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AUTOMATED FACE RECOGNITION BASED ATTENDANCE SYSTEM USING LBP FACE RECOGNIZER

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Abstract: The Attendance of the students is an important task in class. The overall period for conducting the class cannot be utilized as the attendance is taken manually. The productive time of the class can be utilized very efficiently by implementing automated attendance system. Face is the unique identification for any human being. This paper describes the method of detecting and recognizing the face in real-time using OpenCV. The paper describes an efficient algorithm using open source image processing framework known as OpenCV. The approach follows five modules which are Face Detection, Face Preprocessing, Face Training, Face Recognition and Attendance Database. For the face recognition of the student, the database of the faces is collected. The system is initially trained with the unique faces of the student, which intern creates the student database. The system uses friendly approach to highly optimize the user experience by training and testing the students' images. This type of approach can be used for many other applications where face recognition is used for authentication. This paper uses modified algorithm of Haar's Cascades proposed by Viola-Jones for face detection.

Keywords—OpenCV; face detection; face recognization; face training; database: LBP(Local Binary Pattern)

I INTRODUCTION

Currently the attendance system is manual. It wastes a considerable amount of time of faculties as well as students. Also the waiting time of the students is increased if attendance is taken manually. There are more chances of proxies in the traditional method of manual attendance. Manual attendance always have a cost of human error. Face can be considered as one of the most recognizable proof for any human. So automating the attendance process will increase the productive timing of the class. Currently, the system available has a camera that captures the image then pass it to the Raspberry Pi which is programmed to handle the face recognition by implementing the Local Binary Patterns algorithm LBPs. If the student's input image matches with the trained dataset image the prototype door open's using Servo Motor, then the attendance results are stored in the MySQL database. The database is connected to Attendance Management System (AMS) web server, which makes the attendance results reachable to any online connected web browser [5]. Authentication is extremely important issue in the era of information system. Among various techniques available, human face recognition (HFR) is a well-known technique where user can be used for authentication. As an crucial branch of biometric verification, HFR is mainly used in applications like video surveillance or monitoring system, human-computer interaction, door access control system, network security etc. The another paper proposes the automated attendance system in the classroom using the combination of Discrete Wavelet Transforms (DWT) and Discrete Cosine Transform (DCT). These transforms extracts the features of student's face and then it is followed by applying Radial Basis Function (RBF) for classifying the facial objects [6]. In this paper I have proposed a PC based system with an inbuilt webcam. The webcam is used to capture faces, this faces are detected using Haar Cascade classifier. The detected faces creates the dataset with ids. The faces of the students are recognized with the help of trained images by implementing the LBP classifier.After matching attendance of the student, record is also created.

II LITERATURE SURVEY

Many organizations, companies and institutions takes

periodic attendance of the employees using RFID methods[1] , Biometric Fingerprint method and Registers[2].These methods generally require more time for calculation.

RFID(Radio Frequency Identification) is a method where in there are electromagnetic fields which are used to automatically detect and track the tags attached to persons[1]. RFID can invade the privacy and security of human beings in the industrial environment. RFID strategies inturn effect's the software that allows each person to be analyzed by the primary database. This environment can be easily studied by hackers. If RFID reader and receiver are not properly resonated then less read rate occurs.

Biometric fingerprint identification system makes use of fingerprint as a unique identity[2].Amongst all the systems used for recognition this is the most accurate and efficient one. But recognition of an individual fingerprint from a set of enrolled fingerprints is a difficult process. The fingerprint system may not always reveal any detail about the original fingerprint. This may have been proved to be false as many algorithms reveal that a fingerprint can be reconstructed with minute templates[3].

Iris Recognition is another type of implementation where the iris of people are scanned, stored and then retrieved for the matching and attendance is done without fail in the server[4].But there is lot of trouble in accumulating the iris of the students and therefore a fast application of face recognition with minimum illumination can be used.. Face recognition attendance system with IOT gives high accuracy, it access and control IOT devices, which is always, low cost and low power.

Main aim is to reduce documentation cost and efforts of human beings which are generated in the digital classroom and offices. So the proposed face recognition system combine three part face detection, feature extraction and face recognition. The extended local binary pattern then extracts the local features of the face [7].

III PROPOSED MODEL

Proposed system is based on capturing faces of student & match with database if this face matches with database then the attendance is marked as present & it generates attendance report.

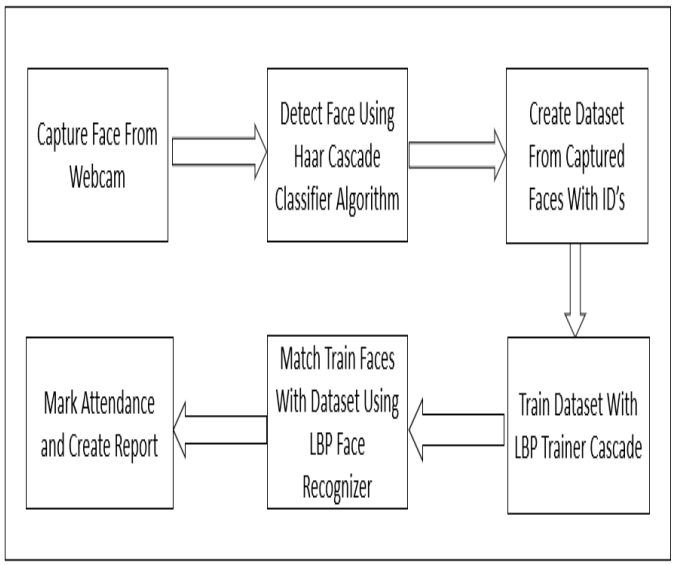

Figure. 1. Proposed Model

IV METHODOLOGY

The proposed model given is going through a series of process in order to recognize the face and creates the attendance report. Following is the methodology followed for this paper:-

1. Creation of Dataset

For the system to work we are using 30 images per student which are going to get stored in database. Our flow of algorithm uses module which can access the frames from the laptop's webcam although an external can also be used. This results in proper setting of dimensions of images to be captured and pixel resolution of those images. The python library urllib is imported which provides the above functionality. When we are creating database each student will be asked to sit in front of the camera and give different head poses, different expressions, in different lightning conditions and at different distances from the camera. For creating the dataset, it is mandatory for teacher to enter the 'id' of the student which will store the images of student. Ever student added will have his unique id attached to its number of images which will be stored in the folder. Also if the student wishes to change the dataset he will have his unique id and can go to the teacher and change the dataset of images that he has for himself.

After taking 30 consecutive photos the camera shuts down once the counter exceeds its limit. After the images are being captured it will be stored in a 'training folder'.

2.Pre-Processing of image

There are many face detection methods such as feature, appearance, template matching. The method we are goin to use is a feature-based method. The feature-based locates faces by extracting structural features of the face. It is first trained as a classifier using HAAR-CASCADE classifiers and then used to find the difference between facial and non-facial regions. This approach of Viola Jones is divided into several steps and even photos with multiple faces have reported a success rate of 94%. We are going to use method that was proposed by Viola-Jones in there paper[15]. The process of Viola Jones includes finding the integral image where in allows the used by our detector to be compared very quickly. Ada-boost selects a minute number of critical visual features from a bigger dataset and gives extremely efficient classifier. What cascade does is it allows us to compute on our region of interest that is separates the background quickly and allows to work on our computation for interested regions. Earlier the high frames rates were achieved in video sequences using pixel color in image. HAAR-CASCADE achieves gets high frames rates using gray scale images with most of the information present. For detecting the face in n image it has to converted from BGR(3-Dimentional Image) to grayscale. The edge features used by haar-cascade for detecting the face is mentioned in the figure given below. Viola Jones uses 24*24 as a base window size & calculates the feature in an image by shifting by one pixel. As per as the preprocessing is concerned we are doing image segmentation and resizing the student image since while capturing the dataset the student present in front of the camera may have background present and we are in the face of the student so while capturing the face of students we are taking at least 300 images of a student in all the different angles so that our data set must be a combination of various images of students that it should get recognized.

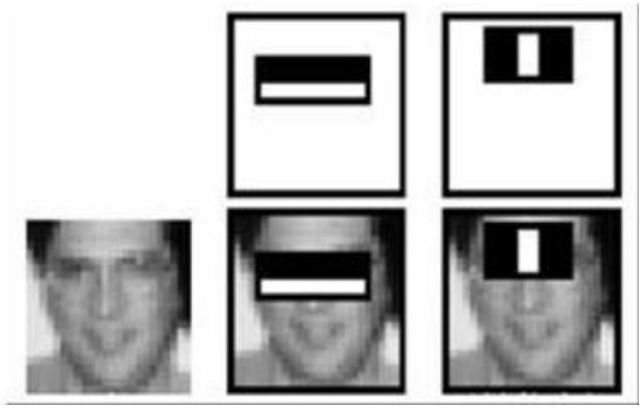

Figure 2. Working of Haar-Cascade Edge Features

Figure 3. Capture dataset image from webcam

Here we can extend the 'id' as the students get increased for the dataset.

3. Face Recognition

The steps of LBP is to summarize the local region in an image by comparing every pixel value with its neighbouring pixel. OpenCV highly supports LBP (Local Binarry Pattern) and the steps are:

- Dataset image is given to the recognizer which is createdby using the function cv2.face.LBPHFaceRecognizer_create().
- The recognizer does the training process by recognizer.train() and histogram gets generated which is stored in a Trainer.yml file by using recognizer.write(). It stores image data corresponding to each name and ID of student in a text readable file. The yml stands for YAML Ain‟t Markup Language. This is a very common file type for storing data of such image database.

- Once the training complete it will be informed to the user with display of message on the IDLE screen saying “Image Trained”.
- After the training is done in similar way for all the students the system is ready for marking attendance using face recognition. Again, the frames obtained are tracked for faces which are converted to gray and undergo all the pre-processing discussed above. These pre-processed images are used for making the prediction about the ‘id’. It will take real-time image feed which is compared with the stored histogram and returns the ID which best matches with the stored information of histograms.
- If a student is present his name is stored in csv file with date and time in excel sheet. Because of this data is well managed and is easily accessible. After this data stored for the student can be sent to parents through email for keeping checks whether he is attending the lectures or not.
-

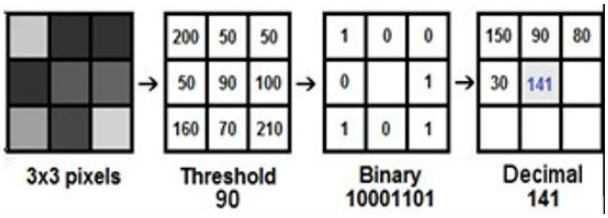

Figure 4. Theoretical Working of LBPH

LBPH working is explained above figure where an image is having different intensities values and there is a window of 3*3. The number of neighbors we are considering can be changed. Considering the center pixel other pixels value are changed if the other pixel less than it is made zero and if it is greater than then those pixels are made one. LBPH works on the concept of sliding window, based on limitations of neighbors it is denoted by P and radius is denoted by R and thus the LBP operator is represented by LBPP, Ru2, u2 stands for using uniform pattern only. Different examples of windows is given in figure below Fig.5.

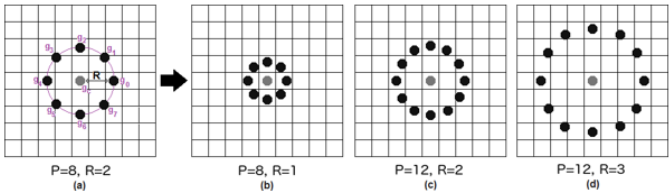

Figure 5. Variations of windows and neighborhood.

4. Accuracy and Distance

- To find the image which can be matched to the input image, histograms of both the images are compared and image with least distance is chosen that is the image closest histogram is chosen.
- There are many ways of comparing the histograms. Some of the examples are Manhattan Distance, standard deviation, euclidean distance, chi-squared distance, absolute value distance etc. In this paper, we are using Euclidean distance and its formula is given as:

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

- The code outputs name of the image from the database which has nearest histogram. The calculated distance is also returned by the algorithm, which is a parameter value called “confidence”. The lower the confidences the better it is since it means the measurement of distance between the two histograms is smaller.
- The machine learning algorithm we are going to use is a supervised algorithm because we are using a labelled data for predicting our output. An supervised algorithm is a algorithm where in we have a test data and the output data is labelled.
- We are dividing our data in train and test.In our project the train can be considered as the student face in the database which is trained using a particular classifier the test data is the data on which we want to give our prediction in our case the test data would be the face which is in front of the camera.

- Accuracy of algorithm varies with the no. of images taken per student.

No. of Images taken in the database	Accuracy (%)
30	26
100	57
150	**64**
300	**75**

Table 1. Accuracy variation with no. of images.

- The test image matched with the dataset which consists 'id' is taken into account for attendance marking. It is then updated in the excel sheet.

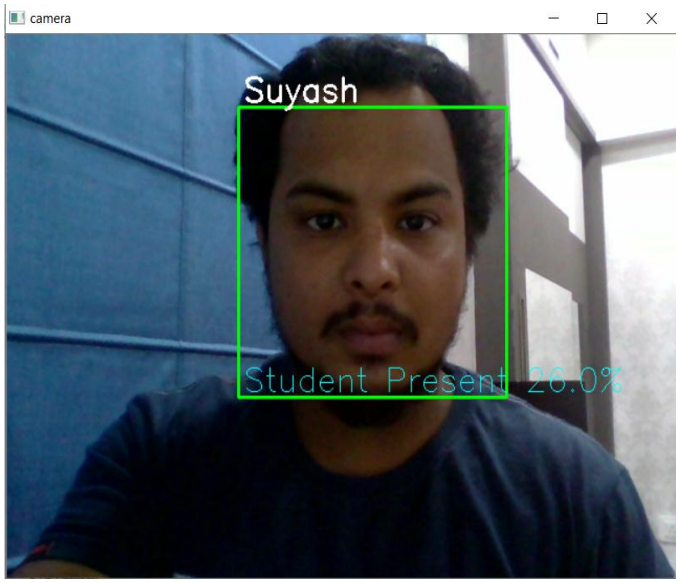

Figure 6. Face matched with dataset

	A	B	C	D	E	F
1		Sr No	Date	Time	Student Name	Status
2		1	05/04/2020	12.44 PM	Suyash Dhabre	Present
3						

Figure 7. Excel sheet updated

V CONCLUSION

Hence with the help of automated attendance system we were able to get our desired results and our lot of productive time is saved. We have also dismissed the probabilities of marking the proxies which occurs due to the manual attendance system. For such a complex process we don't require any peculiar hardware, simply camera and database servers are required.

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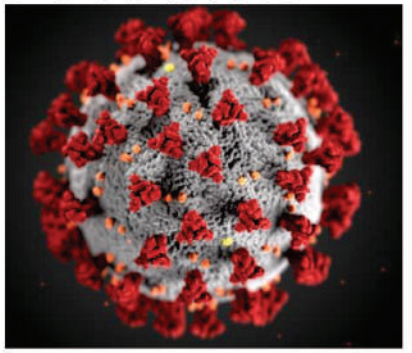

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