DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Project report on Facial Detection and Recognition

Guided by:

Dr. Goutam Sanyal

Head of Department

Project Prepared By:

Niraj Kumar Dhotre

Reg. no: 20151007

Roll No: 15/CS/87

Background:

• Face detection has been a trending topic of computer vision for past few years.
• It is used in social media websites to automatically tag people. In case of Facebook it recognize faces with 98% accuracy.
• In classroom, it can be used as an alternative to manual attendance tracking. The facial recognition software can be downloaded on an Arduino kit with a camera and it can keep track of student presents in the class and save the data to a database.

Objective:

• To study face detection and recognition techniques
• To design a system that can detect and recognize faces in real time
• Simulate the algorithms and obtain results using OpenCV with Python.
• Prototype of an automated attendance software which automatically recognizes students and keep track of their attendance in database.

Features of the code:

• Can identify multiple faces in real-time
• It can detect faces of the person on real-time and identifies them and shows the information about the person.
• Generate and store the test data images of people so that every time compilation is not needed
• SQLite database is used to store the information
• The program is not affected by lightening condition.

Project Specification:

Tools and Technologies Used
• Operating System: Windows 10 and Ubuntu 18.04 (64-bit architecture)
• 7 th Generation i7 Processor
• Programming Language: Python 3.7
• Image Processing Library: OpenCV

• Database Used: SQLite
• Hardware Requirement: A webcam for image input
• IDE used: Anaconda Distribution Version 2018.12 / Spyder 3.3.2

THEORY

• The classifier used in the project is HAAR Classifier. HAAR
functions are used for different purposes since 1910. They were
introduced by Hungarian mathematician Alfred Haar.
• We need full frontal upright face to work on.
• HAAR classifier is used in image processing due to its low
computing power requirement. Due to this reason, image
processing is an area of efficient application of HAAR transform
due to their wavelet-like structure.
• There are a variety of powerful and sophisticated wavelet–
based schemes for image compression were developed and
implemented.

Haar Filters
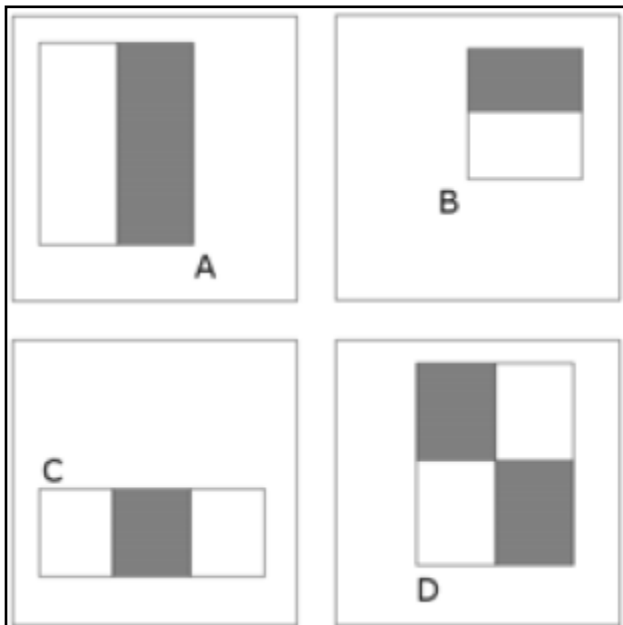
Haar Filter is applied to image region which reveals Horizontal and
vertical features of the image. A Haar-like feature considers
adjacent rectangular regions at a specific location in a detection
window, sums up the pixel intensities in each region and calculates
the difference between these sums. This difference is then used to
categorize subsections of an image.

Haar Feature that looks similar to the bridge of the nose is applied onto the face.
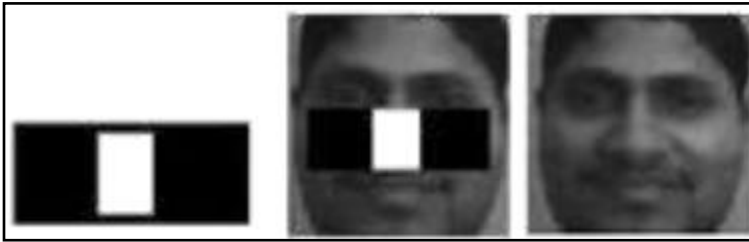
Haar Feature that looks similar to the eye region which is darker than the upper cheeks is
applied onto a face.
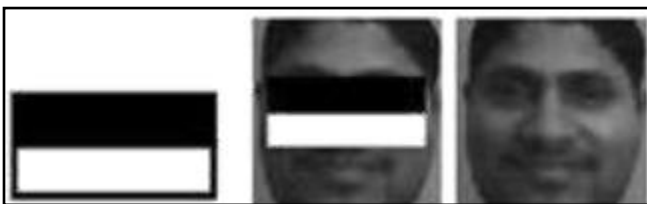
Haar features used to detect a face

FACE RECOGNITION

• How is it different from face detection?
In detection we just need to determine if there is some face
in the image, but in recognition we want to determine whose
face it is.
• The basic concept here is that the face to be recognized is
compared with some training set of known faces.
• In the training set, we supply the algorithm faces and tell it to
which person they belong.
• When the algorithm is asked to recognize some unknown face, it
uses the training set to make the recognition.

WALKTHROUGH THE PROGRAM

There are 3 steps of the whole process.
(i) Pre-processing of image and Dataset Generation
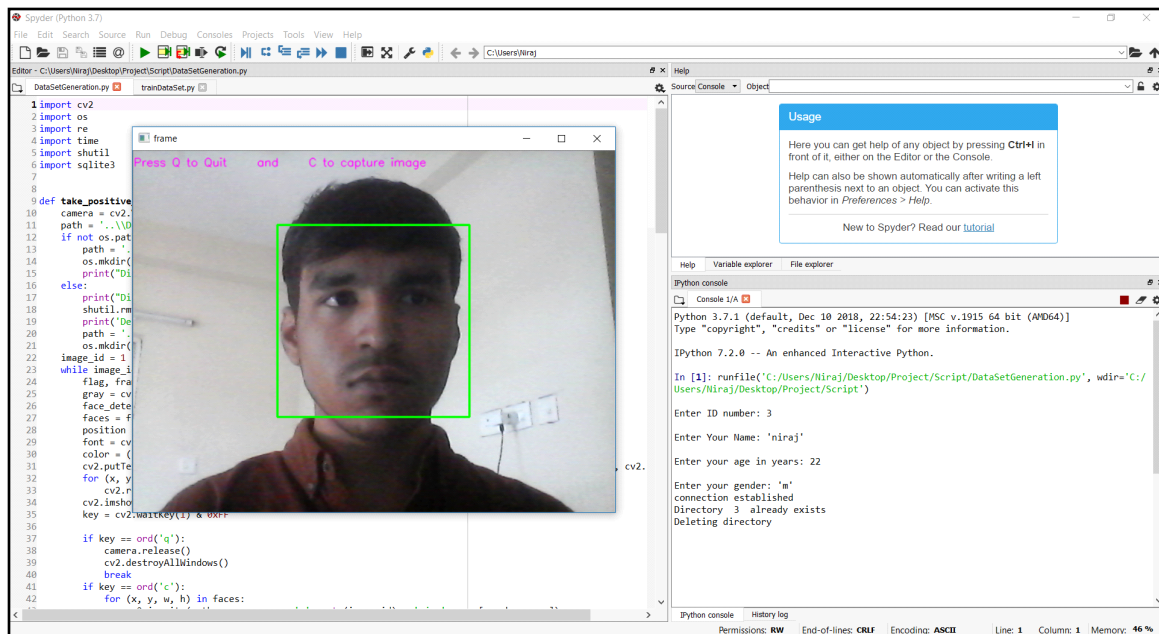(ii) Training the dataset over the input images
(iii) Detecting faces

PREPROCESSING

• In this step, we process the input image so that it can be used for
efficient image feature extraction.
• For this purpose, we take a 200x200 pixel sized image of face
only.
• We convert the image to the grey scale for quick and efficient
computation.

DATA SET GENERATION

• In this step, we take 20 images of each individual person along
with some information like ID, name, age, sex etc.
• If we could not find a image in which the face is clearly visible,
the we classify the image as negative image and separate them
from other images, so called, positive images.
• The images of a person is saved in a separate folder, which is
used to extract the image features.

Collecting Information:

Test Data collection:


```
Enter your gender: 'm'
connection established
Directory  4  Created
1 Image Captured
2 Image Captured
3 Image Captured
4 Image Captured
5 Image Captured
6 Image Captured
7 Image Captured
8 Image Captured
9 Image Captured
10 Image Captured
11 Image Captured
12 Image Captured
13 Image Captured
14 Image Captured
15 Image Captured
16 Image Captured
17 Image Captured
18 Image Captured
19 Image Captured
20 Image Captured


In [5]:
```

IPython console   History log

|				
'Niraj'_1	'Niraj'_2	'Niraj'_3	'Niraj'_4	'Niraj'_9
'Niraj'_10	'Niraj'_11	'Niraj'_12	'Niraj'_13	'Niraj'_15
'Niraj'_16	'Niraj'_17	'Niraj'_18	'Niraj'_19	'Niraj'_20

TRAINING THE DATA SET

• In this step, we compile the features of the images in the dataset and train them over in order to identify them a test image.

• The trained dataset is saved in a yml file.

```
In [5]: runfile('C:/Users/Niraj/Desktop/Project/Script/trainDataSet.py', wdir='C:/
Users/Niraj/Desktop/Project/Script')
Training data set...
Data set training completed...

In [6]:
```

RECOGNITION
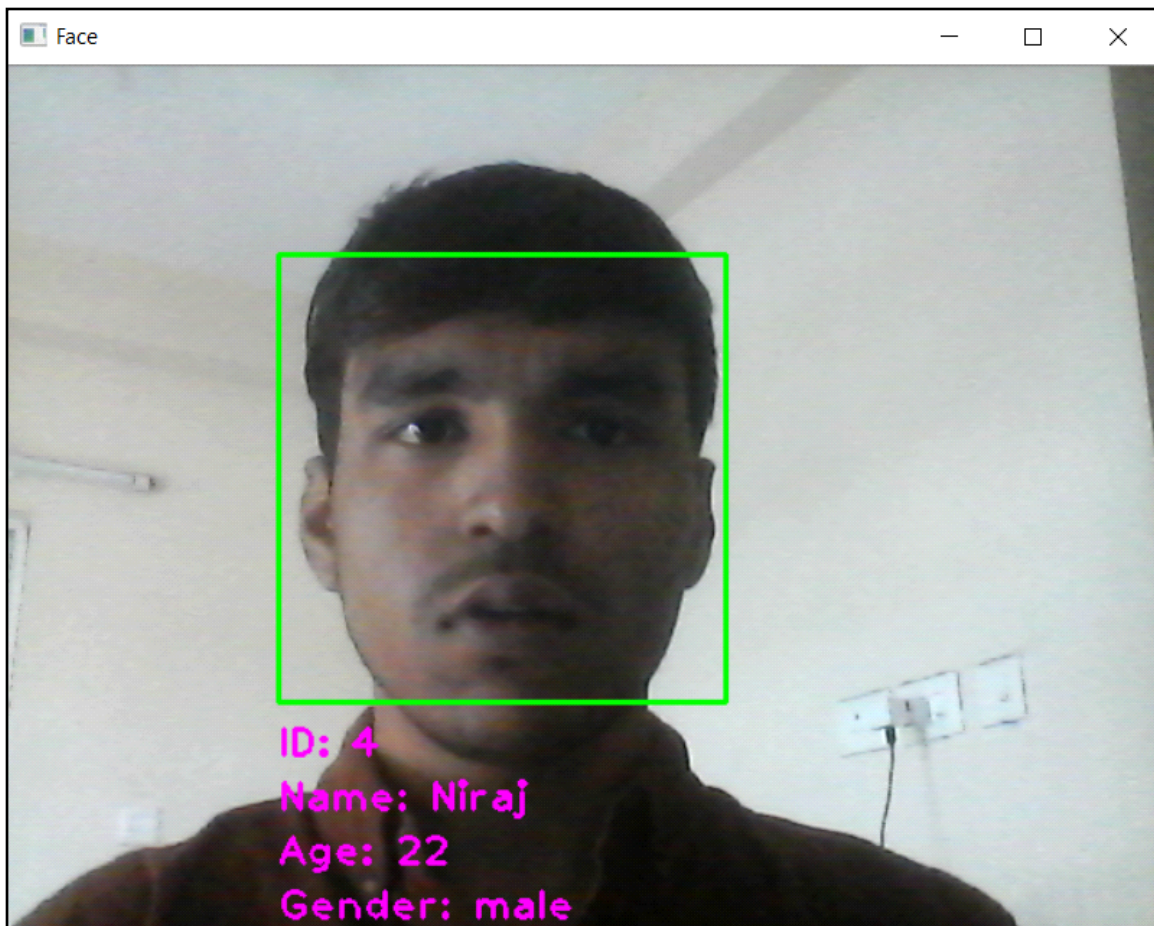
In this step, we take inputof a test image through
webcam
and
the
recognizer then loads the
trainer file and compares
the input image with
stored database. It then
returns the name and the
information of person
detected.

EVALUATION

• Full frontal faces can be detected and recognized easily.
• The application recognizes person in real-time.
• Accuracy reduced with pose variation, change in angles and low
resolution.

FUTURE WORK

• This application will be used in the development of an facial recognition based attendance system with such disguise for example, with beard, changed hair cut etc.
• Other applications of this project would be in gender classification, emoticon analysis, happiness index etc.

CONCLUSION

•The face recognition and detection algorithms were thoroughly studied taking a number of test images and varying the conditions and variables.

•I learnt a lot about the vast collection of image processing modules in OpenCV.

•Other applications of this project would be in gender classification, emoticon analysis, happiness index etc.

•I would like to thank my project guide, Dr. Goutam Sanyal Head of Department, for helping me all along the way.