An Enhanced Automatic Attendance System with Facial Recognition Algorithm Using OpenCV

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Abstract—

The face is the important part of the human body that uniquely identifies a person. With the unique facial characteristics, the face identification system can be invented. The difficult task for any institution's attendance system is attendance marking. Generally, the student's attendance will be taken by the lecturer during every period and the attendance will be maintained in the register books and they will mark present if the student is in class and mark as absent if the student is not in class. However, those conventional strategies are time-taking and it is a very slow process. To avoid this process, a face recognition system using OpenCV has been implemented. This system will take images from a digital camera that captures an input image, encoding and identifying the face, marking the attendance in an excel sheet, and changing it into a PDF file, these operations take place by following a set of rules. A training database is created via way of means of trains the system with the faces of the legal college students. The photographs are then saved as a database with respective labels. The functions have extracted the usage of the LBPH set of rules.

Keywords— Automatic Attendance, OpenCV, Biometric attendance, biometric, Facial Recognition, spreadsheet

I. INTRODUCTION

Attendance maintenance has great importance in all the establishments that reveal the overall performance of the students. Every institute performs this in its very own way. Some of those institutes use the attendance register or file primarily based structures and a few have followed strategies of automatic attendance the usage of a few biometric strategies. The facial recognition system is computerized-based biometric software that is suited for determining or validating a person via way of means of performing comparison on styles primarily based totally on their facial appearances. Face recognition systems have upgraded a lot in their management over the current years and this generation is now massively used for numerous targets like protection and industrial operations.

The Face Recognition system is a successful field of research that is a computer-based primarily based digital technology. The face recognition system gadget has evolved for marking attendance is innovative software program of attendance system. It is appreciably utilized in safety systems and it can be in assessment with exceptional biometrics collectively with fingerprint or eye iris reputation systems.

As the quantity of college students in an educational institute and the number of employees at an organization grows, for instructors or to the organization moreover increases the hassle of attendance taking additionally increased. So, this paper can be beneficial for these types of problems. The number of college students found in a lecture hall is observed, everyone is recognized after which the records about the number of college students who're present are maintained.

Several methods have been proposed in the current context which is not mature enough to handle the mass quantity and lack of accuracy in marking attendance with facila recognition systems. So this paper proposed method that comes with additional features like e-mail notification to all the students and the marked excel sheet will be shared with class teachers. The remaining section of the paper contains related work, system design, methodology and results.

II. EXISTING WORK

Numerous works have been proposed in the current context to mark attendance automatically using face recognition methods.

Sudha Narang *et al*. [4] proposed a method to face recognition algorithms using OpenCV for attendance systems. To solve the proposed method of face recognition for attendance system using OpenCV it solves challenges of manual system of attendance like error-prone and time consumed. So, this proposed method applied histogram for the Face recognition algorithm. The database is being used for mode was given and SVM classifier for name recognition. This method mechanically detects student once he/she enters the category area and marks the attendance by recognition.

Visalakshi *et al.* [5] proposed a method for marking attendance in required premises that will be monitored by the cameras which were fixed in every class rooms and laboratory. This will be done in the OpenCV module. The face will be recognized by the method using the histograms method. OpenCV is an open-source module is used for Face recognition, three-dimensional reconstruction, and target recognition, and target recognition. The student faces

are matched with the template images which were captured already during the enrolment process and this process is designed using OpenCV libraries.

The proposed system's idea is developed in python, OpenCV module, MySQL, Wamp and Apache, MS Excel and additionally steps concerned on this assignment creates a database, training faces, face detection, face recognition, post-processing.

In this challenging path face recognition and face detection. In face detection, the detector looks for the face using Harr cascade frontal face module and in face recognition, real-time recording is done to ensure the accuracy of the system. In the algorithm the LBPH in training faces is used to be employed to coach is set of resolution and the recognized face resolutions are different. As the result, the face recognition system exhibits a well-organized way with the help of Harr frontal face cascade and real-time face recording.

Vishnu Priya *et al*. (2018) [6] addresses that, formerly the organizations /establishments use biometrics like fingerprint-primarily based totally and iris identification.

But Facial reputation is one of the biometric software program programs which could perceive a selected person in a virtual image. Face recognition had been used in lots of programs in the subject of banking, passport office. But the problem in it is it cannot identify the person in the case of identical twins. So, the author proposed the Local Binary Patterns algorithm to identify in case of identical twins because the LBP can describe nicely the micro patterns present within the face and it shops them within the database with an accuracy of 89.3%.

Similarly, Akshara Jadhav *et al*. (2017) [7] proposed that- in modern times face recognition has a vital part in the case of attendance marking. So, the author proposed an Face metrics based attendance system. The existing system for attendance taking is taking manually. So, one has to note details of each person and take attendance for each person which takes more time.

For time management, they had introduced this attendance system with face recognition. Whenever a person comes in front of a camera it detects and recognizes automatically and marks the attendance in the database. Here, they used the Viola-Jones algorithm for face detection which detects face using cascade classifier and PCA for feature collection and SVM for classification. As above, it also performs and stores the data in a database with an accuracy of 89.1%.

Ashish Chowdary *et al*. (2016) [10] says that through one of the biometric technique used for face recognition proposed model. It is taken into consideration to be one of the essential success programs of picture evaluation and processing; this is the principal motive in the back of the remarkable interest it's been given within side the beyond numerous years.

The face identification process involves two major procedures among the first one contain normalization and localization. After these face template matching process was carried out.

This paper proposes a novel approach for taking automatic attendance of the students with in the class and lab premises without disturbing them. The attendance will be taken automatically from the cameras which are fixed in different locations where we need to mark the attendance. Face mages will be matched with the template images already stored during the template registration process, and the matched faces will be marked attendance, these details will be updated in the system database for scrutinising and also an acknowledgement

mail will be sent to the corresponding student that the attendance is marked. These approaches were not available in the current context.

III. SYSTEM DESIGN

The block diagram of the proposed system is given in Fig.1 which give us a transparent view of the proposed automatic attendance system. with face recognition using OpenCV. Fig. 1 represents the proposed architecture diagram of Face Recognition. This figure concisely describes the steps which are to be required build this automatic attendance system. The four steps are:

*1)*From the architecture diagram of Automatic Attendance System with Face Recognition Using OpenCV, this clearly shows that the user needs to enter an ID, Name, Email and need to press enter button in the command prompt.

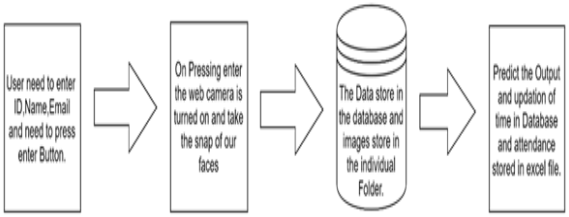

Fig. 1. The Architecture of Automatic Attendance System with Face Recognition Using OpenCV

2) Tap the enter key, to turn on the web camera and takes snaps of faces. It not only takes a single snap, several snaps can be taken from it.

3) From the details given in the command prompt, it stores that data in the database, and images are stored in individual folders.

4) As a result, the last step shows that the time gets updated in the database and attendance will be marked in an excel sheet.

IV. METHODOLOGY

Local Binary Pattern Histogram algorithm is one of the simplest face recognition algorithms. It can recognize the face both the front face and side face. It is possible to get great results from LBPH. This can be achieved by providing the OpenCV (Open-Source Computer Vision). Before going to the LBPH algorithm, let us first understand the basics of images and pixels are represented in face recognition.

Now coming to the LBPH (Local Binary Pattern Histogram) algorithm, the main parameters are such as Radius: with this radius, the circular local binary pattern can be built and represents the radius around the central pixel. Radius is initially set to 1. The other important parameter is neighbors. It gives the count of sample points to build the circular local binary pattern. It is set to 8.

The algorithm should be trained initially. To train, there is a necessity to apply a dataset of the face images of students to identify. For this purpose, set an ID, name, subject name, and email for each image, so that these details will be useful for the algorithm for recognizing an

input image and then it marks the attendance. There is a necessity that a person should have the same ID of multiple images.

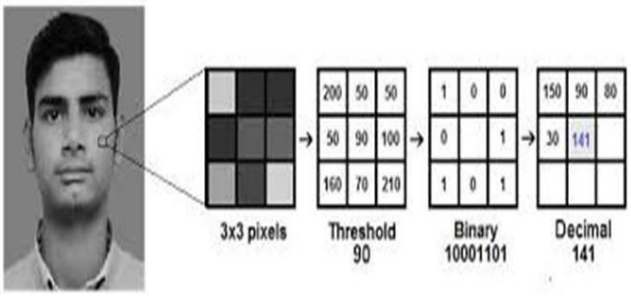

Fig. 2. Performance of LBPH Operator (Courtesy Google)

LBPH algorithm generates a temporary image which describes the template image in a quality way in which facial features are highlighted. This step is achieved with the help of sliding window technique by applying radius and neighbor as parameters

The procedure for the above image is:

- Let us assume that we considered a face image in grayscale.
- The portion of the image can get as a window of 3*3 pixels.
- Now, the threshold value is nothing but the central value from the matrix.
- The maximum value can be applied to find the fresh values taken from the 8 neighbors.
- For every neighbor of central value, assign a new binary value. The values that are larger than or equal to the maximun value are assigned to 1and the other values less than the threshold value are assigned to 0.
- Therefore, the matrix includes the best binary values by leaving the important central value. And, then concatenate every 0 or 1 value from every places from the matrix line through a line into brand new binary values. Use a clockwise course to concatenate the binary values. The binary value is 10001101.
- A decimal value can be obtained by converting the binary value and then assign it to a pixel value generated from the real image which is the centre value of the matrix..
- At the end of this method, the new image will be formed with better features of the real image.

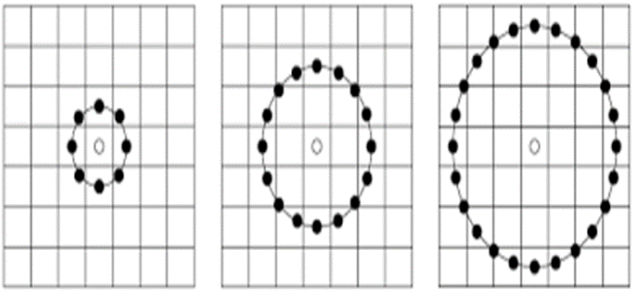

Fig. 3. Circular three different neighbors set for different values (Courtesy Google)

The LBP operator was extended to select a radius and neighbors value differently, which is normally described as circular Local Binary Pattern.

Bilinear Interpolation method is applied to identify the radius and neighbors. If there is some data point in between the pixels, it can use values from the four nearest pixels (2*2) to guess the value of the new data point. Now, histograms should be extracted.

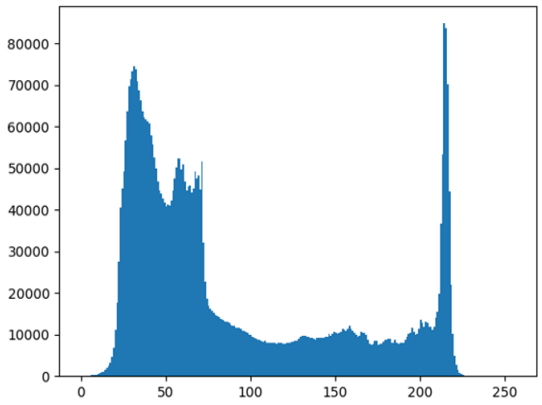

Fig. 4. Concatenated Histogram (Courtesy Google)

Generally, Histogram contains 256 positions that represent the occurrences of every pixel intensity. Now, the algorithm is trained. Each histogram describes an image taken through the training dataset. Consequently, when another input image is given it performs the following steps and a histogram will be created.

Face recognition performs by differentiating the two histograms. There are numerous approaches to compare the histograms. In this chapter, the used approach is chi-square.

From this, a face is detected and it forms into decimal values using binary value matrices and then forms into histograms. This process repeats until the whole image is detected.

The distance calculated is known as confidence. Both confidence and threshold will help estimate whether the face has been recognized correctly or not. The recognition will be successful when the threshold value is greater than confidence.

V. RESULTS

The below data is taken from the system web camera using OpenCV. Around 50 images during the enrollment phase is taken with different dimensions were generated for a single person which will make the proposed system gives more accuracy in face identification and matching process. All these 50 images of each user will be stored in the database which will be considered as a dataset for this model.

For this system, a dataset for 3 users were taken to evaluate the performance of the proposed system. This system is identified those three users during attendance marking phase and email notifications also sent successfully.

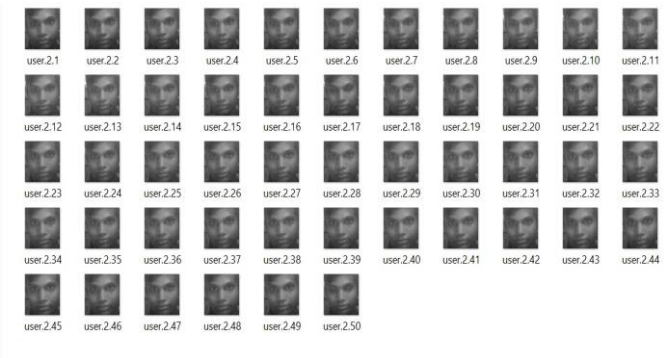

Fig. 5. Trained dataset

All the 50 images were stored in the database as an image template during the user registration phase. The above Fig. 5, it is achieved from the trained dataset of the image and finally, the face will be recognized by using the Local Binary Patterns Histograms.

The LBPH performs its operations and recognizes the face as shown in the below Fig. 6, by displaying the name and confidence value. Another feature of this method of automatic attendance system is that, when the image is captured by using the camera, the camera image itself notified that the name of the person, the amount of accuracy in face matching along with his register number.

Fig. 6. Face Recognition

It performs the remaining operations like attendance stored in an excel sheet and mail sent to the person whose attendance was marked successfully. These operations are shown below.

The following figure Fig.7 describes the recognition percentage be owned by one dataset. For testing purpose, only limited data set entries were produced. The performance of this model also evluted with these three datasets only.

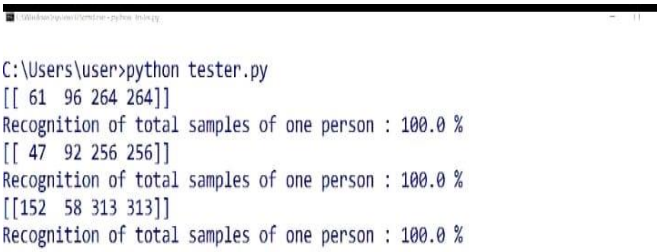

Fig. 7. Recognition of entire samples of a person

Fig.8 describes the user details were given and these information's will be stored in the database. This figure contains the details about the user enrollment phase. During the enrollment phase a collection images approximate 50 images were taken for each person with different angles. These 50 different facial images of the same person is stored in the database as face image dataset.

In this paper, for evaluating the system performance we have taken the image s of 3 persons only.

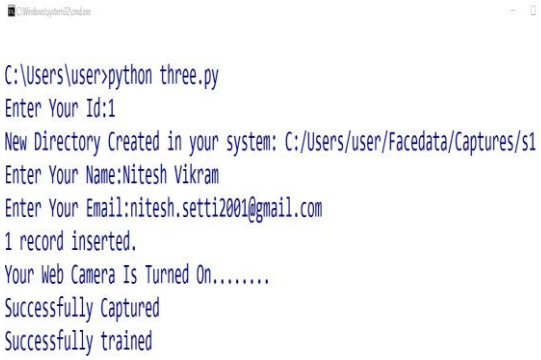

Fig. 8. User details which were given in the command prompt

So our dataset contains approximately 150 images. When the students were enterd in to the class room, lab premises or library, the cameras fixed during these locations will capture the image and this captured images is matched with images which were collected during the enrollment phase. If it finds the exact match, then the matching accuracy, name of the student and their roll number were displayed. Writing in excel sheet and email notifications are also initiated after the successful match

Fig. 9 contains the details about how attendance will be stored and passed to the respective mail id. Attendance will be marked for each session. Each time, the marked attendance will be stored in the database for future reference ans well as mail also delivered stating that attendance is marked for all the sessions.

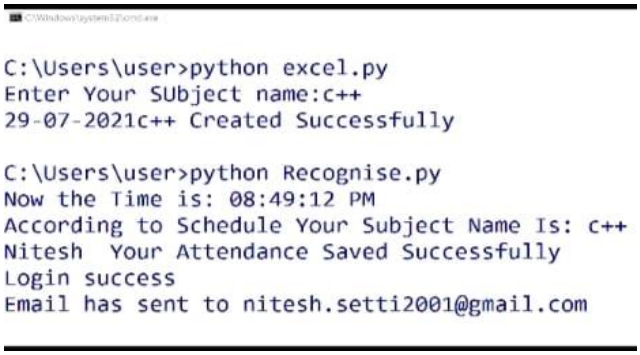

Fig. 9. Attendance Details which were declared in command prompt

Therefore, when the face is detected and it will be recognized by the system, and the attendance is stored automatically in an excel sheet as shown in figure 10. Attendance will be marked on each period of the day and the each time the excel sheet is updated session wise

which will make the attendance administrator to maintain the attendance sheets as well as report preparation. E mail notification also sent to the corresponding student, so each student can check their attendance individually.

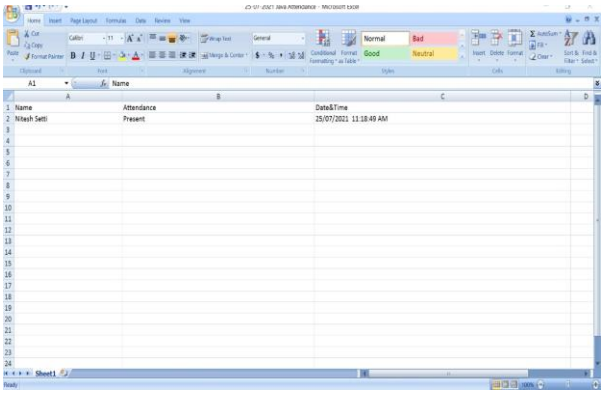

Fig. 10. Attendance stored in excel sheet

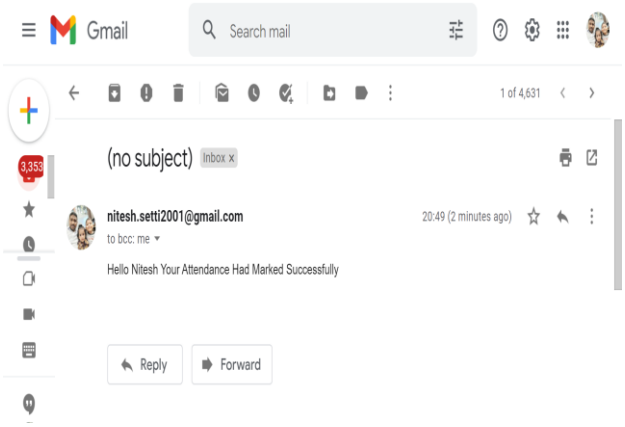

Fig. 11. Successfully mail sent to that particular person

The performance of face recognition of a person is shown in Fig.12.

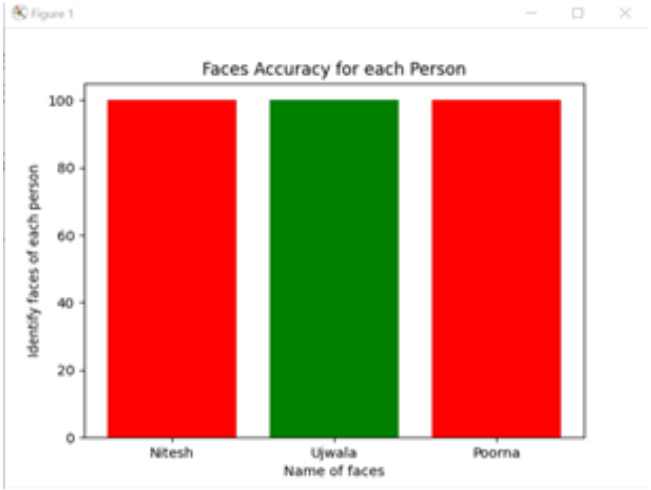

Fig. 12. Accuracy Graph of LBPH

CONCLUSION

This paper concentrates on an automatic attendance system with face recognition. The human daily cannot note or mark the attendance of each person in a particular class or an organization. This will be a daily task for that particular person. An alternate is required for this problem. So, to avoid this "Automated Attendance System with Face Recognition using OpenCV" was implemented by using Local Binary Pattern Histogram Algorithm. In this algorithm, the face is recognized and attendance is stored automatically in the database. So, this idea makes it easy to mark attendance and also saves time which gives the maximum accuracy.

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