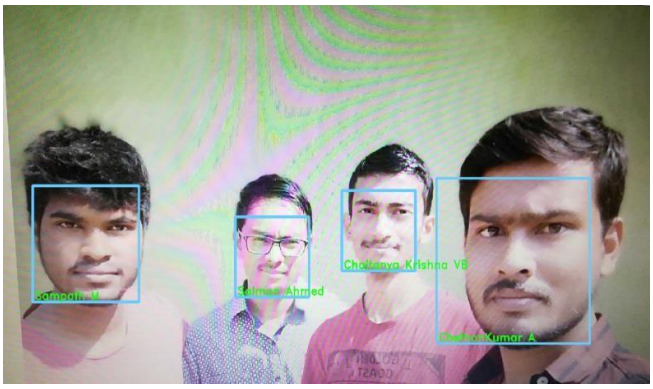
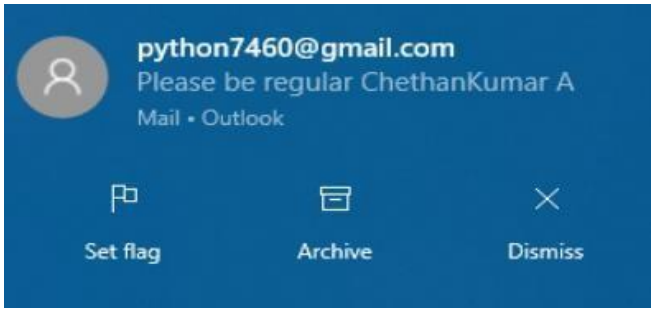


Fig: 8 Recognizing the student faces

6) Sending Message to concerned Student/Parent in case if the student is absent.

Mail



WhatsApp

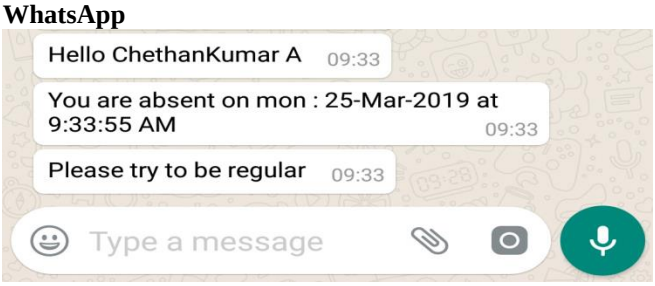


Fig: 10 WhatsApp message received by the student

In **Fig 9** the mail is sent to the concerned [8,9] student using (SMTP) Simple mail transfer protocol.

In **Fig 10**WhatsApp message is sent to the students using what's app web with the help of selenium [10] automation tool.

VI. CONCLUSION AND FUTURE SCOPE

Reduce paper-work and save time and money. Helps teachers and students to focus mainly on academics without any intervention. The smart attendance management system will replace the standard methodology, that consumes lot of time and is difficult to maintain.

This system can also be used in other applications like to identify the lost people, Fraud detection, Theft alarms and can also be used in many companies and industries for monitoring the attendance of the individual.

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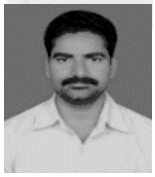

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