Face/Eye Detection 6b

1. Create the combination of various (at least two) face cascade classifiers
   - profile_face + frontal_face
   - cascade classifiers: https://mrl.cs.vsb.cz/data/vyuka/zao/haarcascades.zip
   - experiment with different types of **detectMultiScale** function – e.g. **levelWeights** to filter weaker classifications
   - try to find suitable parameters
   - measure of the time required for localization

```
cv.CascadeClassifier.detectMultiScale(   image[, scaleFactor[, minNeighbors[, flags[, minSize[, maxSize]]]]] -> objects
cv.CascadeClassifier.detectMultiScale2( image[, scaleFactor[, minNeighbors[, flags[, minSize[, maxSize]]]]] -> objects, numDetections
cv.CascadeClassifier.detectMultiScale3( image[, scaleFactor[, minNeighbors[, flags[, minSize[, maxSize[, outputRejectLevels]]]]]] -> objects, rejectLevels, levelWeights
```

2. Detection of eye and mouth/smile inside each face region
   - you can use the following eye detector (or use .xml from OpenCV): https://mrl.cs.vsb.cz/data/vyuka/zao/eye_cascade_fusek.zip

3. For testing, you can use the following video: https://mrl.cs.vsb.cz/data/vyuka/zao/fusek_face_car_01.zip

4. Try to recognize close/open eyes (detection of sclera or pupil/iris)
   - for example, using thresholding: https://docs.opencv.org/4.9.0/da/d97/tutorial_threshold_inRange.html
   - or Template Matching
   - or Hough Circle Transform: https://docs.opencv.org/4.9.0/d4/d70/tutorial_hough_circle.html

5. Calculate accuracy of the eye/close recognition results of the previous video (https://mrl.cs.vsb.cz/data/vyuka/zao/fusek_face_car_01.zip)
   - real (ground truth) data: https://mrl.cs.vsb.cz/data/vyuka/zao/EX/eye-state.txt

CascadeClassifier docs: https://docs.opencv.org/4.9.0/d1/de5/classcv_1_1CascadeClassifier.html

Python:

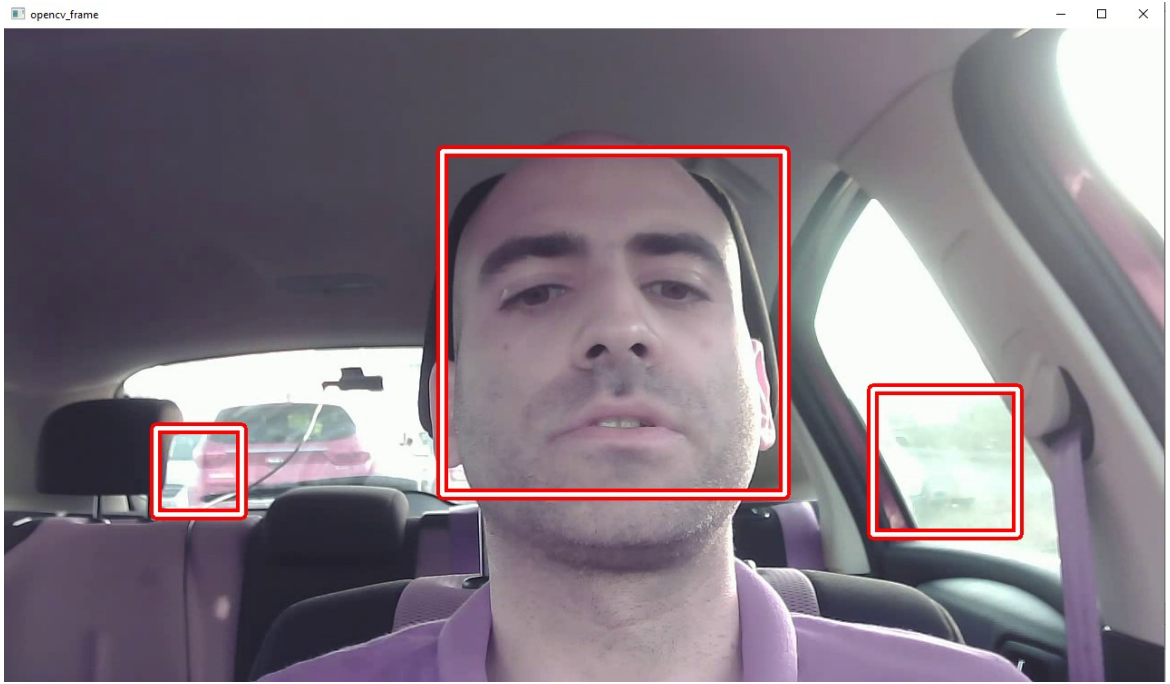
```
cv.CascadeClassifier.detectMultiScale(  image[, scaleFactor[, minNeighbors[, flags[, minSize[, maxSize]]]]] ) -> objects
cv.CascadeClassifier.detectMultiScale2( image[, scaleFactor[, minNeighbors[, flags[, minSize[, maxSize]]]]] ) -> objects, numDetections
cv.CascadeClassifier.detectMultiScale3( image[, scaleFactor[, minNeighbors[, flags[, minSize[, maxSize[, outputRejectLevels]]]]]] ) -> objects, rejectLevels, levelWeights
```

Detects objects of different sizes in the input image. The detected objects are returned as a list of rectangles.

Parameters

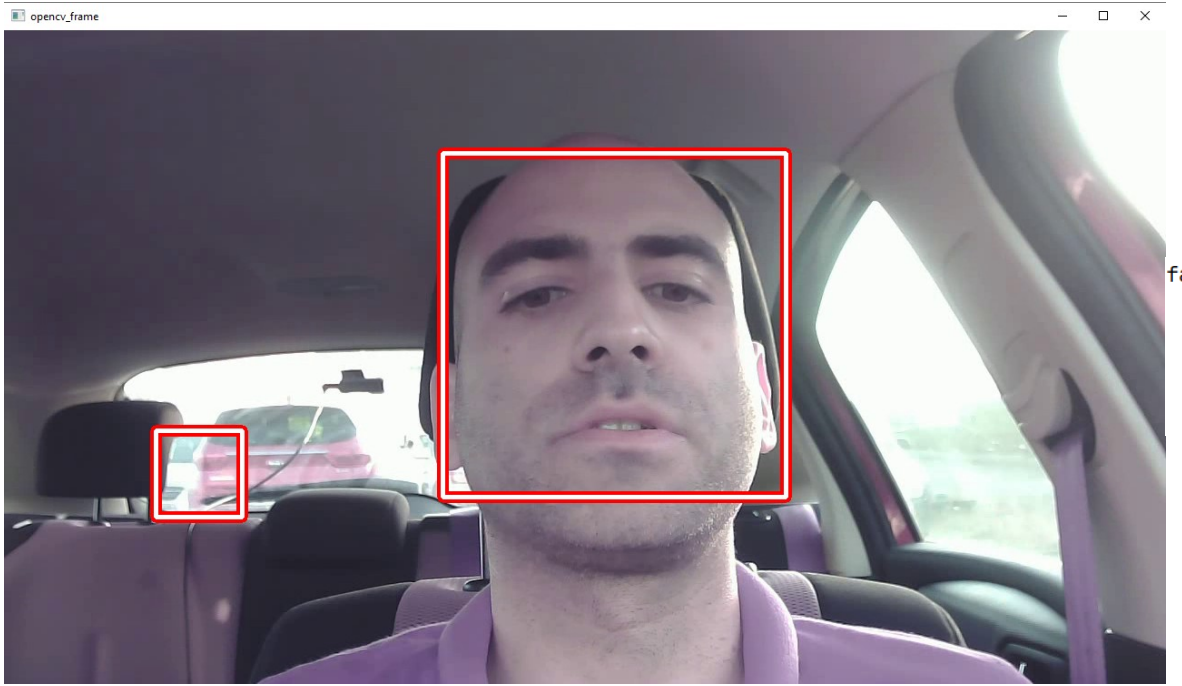
image	Matrix of the type CV_8U containing an image where objects are detected.
objects	Vector of rectangles where each rectangle contains the detected object, the rectangles may be partially outside the original image.
scaleFactor	Parameter specifying how much the image size is reduced at each image scale.
minNeighbors	Parameter specifying how many neighbors each candidate rectangle should have to retain it.
flags	Parameter with the same meaning for an old cascade as in the function cvHaarDetectObjects. It is not used for a new cascade.
minSize	Minimum possible object size. Objects smaller than that are ignored.
maxSize	Maximum possible object size. Objects larger than that are ignored. If `maxSize == minSize` model is evaluated on single scale.

https://docs.opencv.org/4.9.0/d1/de5/classcv_1_1CascadeClassifier.html



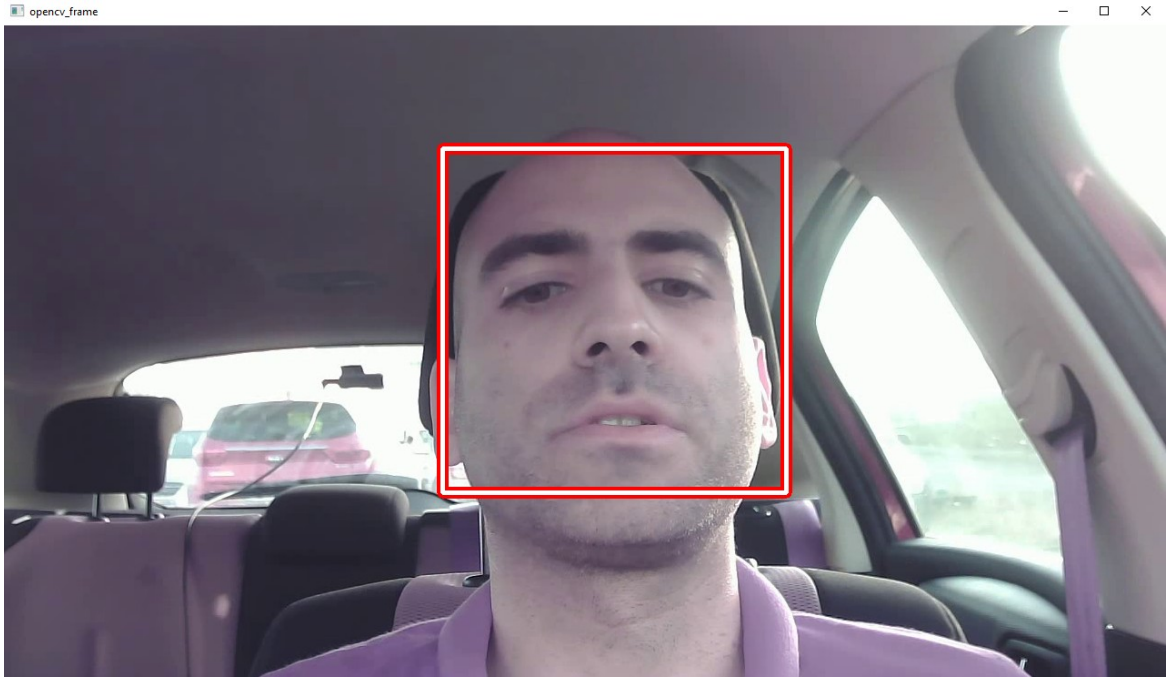

```
faces = face_cascade.detectMultiScale(frame,
                                      scaleFactor=1.1,
                                      minNeighbors=1,
                                      minSize=(50, 50),
                                      maxSize=(500, 500))
```

https://docs.opencv.org/4.5.5/d1/de5/classcv_1_1CascadeClassifier.html#aaf8181cb63968136476ec4204ffca498




```
faces = face_cascade.detectMultiScale(frame,
                                      scaleFactor=1.1,
                                      minNeighbors=3,
                                      minSize=(50, 50),
                                      maxSize=(500, 500))
```

https://docs.opencv.org/4.5.5/d1/de5/classcv_1_1CascadeClassifier.html#aaf8181cb63968136476ec4204ffca498




```
faces = face_cascade.detectMultiScale(frame,
                                      scaleFactor=1.1,
                                      minNeighbors=3,
                                      minSize=(100, 100),
                                      maxSize=(500, 500))
```

https://docs.opencv.org/4.5.5/d1/de5/classcv_1_1CascadeClassifier.html#aaf8181cb63968136476ec4204ffca498