Computer Vision Lab 5 - Exercise 2

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Apply and evaluate Viola & Jones method on a video

The following code loads the video classified each frame in two groups. The ones which a face was detected, using the CascadeObjectDetector and the ones no face was detected for the first 100 frames.

```
%% Detection over a video sequence (100 frames)

% Create a cascade detector object.
faceDetector = vision.CascadeObjectDetector();
videoFileReader = vision.VideoFileReader('Black_or_White_face_Morphing.mp4');

face_frames = {};
nonface_frames = {};
frame = 1;
while ~isDone(videoFileReader) && frame <= 100

    % Extract the next video frame
    [I, AUDIO] = step(videoFileReader);

    % Select a video frame and run the detector.
    bboxes = step(faceDetector, I);

    % Draw the returned bounding box around the detected face.
    if(isempty(bboxes))
        nonface_frames = [nonface_frames {I}];
    else
        I = insertObjectAnnotation(I, 'rectangle', bboxes, 'Face');
        face_frames = [face_frames {I}];
    end
    %imshow(I), title('Frame: ' + string(frame));
    frame = frame + 1;

end
```

Question 4.1: Is the Viola & Jones method detecting faces in the video frames?

Yes, the method works quite well. The following figure shows 6 frames which a detected face.

```
imshow(imresize([face_frames{2:3};face_frames{10:11};[face_frames{83} face_frames{89}]],0.5))
```

The two images in the first row shows a well detected face. Even when there is a face transformation during the videoclip, the faces were correctly detected. An example is shown in the images of the third row. However, there are some false positives detected. The first picture of the second row, brilliantly detects a face looking to a side but the ear is also detected as a face. The second picture of the same rows clearly shows the false positive of only detecting the ear as a face.

Question 4.2: When is a the Viola & Jones method not able to detect the faces? Explain your response.

The method struggles to recognise the face when the head is turned to a side. This is not a surprice as the default model used is called Frontal Face Cart which is trained to recognise faces that are upright and forward facing. The model is composed of weak classifiers, based on the classification and regression tree analysis (CART). The following figure shows 6 frames which no faces were dected. A debate could be started if we consider the frame in row 2 and column 1 as a false negative sample. It is not a complete upright or forward facing face but similar candidates were correctly identified in the examples shown in the previous question.

```
imshow(imresize([nonface_frames{2:3};nonface_frames{4:5};nonface_frames{7:8}],0.5));
```