

# CMPE58Z Introduction to Biometrics

## Assignment 2 Face Detection

Deadline: June 14<sup>th</sup>, 23:59

In this assignment, you are going to analyze the performance of a face detector. You can use Python implementation of the DLIB face detector:

[https://github.com/ageitgey/face\\_recognition](https://github.com/ageitgey/face_recognition)

Refer to the following Python codes in the /examples directory:

find\_faces\_in\_picture\_cnn.py

find\_facial\_features\_in\_picture.py

There are two face detectors: HOG-based and CNN-based. Use the CNN-based version. DLIB can find 1) faces and 2) facial features (facial landmarks), as shown in Figure 1. In your report, plot both detected faces and facial landmarks.



**Figure 1** Found faces (red) and facial landmarks (white).

In order to test the performance of the face detector, you will use a set of images, i.e., use 10 images you choose. Plot the automatically detected faces (and landmarks) in the images and report the following performance measures in a table. See Table 1 as an example. Try to be creative in selecting your images © (See Figure 2 and 3)

1. Number of true positives: Correctly found faces.
2. Number of false negatives: Missing faces (face detector could not find the face in the image)
3. Number of false positives: Face detector finds a face when there is no face.

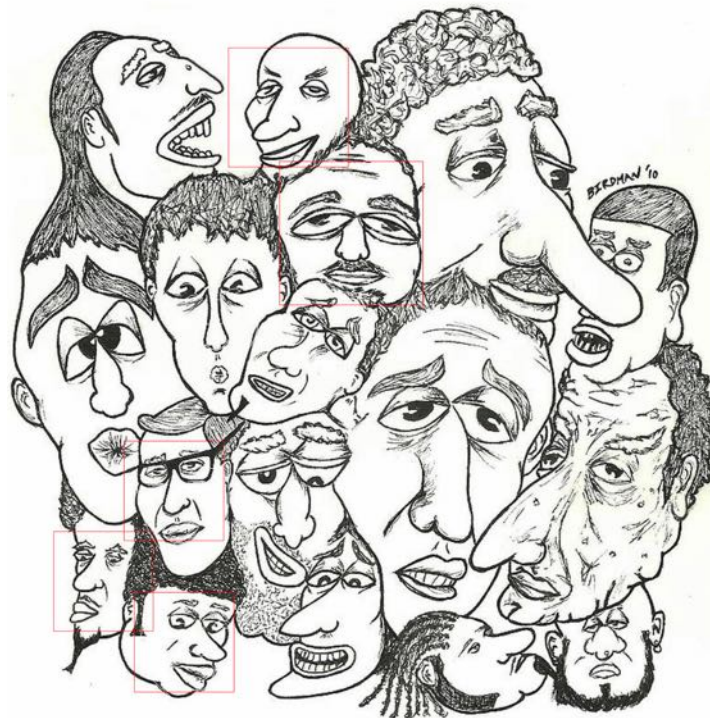
Plot each image in a separate figure, together automatically detected face rectangles, as shown in Figure 1. In the figure caption, explain the failures and potential reasons/explanations for the failures. For instance: "Two faces are not detected because one of them is rotated and the other one is too dark.". If you use DLIB, plot facial landmarks as well.

**Table 1** Performance of the face detector for the given images.

Files	#Faces	Correct Detections	False Positives	False Negatives
Filename1	7	6	2	1
Filename2	10	8	3	2
Filename3	6	5	1	1
...	...	...	...	...
<b>TOTAL</b>	<b>97 faces</b>	<b>89</b>	<b>9</b>	<b>7</b>



**Figure 2** Faces with various colors/patterns.



**Figure 3** Cartoon faces.

If you prefer MATLAB, you can use MATLAB's Viola-Jones face detector.

Computer Vision System Toolbox (vision.CascadeObjectDetector)

<https://www.mathworks.com/help/vision/ref/vision.cascadeobjectdetector-class.html>

Viola-Jones detector usually perform worse than the DLIB face detector.

### Submission Guide

Upload the following files as a single zip file (name\_surname.zip) to the course Moodle page:

**Report:** Report (to be submitted in PDF format) should contain the results of the assignment.

**Source Code:** All required source codes.

### Important Notes

**Late Submission Policy:** Maximum late submission delay is two days. Late submissions will be graded on 50% of the original grade.

**Submissions are Mandatory:** Assignment submissions are mandatory. Otherwise, you fail the course.