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Instinctive Face Identification System for Classroom Attendance

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Abstract: To maintain the attendance record with day-to-day activities is a challenging task. The conventional method of calling the name of each student is time-consuming and there is always a chance of proxy attendance. The proposed system is based on face recognition to maintain the attendance record of students. The daily attendance of students is recorded session-wise which is stored already by the administrator. As the time for the corresponding session starts, the system automatically takes snaps and detects faces to perform recognition. Once the face is recognized in the given image, the recognized students have marked present and their attendance is updated with the corresponding time and session id. A linear binary pattern histogram has been used to detect faces by comparing reference images stored in the database. The result shows higher accuracy in recognition as well as detected face count.

Keywords: *Modified Linear binary pattern histogram), LBPH, Face Identification, Face recognition, Automatic attendance.*

INTRODUCTION

Every organization requires a robust and stable system to record the attendance of their students and every organization have their own method to do so, some are taking attendance manually with a sheet of paper by calling their names during lecture hours and some have adopted a biometrics system such as fingerprint, iris or voice recognition and RFID card reader. The conventional method of calling the name of students manually is time-consuming event. In the RFID card system, each student is assigned a card with their corresponding identity but there is a chance of card loss or an unauthorized person may misuse the card for fake attendance. In the wake of COVID-19, the use of biometrics system such as a fingerprint is at high risk to get infected.

Use of face recognition for the purpose of attendance marking is one of the smart solutions for Instinctive attendance system. Face recognition is more accurate and faster technique among other techniques and reduces the chances of proxy attendance. Face recognition provides passive identification that is a person who is to be identified does not need to take any action for their identity. Face recognition involves two steps, first step involves the detection of faces and the second step consists of the identification of those detected face images with the existing database. The proposed system uses a real-time face recognition approach to reduce the flaws of the existing system with the help of a modified Linear Binary Pattern Histogram (LBPH) algorithm. The image is captured through the camera and then input images are compared with the set of references images of each student to identify the faces and mark their attendance. After that attendance sheet will be generated and these sheets through message will be sent to the faculty. Our main goal is to develop an automated attendance management system using face recognition that overcomes the limitations of existing systems.

Related Work

One of the Major areas for most of researchers to work on is Image processing. The most Popular sub-part of image processing is face recognition and face detection. There are many algorithms present that detect and recognizes human being faces. Like LBPH, Eigenface, Neural network, Fisher face, Elastic Bunch Graph Matching. The Eigenface is one of the most used algorithms for face recognition. This method is used for dimensionality reduction. Principal Component Analysis (PCA) is used for face recognition and face detection. Eigenfaces use eigenvectors to divide into principal components. This eigenvector are obtained from the covariance matrix. Eigenvectors are used to find the variation between multiple faces. The faces having the largest eigenvalue are approximated to detect faces. The accuracy of eigenfaces depends on many factors such as pixel value for comparison of the projection, light intensity. The process of finding the eigenvectors and eigenvalues is time-consuming. The LBPH method is another widely used algorithm for extracting useful features from preprocessed facial images to perform face recognition. It is a pixel-based Texture extraction method and it is one of the best performing texture descriptors. Model used in [1], fetch all the data of students from database firstly, then resize and create face vector. The created face vectors are used for eigenface and saved into XML file. In another solution proposed by authors of [2, 6, 12], the first step in this system is the creation of a database of faces, and a camera is used for the detection of faces. In these work models are trained on faces stored and detected faces are compared with the id of the student. This system is totally dependent on the quality of the camera. Each image of training data is converted into a grayscale. The face image is detected using Haar Cascade frontal face module using LBPH algorithm and the faces in the image are predicted after those faces displayed in a green box along with their associated names. In [15], the camera is set at the entrance to capture snaps when a student enters in the classroom. In this work, queue of students slows down the detection process.
In one of the recent research, the authors of [3] have used Viola and Jones algorithm for face bounding box detection and PCA is used for face recognition. Each image in the training dataset is represented as an eigenface. The authors of [19] have used the alignment-free partial face recognition along the viola-Jones algorithm for face detection. In this work snaps of students are taken from a camera placed at the top center of the blackboard at fixed intervals and then the image is converted to grayscale before performing the face detection. Then Alignment-free partial face recognition algorithm is used to recognize faces. After recognition, data is updated into an excel sheet. In [11], the authors have used Convolutional Neural Network (CNN) to detect faces. Once the face is detected it is being compared to the faces stored in the database for matching the student details for attendance. Research conducted by [4] used Complete Kernel Fisher Discriminant (CKFD) method. In this work, image captured by the webcam is converted into grayscale and cropped to 50 x 50 pixels. Then it computes Eigenvectors from scattering Matrices.

The limitations of existing solution on the basis of the parameters such as accuracy, ageing problem, real time detection, recognition of different facial angles and multiple face detection are described as follows:

1. Solution presented in [1, 6, 10, 14, 16, 17, 15] have low accuracyin comparison to recent face recognition systems.
2. The methods used in [16, 17] can partially solve the aging problem.
3. It is difficult to recognize face in real-time using methods adopted in [1, 5, 8, 12, 17, 18, 19].
4. The solution provided in [1, 5, 6, 7, 10, 13, 14, 15, 17] are unable to detect and recognize faces presented with different angle.
5. The work presented in [5, 18] fails in detecting multiple faces together.
6. The solution of [1, 8, 10, 11, 12] is sensitive to lighting conditions.

PROPOSED METHODOLOGY

In general, the attendance is taken offline in paper or by using a fingerprint or using ID. The proposed system automatically detects students and marks attendance accordingly without human interventions. Figure 1 represents the overall flow of the proposed system. The proposed Instinctive attendance system consists of modules like a camera, an image database. The camera installed in the classroom is used to capture an image, whereas an image database is used to store images of students.

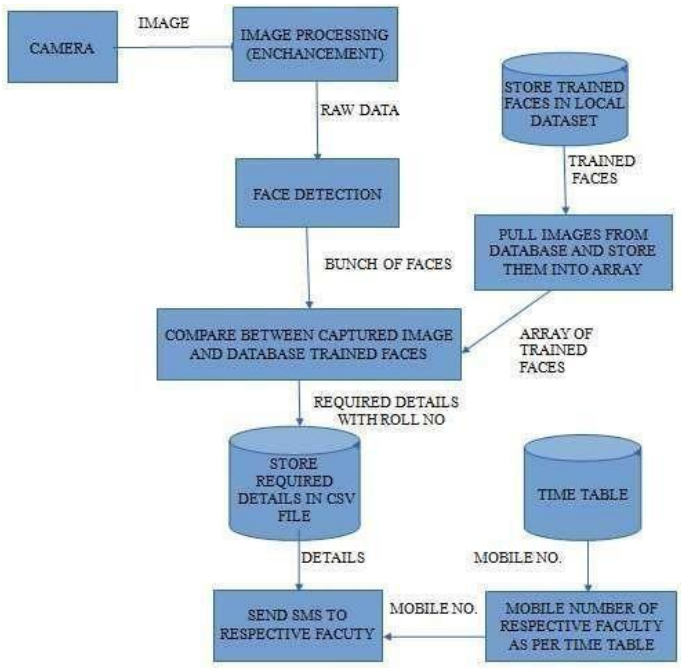

FIGURE 1 Proposed System Workflow Diagram

The detail steps of proposed system is described in following algorithm.

Algorithm of Proposed Solution

Step-1: Registration of students' details in student's database

Step-2: Image is captured by the camera

Step-3: Image processing and detection of faces

Step-4: A bunch of detected faces is then compared with trained faces which are stored in a database

Step-5: If faces which are recognized then the system collects Roll no and saves it into CSV file

Else: go back to Step 1

Step-6: Roll no. which is saved in CSV file then convert the data into specific structure of a message

Step-7: At last, the message is sent to the respective faculty as per time table

Different modules of our proposed system are discussed as follows:

A. Storage and retrieval of student images and metadata:

General information like Enrollment No., Name, and Class with section, along with images is stored in the database. The images stored in the database are used for training the model and comparison with new input images. The database also contains the respective faculty mobile number as per time table. With the use of the mobile number, the system sends enrollment no. of students whose faces are matched with respective database faces.

B. Capture the faces of students Camera:

The camera installed in the classroom is used to capture the faces for detection and recognition of existing students. For the proposed system, the camera is used in such a way, that all students are visible.

C. Face Detection:

The face detection module is used to check whether the human's faces appear in the given image or not. In other words, face detection is used to detect landmarks that are presented on a human's face. Face detection is important for face recognition after the image is taken through the camera and given to the system.

D. Face Recognition:

After face detection, the faces are compared with respective database faces. Face recognition is used to identify an individual student with their face. If the face is matched with any of the images stored in the database, the respective enrollment number from the database is retrieved. In this paper face recognition has been done using the LBPH algorithm as discussed in the related work section.

E. Send Message:

Once students are recognized then, the enrolment number is stored in the CSV file for attendance purposes. The system also sends a text message to the registered number of faculty as per time table.

RESULT

In our proposed system, we mainly focus on three things that is Real-time, accuracy rate, and aging. With the real-time system, there will be no delay to get the attendance after the detection of the faces. For good accuracy, the high-resolution camera has been used to get the proper face identification. This system is very easy to operate and the system runs well in any lighting condition but not too dark. It can still recognize the faces of the growth in hair or growth of beard. After detecting faces, the excel sheet will be generated which contains the present student's enrollment number, and send those enrollment numbers to respective facilities. Figures 2, 3, and 4 show the results of the proposed system as per steps given in different modules in the above section.

FIGURE 2 Opening of WebCam from proposed system

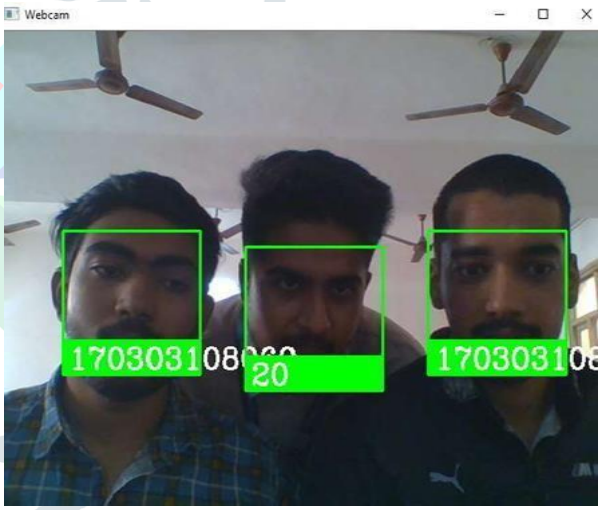

FIGURE 3 Detecting of faces along with enrollment numbers

FIGURE 4 Notification of present numbers

CONCLUSION

An instinctive face identification system is a smart solution for students' face recognition and classroom attendance. This system is useful to avoid fake attendance and human intervention. The recognition rate is lower during cloudy weather because faces are not clearly visible to the system. The results show that the accuracy level of a grayscale image outperforms the color images. Furthermore, the recognition system has enough precision for the identification process. Most schools and colleges often use paper registers for attendance Therefore, this system will decrease paper usage in schools and colleges which is good for the environment. A few factors affect accuracy in the detection and recognition of unintentional changes. In the future, the system can be enhanced by utilizing color images. Additionally, an instinctive face identification system can be enhanced to recognize different poses of a person and the faces along with the masks.

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