isrjournals

International Journal of Advanced Research in Computer Science Engineering and Information Technology

Volume: 6, Issue: 3,Special Issue: 1 ,Mar,2021 ,ISSN_NO: 2321-3337

Automatic Attendance Scheme using Face Recognition System

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Abstract

Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Examples include upper torsos, pedestrians, and cars. Face-detection algorithms focus on the detection of frontal human faces. It is analogous to image detection in which the image of a person is matched bit by bit. Image matches with the image stores in database. Any facial feature changes in the database will invalidate the matching process. A reliable face-detection approach based on the genetic algorithm and the eigen-face technique: Firstly, the possible human eye regions are detected by testing all the valley regions in the gray-level image. Then the genetic algorithm is used to generate all the possible face regions which include the eyebrows, the iris, the nostril and the mouth corners. After a number of iterations, all the face candidates with a high fitness value are selected for further verification. At this stage, the face symmetry is measured and the existence of the different facial features is verified for each face candidate.

Key Terms: GUI – Graphical User Interface, API – Application Programming Interface, CV – Computer Vision.

1. Introduction

An automatic attendance management system that aims at solving the issues faced by manual methods of existing systems. We use the concept of face recognition to implement a system that marks the attendance of a particular person by detecting and recognizing the face. This system eliminates the cost for extra equipment, minimizes

attendance-taking time, and allows users to access the data efficiently.

2. Literature Survey

Refik Samet and others [1] proposed a system developed by the integration of ubiquitous components to make a portable device for managing the students' attendance using Face Recognition technology. The present paper proposes a flexible and real-time face recognition-based mobile attendance management system. A filtering system based on Euclidean distances calculated by Eigenfaces, Fisher faces, and LBP has been developed. Smart devices are very user friendly to perform classroom attendance monitoring. Teachers, students, and parents can use the application without any restrictions and in real-time.

Shubhobrata Bhattacharya and others [2] proposed an system which has been designed to register the face of each individual for the first time. Once done, the network trains it automatically for future usage. For the next classes, the students can get their self-attendance done with the GUI offering a drop-down menu for the recognized face. This is because of the chance of look-alike within the class. The first name in the drop down has the highest probability of the match.

Huimin Zhang and others [3] proposed a system. The system is designed in such a way that the attendance is generated for the students individually to ensure their course and the classes. The database is more accurate, and the statistical analysis reports the results date wise, course wise, major wise and also the instructor of the course wise.

Mashhood Sajid and others [4] proposed a proposes a model for attendance management system in which we have two databases one is storage database and the other is known as student database. The storage database contains the already stored images and the masks calculated by the facial fiducial points of the students such that of nose, eyes and lips mainly. The other database known as student database will be used to mark the attendance of the students. A camera will be fixed in the class in the front, at such an angle where the picture of the whole

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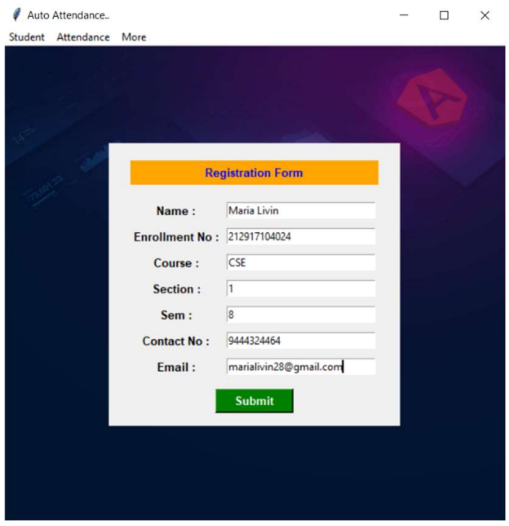
class can be taken. It will calculate the measurements of the facial features and then they will be matched to the image information stored in the storage database. Once the matches are done, the student's attendance is marked to solve the issue of validation of the student present in the class or not.

System Design

The system uses a combination of techniques in two topics; face detection and recognition. The face detection is performed on live acquired images without any application field in mind. Processes utilized in the system are white balance correction, skin like region segmentation, facial feature extraction and face image extraction on a face candidate. Face recognition is done by Haar cascade algorithm. This recognition system uses biometrics to map facial features from a photograph or video. It compares the information with a database of known faces to find a match. Facial recognition can help verify personal identity, but it also raises privacy issues is used to recognize the face by using positive and negative images. Face recognition is a method of identifying or verifying the identity of an individual using their face. Face recognition systems can be used to identify people in photos, video, or in real-time. Law enforcement may also use mobile devices to identify people during police stops. So this two steps that is face detection and face recognition steps are used in this attendance system. It makes the work very easy and quick. This attendance system mainly based on face recognition and face detection.

3. Implementation

The registration details are filled by the students for the first time and are saved in the database.



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OpenCV Module: We use OpenCV to detect facial landmarks in an image. OpenCV Extracts faces as the function saves the image as a cv2 object.

It then greys out the complete image. This is done so that CV2 can process through the image faster with better results.

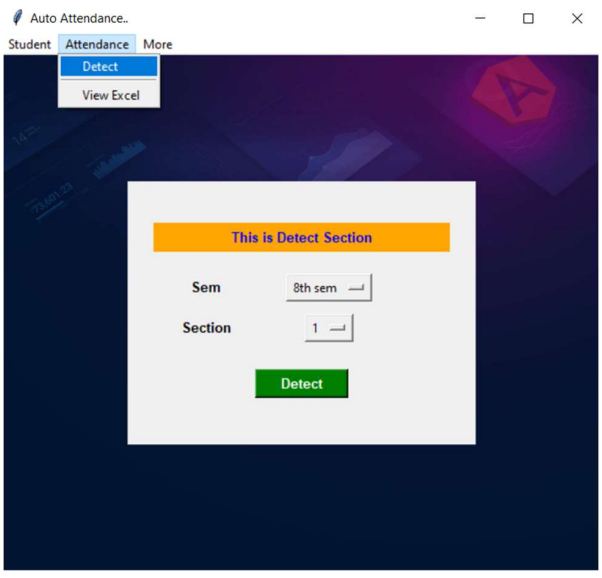
 # Load the image

gray = cv2.imread('face_detect_test.jpeg', 0)plt.figure(figsize=(12,8))

plt.imshow(gray, cmap='gray')

plt.show()

A cascade classifier is defined with built in cascade xml files.



The cascade classifies calls a multi selection detect method which detects patterns with given arguments

The multiselect ion detect method returns an object which has all the 4 points of all rectangles of all the faces detected.

 # Detect faces

faces = faceCascade.detectMultiScale

(gray, scaleFactor=1.1, minNeighbors=5,

flags=cv2.CASCADE_SCALE_IMAGE)

For each face

for (x, y, w, h) in faces:

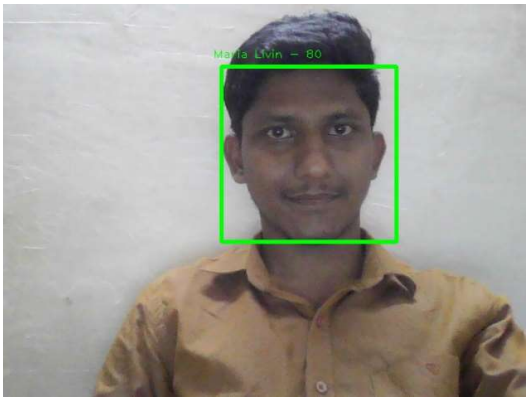
Draw rectangle around the face

cv2.rectangle(gray, (x, y), (x+w, y+h), (255, 255, 255), 3)

plt.figure(figsize=(12,8))

plt.imshow(gray, cmap='gray')

plt.show()



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We Loop through the object and colour the rectangles for reference and at the same time, each rectangle is again converted back to a coloured image and saved in another folder. This folder consists of all the faces OpenCV has detected.

- **Face Identification:** We need to train the model and it consists of 3 types.
- **Image Resizing:** We use PIL Library in python to first resize the image to a fixed resolution in the aspect ratio of 1:1.
- **Image Augmentation:** We use the ImageDataGenerator pre-processing module from the keras library to augment the image and flood them.
- **Model training and testing:** We use the Haar cascade features in python as they contain almost all the algorithms and required functions to build the model. We again use the ImageDataGenerator to pre-process the image.

Cascade classifiers are trained on a few hundred sample of images that contain the object we want to detect, and other images that do not contain those objects.

- Haar Feature Selection, features derived from Haar wavelets
- Create integral image
- Adaboost Training
- Cascading Classifiers

Haar Feature Selection

There are some common features that we find on most common human faces:

- a dark eye region compared to upper-cheeks
- a bright nose bridge region compared to the eyes
- some specific location of eyes, mouth, nose

The characteristics are called Haar Features.

ADABOOST

Given a set of labelled training images (positive or negative), Adaboost is used to:

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- select a small set of features
- and train the classifier

CASCADING CLASSIFIER

In an image, most of the image is a non-face region. Giving equal importance to each region of the image makes no sense. The key idea is to reject sub-windows that do not contain faces while identifying regions that do. A series of classifiers are applied to every sub-window. The classifiers are trained using Adaboost and adjusting the threshold to minimize the false rate. When training such model, the variables are the following:

- the number of classifier stages
- the number of features in each stage
- the threshold of each stage

Luckily in OpenCV, this whole model is already pre-trained for face detection.

References

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