Facial Recognition in Web Camera using Deep Learning under Google COLAB

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Abstract

Face recognition is a method used to identify or verifying the identity of an individual using their face. Now a days systems could be trained to check inputs in the form of photos, video, or in real-time. This kind of systems finds many applications Face recognition is a popular and evergreen area for most research people. Over the period of time, many different algorithms were introduced by the researchers across the globe. Identification of individual using facial image recognition is used in many real time applications like allowing access to server secured locations, opening doors in working place and unlocking a laptop or mobile. Nowadays anybody and add facial image recognition to their applications by simply invoking the suitable APIs provided by several service providers like Amazon, IBM and Google. Still more challenges are available for the researchers like Aging, Illumination, Face Direction and Facial Expressions that greatly affects the of the performance of the system. This paper deals with recognizing the faces of various users with the help of webcam. When the user enters a class room, his image is captured through a web cam and processed by the python code using cascade classifier used to detect each face in a given image. Then in the recognition phase each phase in the image is compared with the existing image stored in the database.

Keywords- Image processing, Neural Network, Deep learning, Computer vision, Video analytics

I. INTRODUCTION

Face detection performance is a complex process ad it involves many issues to deal with the various inputs supplied to the systems. Due to more updated systems in terms of hardware and software, need to develop a face recognition system to deals with detecting and recognizing for the authentication system. The earlier manual process can't not be used for system with more number of users. After the successful implementation of CTV camera, need for a more accurate system to authenticate each and every user whenever enters into the premises. It fins many applications and need for a more accurate system to avoid any problems and threats to the organization.

A. Issues and Challenges in Face recognition

Face recognition has more issues in object recognition and computer vision. In our daily life many more biometric applications are used for person authentication like, face recognition, finger print, iris detection etc. Each and every method has its own pros and cons. To identify each person uniquely, face is considered as having more important one as it is used different applications such as security, forensic investigation. It has more challenges with different facial expressions, pose variations, occlusion, aging and resolution either in the frame of stationary object or video sequencing images. To improve better results, need to have face synthesis, for improving accuracy and recognition rate on different face database like ORL, YALE, AR and LFW.

Facial recognition technology uses a database of photos, such as mugshots and driver's license photos to identify people in security photos and videos. It uses biometrics to map facial features and help verify identity through key features of the face. The most key feature is the geometry of a face such as the distance between a person's eyes and the distance from their forehead to their chin. This then creates what is called a "facial signature." It is a mathematical formula that is then compared to a database of known faces. Another major concern is the use of facial recognition for law enforcement purposes. Today, many police departments across the world have begun utilizing the technology.

II. LITERATURE SURVEY

Identification of human faces by the unique characteristics or features of their face is known as Face recognition. Currently, Face recognition technology is the fastest growing technology. Instead of using the traditional methods, this proposed system aims to develop an automated system that records the student's attendance by using facial recognition technology for those who are present during lecture hours.. Compared to existing system traditional attendance marking system, this system reduces the workload of people and also saves times. System proposed in [1] has been implemented with 4 modules such as Image Capturing, Segmentation of group photo and Face Detection, Face comparison and Recognition, Updating of Attendance in database.

It is indicated that M-FLDA can able to speed up the process of recognition and reduce the memory capacity. Finally, the preliminary study of solving facial pose changes[2]. Face detection overlapping is one of the important works in face detecting applications. In this paper DRLBP algorithm is used to identify overlapped faces detection. Initially the face is detected from database images using DRLBP feature extraction. This feature extraction result is compared to our test images. Finally classified method is used where we can classify and get the attendance validation result [3].

Facial image acquisition systems [4] produce low quality face images. This happens because the imaging conditions like illumination, occlusion or noise might change among images. Now a days, the field of image processing has wide range applications in biometric recognition, behavioral analysis, teleconferencing and video surveillance [5].

The model proposed in [6] focuses on how face recognition incorporated with Radio Frequency Identification (RFID) detect the authorized students and counts as they get in and get out form the class room. Manual entering of attendance in logbooks becomes a difficult task and it can be easily manipulated. The detected faces are matched against the reference faces in the dataset and marked the attendance for the attendees. Finally the absentee lists are said aloud through voice conversion system for confirmation. Secondly, the system is trained to classify the gender of the students present in the class[7].

III. STEPS IN FACE DETECTION

Note that face recognition is different from face detection:

- Face Detection: Mainly it focuses on finding the faces in input image with various features that is the input for face recognition algorithm.
- Face Recognition: Once the facial images extracted, and various preprocessing steps applied like cropping, resizing and it is the responsibility of the face recognition algorithm to find suitable features to describe the image so that it could recognize as expected output image.

There are two modes possible for face recognition systems to operate:

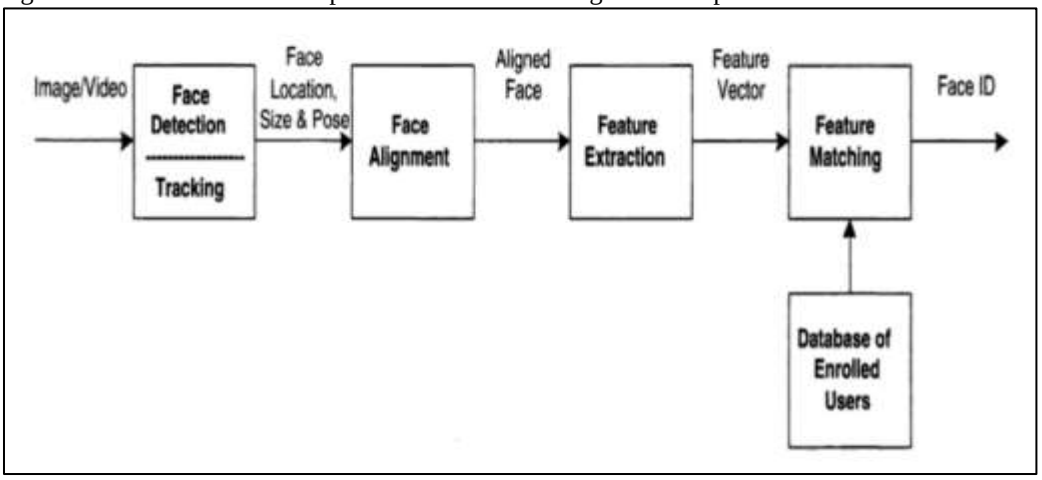
- Verification or authentication of a facial image: It is one to one mapping to compare input facial image and related to image for which authentication is required.
- Identification or facial recognition: In this mode it compares given input image with the given dataset, to find the user that matches that face.

A. Face recognition Steps

Face recognition is often described as a process that first involves four steps; they are: face detection, face alignment, feature extraction, and finally face recognition.

1) Face Detection. To locate the place in which one or more faces in the image and marked with a bounding box.
2) Face Alignment. Regularize the face to have exact match with the database.
3) Feature Extraction. Then, extract features used for the recognition task.
4) Face Recognition. Perform matching of the face against one or more known faces in a prepared database.

The following diagram shows overview of the process involved to recognize the input face.



Face Recognition Process flow

IV. HOW FACIAL RECOGNITION WORKS

Facial recognition is the process of identifying or verifying the identity of a person using their face. It captures, analyzes, and compares patterns based on the person's facial details.

1) The face detection process is an essential step as it detects and locates human faces in images and videos.

2) The face capture process transforms analogue information (a face) into a set of digital information (data) based on the person's facial features.
3) The face match process verifies if two faces belong to the same person.

V. COMPARISON OF RESULTS

LDA-IR algorithm works best, presumably since it is the only algorithm that uses a parameterization that is optimized for those protocols

Table 1: This table details the resulting correct acceptance rates (CAR) at false acceptance rate (FAR) 0.1% on the GBU database

	LDA-IR	LGBPHS	Gabor graphs	ISV
Good	79.2%	66.6%	71.9%	80.5%
Bad	41.8%	12.3%	13.7%	22.5%
Ugly	12.3%	2.7%	3.1%	4.3%

The results on the BANCA database are reported in Table 2. Unlike on the GBU database, here the LDA-IR algorithm performs much worse than the other algorithms, which could be because the meta-parameters of LDA-IR are not optimized for this database, whereas, e.g., ISV was developed using BANCA algorithm.

Table 2: This table presents the verification results of experiments performed on the BANCA database. It includes the equal error rates (EER) on the development set and the half total error rates (HTER) on the test set.

	LDA-IR	LGBPHS	Gabor graphs	ISV
EER	26.2%	13.2%	11.7%	10.0%
HTER	27.2%	16.1%	12.4%	10.9%

VI. EXPERIMENTAL WORK

The below procedure is used to perform face recognition using colab. Haar Cascade classifier is an effective object detection approach which was proposed by Paul Viola and Michael Jones. This is basically a machine learning based approach where a cascade function is trained from a lot of images both positive and negative. Based on the training it is then used to detect the objects in the other images.

So how this works is they are huge individual .xml files with a lot of feature sets and each xml corresponds to a very specific type of use case.

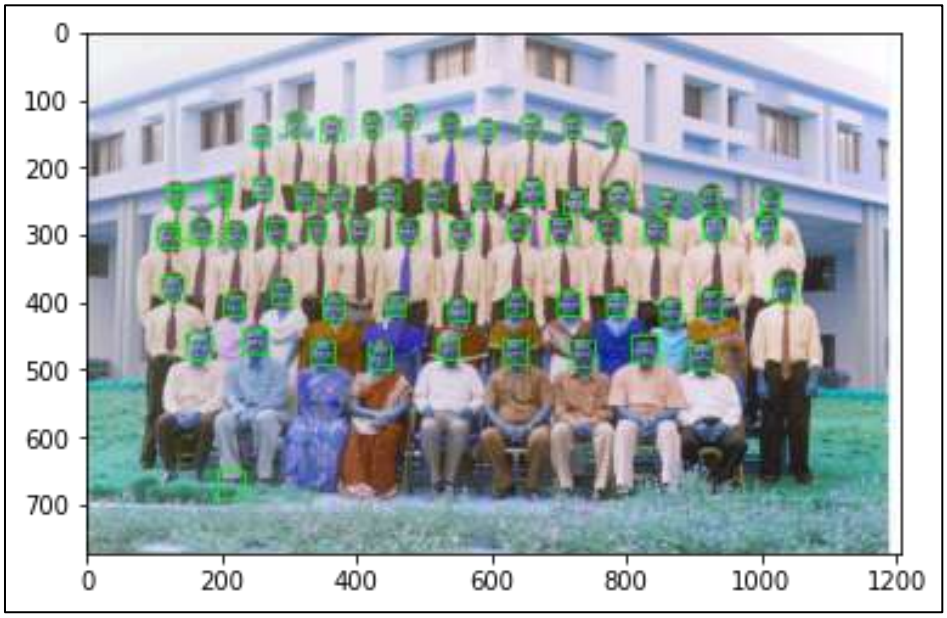
using the face_classifier which is an object loaded with haarcascade_frontalface_default.xml, we are using an inbuilt function with it called the detectMultiScale.

This function will help us to find the features/locations of the new image. The way it does is, it will use all the features from the face_classifierobject to detect the features of the new image.

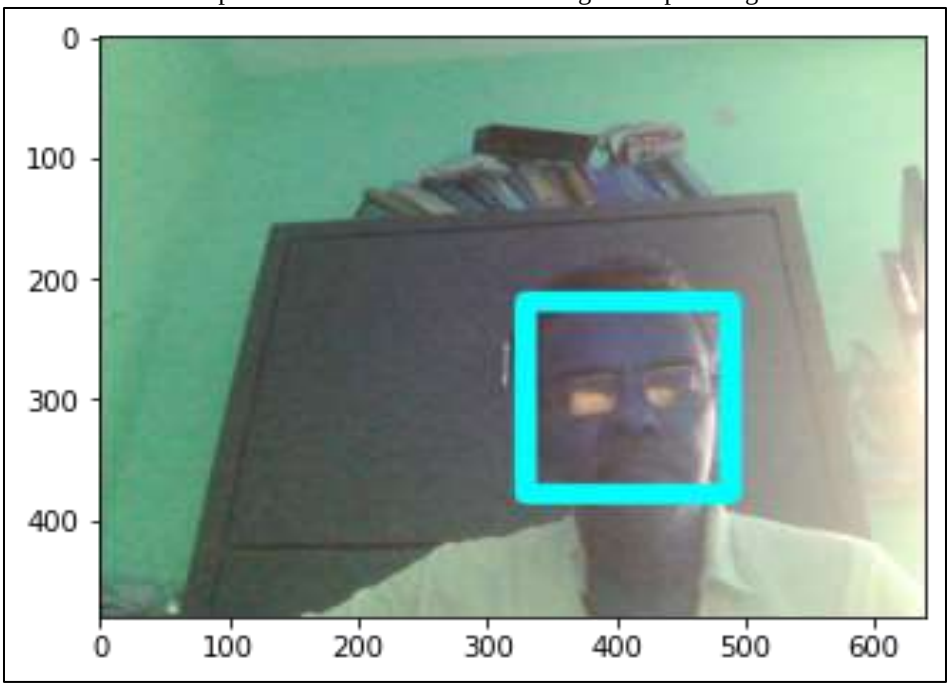
```
from google.colab import files
file=files.upload()
test_image = cv2.imread('mepco.jpg')
# Converting to grayscale as opencv expects detector takes in input gray scale images
test_image_gray = cv2.cvtColor(test_image, cv2.COLOR_BGR2GRAY)
plt.imshow(test_image_gray, cmap='gray')
haar_cascade_face = cv2.CascadeClassifier('haarcascade_frontalface_alt2.xml')
faces_rects = haar_cascade_face.detectMultiScale(test_image_gray, scaleFactor = 1.2, minNeighbors =1);
# Let us print the no. of faces found
print('Faces found: ', len(faces_rects))
for (x,y,w,h) in faces_rects:
cv2.rectangle(test_image, (x, y), (x+w, y+h), (0, 255, 0), 2)
plt.imshow(test_image)
```

VII. CONCLUSION

Thus the face detection and recognition is done with various inputs are given in the form of input image or video from webcam also. From the webcam video, individual images are given to the system and it uses the cascade classifier and do the classification as shown in below. The input may be a single image or collection of images. Still it can able to detect and bounding box is drawn in each and every image object with more accurate manner.



Output that shows Face detection for given input image



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