Face Detection and Recognition for Automatic Attendance System

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***Abstract*: Student attendance structure is define to manage the student class attendance using the face detection and recognition through openCV (open computer vision). The major reason of developing this system is to improve the performance of the attendance system procedure besides reducing the time load and manual work. This project is completely based on general purpose language named as "Python" through which we use the concept of computer vision. For face detection system we use the haar cascade and for face recognition we use the LBPH algorithm. The training of individual student happened and finally the system generates the spreadsheet which provides the number of students present in classroom with an image capturing.**

***Keywords*: LBPH, OpenCV, Camera, Attendance, Face recognition, Face detection.**

1. Introduction

Traditionally, attendance is marked manually by teachers and they must make sure correct attendance is marked for respective student. This whole process wastes some of lecture time. In order to determine classroom attendance, face detection and face recognition is performed. We propose a system that takes the attendance of students for classroom lecture. Our system takes the attendance automatically using face recognition. Face recognition system enhance security, provide secure access control, and protect personal privacy.
Here, we will create four files

1. Attendance: In the attendance file the student's attendance will be mark.
2. Student Details: In student detail file the name and roll no of reach student will be stored.
3. Training Image: In the training image file the image get captured to train and to mark the attendance.
4. Haar cascade File: In haar cascade file is used to analyse the trained faces.

2. Literature Survey

The paper attendance system the automatic attendance was proposed, the system consists of a camera that captures the images of the classroom and sends it to the image enhancement module. Algorithm is trained for the images of faces and then applied on the class room image for detection of face in the image. The detected faces are compared with the face database using an opencv algorithm. The face database consists of templates of face images of individual students that was collected and stored by an roll no. and name. In this way the faces of students are verified one by one and the attendance is marked on the server. The system has been executed in 3 basic steps. The primary step is face detection and extraction. The image is captured by camera which is taken as input. Once the face is detected, it's regenerate into a gray scale image pixel. The second step is to train face which are get captured. The third step is that face recognition and identification. If it's matched means that the student attending is registered with time.

3. Overview

Face recognition being a biometric technique implies determination if the image of the face of any particular person matches any of the face images that are stored in a database. This difficulty is tough to resolve automatically because of the changes that several factors, like facial expression, aging and even lighting can affect the image. Facial recognition among the various biometric techniques may not be the most authentic but it has various advantages over the others. Face recognition is natural, feasible and does not require assistance. The expected system engages the face recognition approach for the automating the attendance procedure of students or employees without their involvement. A camera is used for capturing the images of students. The faces in the captured images are detected and compared with the images in database and the attendance is marked.
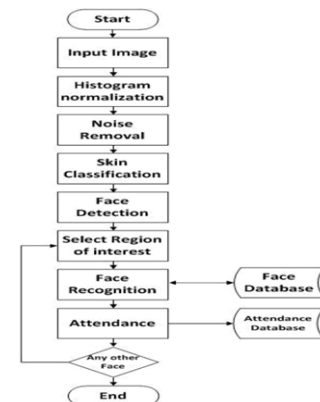

Fig8: Algorithm of automatic attendance using face recognization
Fig. 1. Face recognition
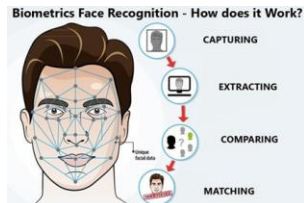
*Corresponding author: mangeshkale009@gmail.com
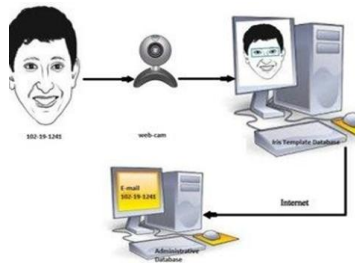
Fig. 2. Biometric face recognition

Fig. 3. Administrative database

4. Proposed System

The proposed attendance system consists of 3 phases; Image acquisition, Face Detection, Face Recognition. The operating of the system is represented as follows:

1. *Image Acquisition*: The system consists of a camera that captures the pictures of the student and sends it to the image pre-processing. Then that image is sends for face detection.
2. *Face Detection*: This method separates the facial space from the remainder of the background image. The faces area unit keep within the information and detected, when that Face extraction is additionally administered.
3. *Face Recognition*: The face image is then compared with the captured image. If the face image is matched with the stored image then the face is recognized. Then for that individual student the attending is recorded.

5. OpenCV

OpenCV (open source computer vision) could be a common computer vision library started by Intel in 1999. The cross platform library mainly setup its unique and specialize in real-time image processing and this also a part of patent free implementations of the upcoming latest computer vision algorithms. OpenCv comes with a packages and programming connection with respect to C, C++, Python and Android.
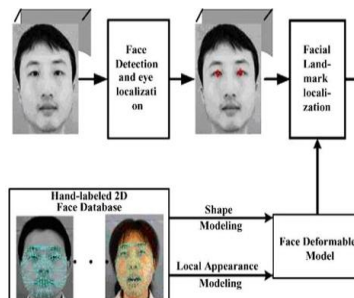

Fig. 4. Computer vision

6. Local Binary Patterns Histograms

This method needs the gray scale pictures for dealing with the training part. This algorithm in comparison to other algorithms is not a total approach.

1) Parameters

LBPH uses the following parameters:
   i. *Radius:* Generally, 1 is set as a radius for the circular local binary pattern which denotes the radius around the central pixel.
   ii. *Neighbors:* The number of sample points surrounding the central pixel which is generally 8. The computational cost will increase with increase in number of sample points.
   iii. *Grid X:* The number of cells along the horizontal direction is represented as Grid X. With the increase in number of cells the grid becomes finer which results in increase of dimensional feature vector.
   iv. *Grid Y*: The number of cells along the vertical direction is represented as Grid Y. With the increase in number of cells the grid becomes finer which results in increase of dimensional feature vector.

2) Algorithm training

For the training purpose of the dataset of the facial images of the people to be recognized along with the unique ID is required so that the presented approach will utilize the provided information for perceiving an input image and providing the output. Same images require same ID.

3) Computation of the algorithm

The intermediate image with improved facial characteristics which corresponds to the original image is created in the first step. Based on the parameters provided, sliding window theory is used in order to achieve so. Facial image is converted into gray scale. A 3x3 pixels window is taken which can also be expressed as a 3x3 matrix which contains the intensity of each pixel (0-255). After this we consider the central value of the matrix which we take as the threshold. This value defines the new values obtained from the 8 neighbors. A new binary value is set for each neighbour of the central value. For the values equal to or greater than the threshold value 1 will be the output otherwise 0 will be the output. Only binary values will be present in the matrix and the concatenation is performed at each position to get new values at each position. Then the conversion of this binary value into a decimal value is done which is made the central value of the matrix. It is a pixel of the actual image. As the process is completed, we get a new image which serves as the better characteristics of the original image.

4) Extraction of histogram

The image obtained in the previous step uses the Grid X and Grid Y parameters and the image is split into multiple grids. Based on the image the histogram can be extracted as below:

1. The image is in gray scale and each histogram will consist of only 256 positions (0-255) which symbolizes the existences of each pixel intensity.
2. After this each histogram is created and a new and bigger histogram is done. Let us suppose that there are 8x8 grids, then there will be 16.384 positions in total in the final histogram. Ultimately the histogram

signifies the features of the actual image.

5) The face recognition

The training of the algorithm is done. For finding the image which is same as the input image, the two histograms are compared and the image corresponding to the nearest histogram is returned. Different approaches are used for the calculation of distance between the two histograms. Here we use the Euclidean distance based on the formula:

$$x_p = x_c + R\cos\left(\frac{2\pi p}{P}\right)$$

$$y_p = y_c - R\sin\left(\frac{2\pi p}{P}\right)$$

Hence the result of this method is the ID of the image which has the nearest histogram. It should return the distance calculated in the form of 'confidence'. Then the threshold and the 'confidence' can be used to automatically evaluate if the image is correctly recognized. If the confidence is less than the given threshold value, it implies that the image has been well recognized by the algorithm.
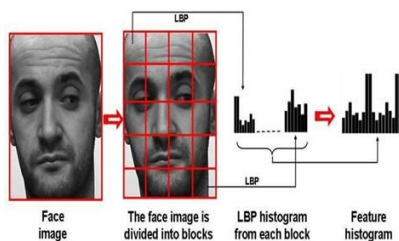

Fig. 5. Face image

7. Advantages of LBPH

1. It is one of the simplest algorithm for face recognition.
2. The local features of the images can be characterized by this algorithm.
3. Using this algorithm, considerable results can be obtained.
4. OpenCV library is used to implement LBPH algorithm.
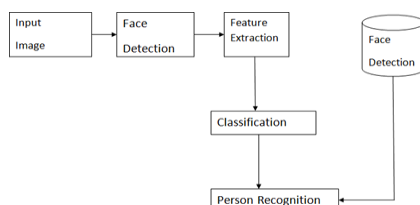
1) Block diagram

Fig. 6. Block diagram

8. Face Database

In automated attendance system, there are generally 3 methods to create customized dataset so that one can use face recognition and detection to acquire certain results for satisfying ones requirements, they are given as:

- *Use open computer vision and camera:* In this method, you need a particular person to create and gather the certain datasets which is loaded in system using the computer vision library.

- *Capturing the frames from image*: This method is similar to earlier method but the different is that it captures an image of a student from which it extracts certain data frame by frame loop in it. Saving the acquire dataset or frames in our database – In this phase we don't need a physical appearance of an individual instead we use a public figure of strong online presence

9. System Description

1. Capture the student's image through camera.
2. Detect each and every individual face by apply face detection algorithm.
3. Extract the ROI (Region of Interest) in rectangular bounding box.
4. Converting to gray scale, apply histogram equalization and resize to 100x 100 i.e. apply pre-processing.
5. If image captured, then
   Store in database
   Else
6. Apply LBPH [Local binary patterns histogram] (for feature extraction)
7. Post-processing

1) Project Advantage

1. Proxy attendance id eliminated.
2. It saves time and efforts.
3. It stores the faces which are detected and automatically marks attendance.
4. The system is convenient and secure for the user.

10. Project Scope

1. Provide facility for the automated attendance of students and mark the attendance in excel sheet.
2. Uses live face recognition to recognize each individual and mark their attendance automatically.
3. Facility of marking and updating attendance automatically.

11. Conclusion

In this project we have implemented an attendance system for a lectures to record student's attendance. It saves time and effort. This attendance system shows the use of facial recognition techniques for the purpose of student attendance. Then the detected faces are then verified with face database. The system has been implemented using the LBPH algorithm. It tends to be assumed that the strong, secure and quick framework. There is no further requirememt for the certain equipment for this system it only required the personal computer and a digital camera.

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