main

April 29, 2018

1 Face detection and object detection

1.1 Part 1 - Face Detection

In this project, we aim to construct a face detection model. We used a method haar to extract features. After that, by applying extracted features to cascade method, we were able to dectect people's faces and also count the number of faces through pictures as well as webcam. Pre-trained cascade was used from OpenCV.

We suggest clone or download the whole repository to reproduce the result. You can reproduce them all from this notebook. Besides, you are encouraged to add your own test images simply by putting all the images you want to test into the data/test_data/cascade or data/test_data/tensorflow directory.

You can hit the button below to show the full codes and hit again to collapse all cells.

Note that you may need to set the working directory to the "doc" folder by hand before you start reproduce the results, if not by default. Otherwise, you may run into some directory issues. It is always safe to set the directory back to "doc" before you run any of the functions below. You can do that through running "os.chdir('Put your relative path or absolute path to the doc folder here')".

1.1.1 Part 1.1 - Face Detection without Rotation on Image

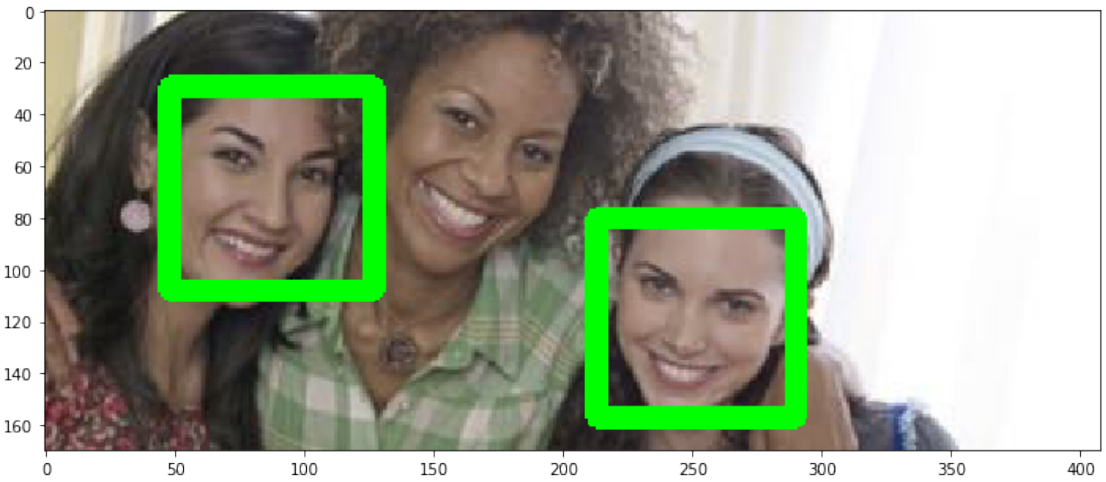
We started off the project with face detection on an image.

```
In [167]: # Collapse cells
          HTML('''<script>
          code_show=true;
          function code_toggle() {
           if (code_show){
           $('div.input').hide();
           } else {
           $('div.input').show();
           }
           code_show = !code_show
          }
          $( document ).ready(code_toggle);
          </script>
          <form action="javascript:code_toggle()"><input type="submit" value="Click here to togg
```

```
Out[167]: <IPython.core.display.HTML object>
```

```
In [1]: import os
        import sys
        import cv2
        import numpy as np
        import count_face as cf
        import counting_faces_image as cfi
        import counting_faces_webcam as cfw
        import tensorflowFn as tf_image
        import tensorflowFnVideo as tf_video
        import ipywidgets as widgets
        from pathlib import Path
        from matplotlib import pyplot as plt
        from IPython.display import HTML
        from IPython.display import display
```

```
In [2]: # Apply face detection
        cf.counting_face()
```



1.1.2 Part 1.2 - Face Detection with Rotation

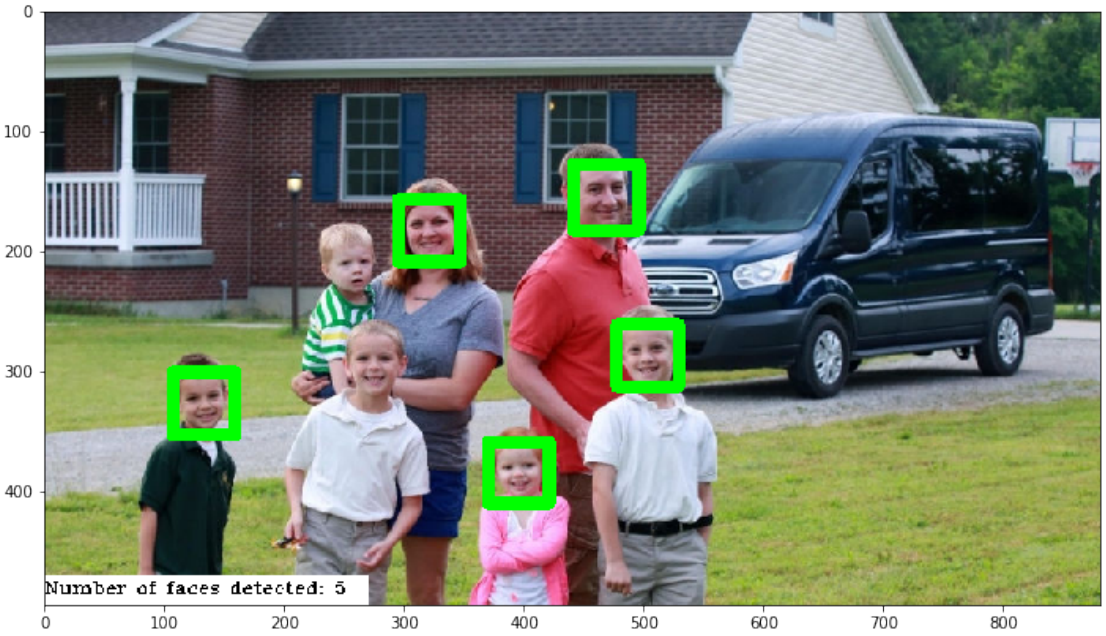
After implementation of Part 1, we realized the OpenCV front face cascade could not detect rotated face. Hence, we made some adjustments and declared additional functions to allow our model to analyze images from different rotation angle.

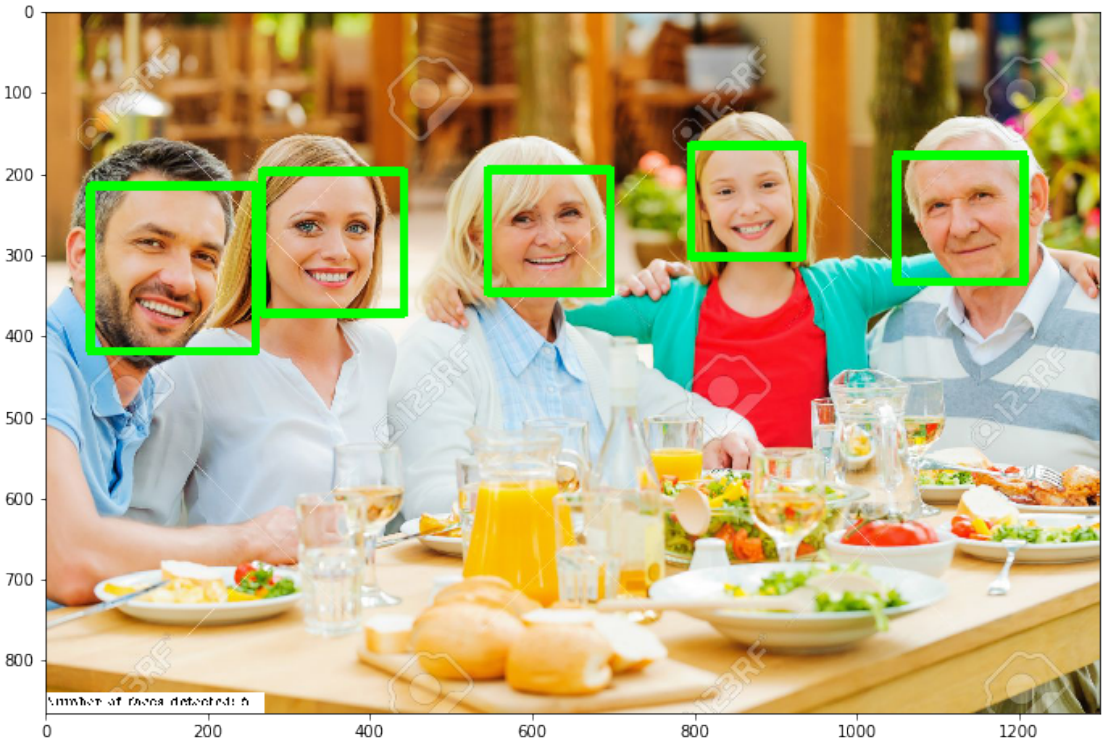
```
In [3]: '''

        You can put your own images into the directory: '../data/test_image/cascade'

        '''
```

```
cfi.face_dectect_image('../data/test_image/cascade/')
```

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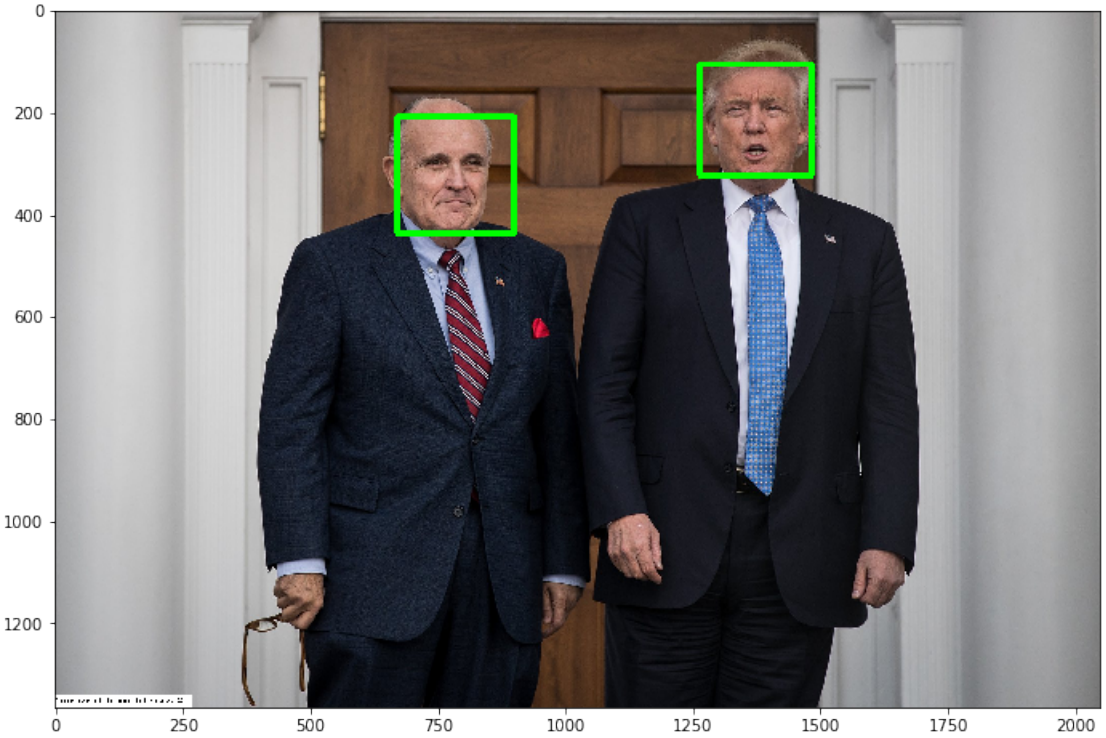
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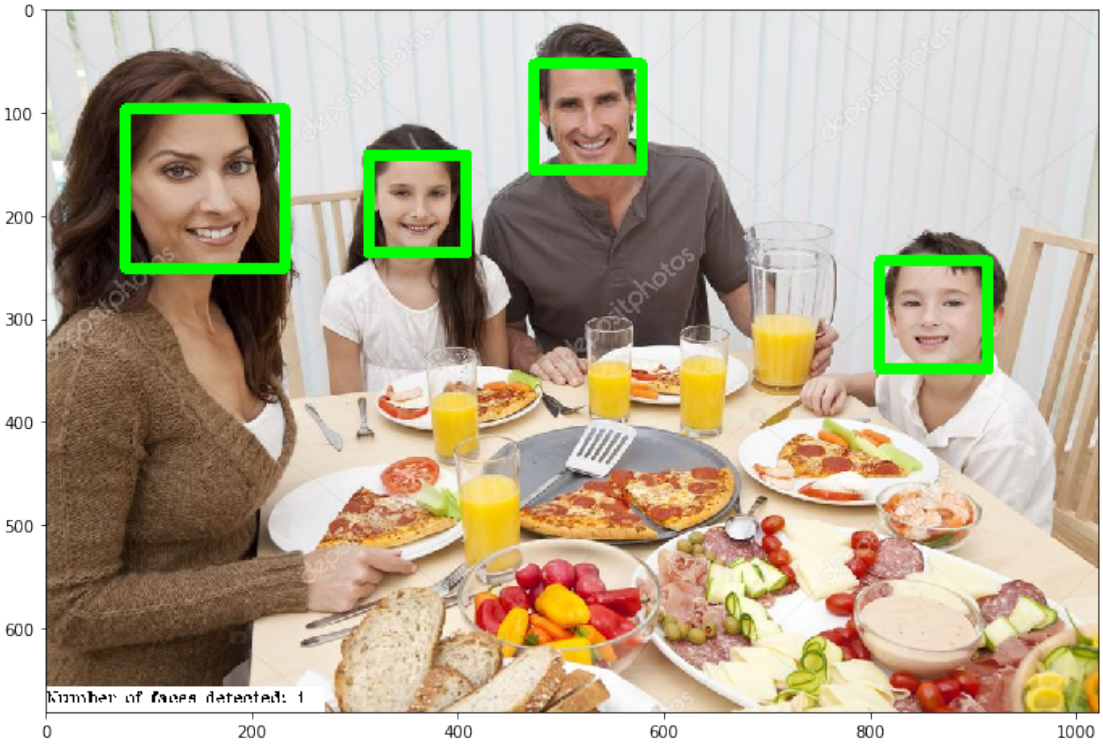
Number of faces detected: 4
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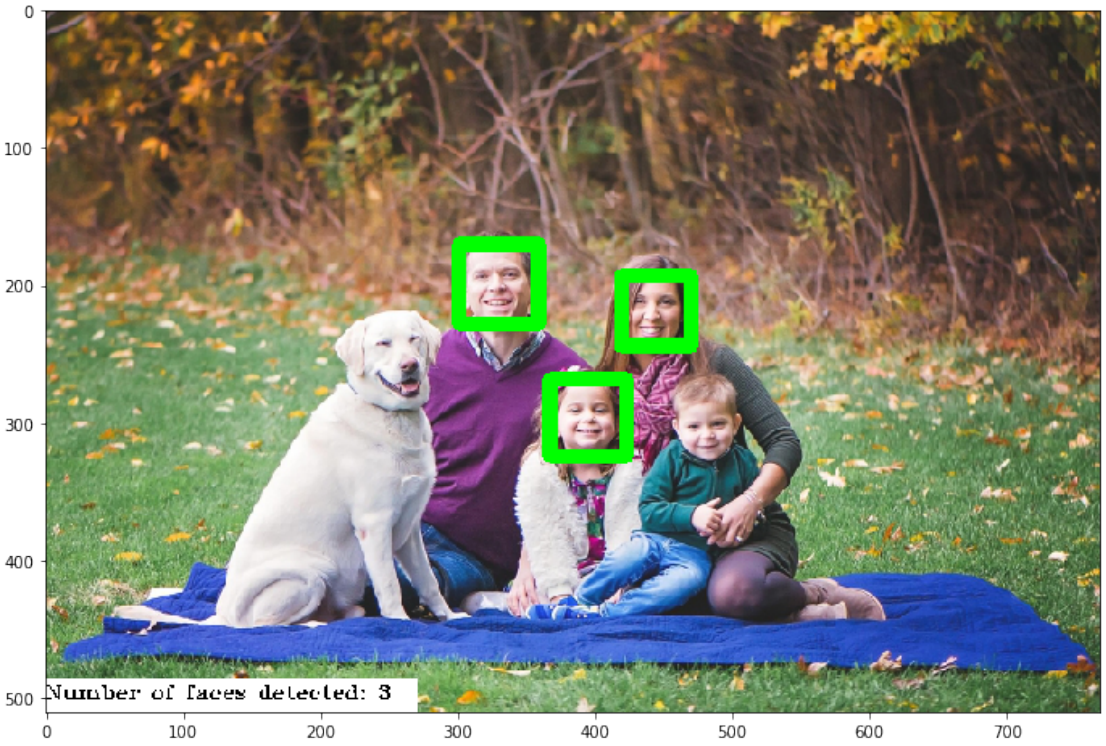
Number of faces detected: 3
0
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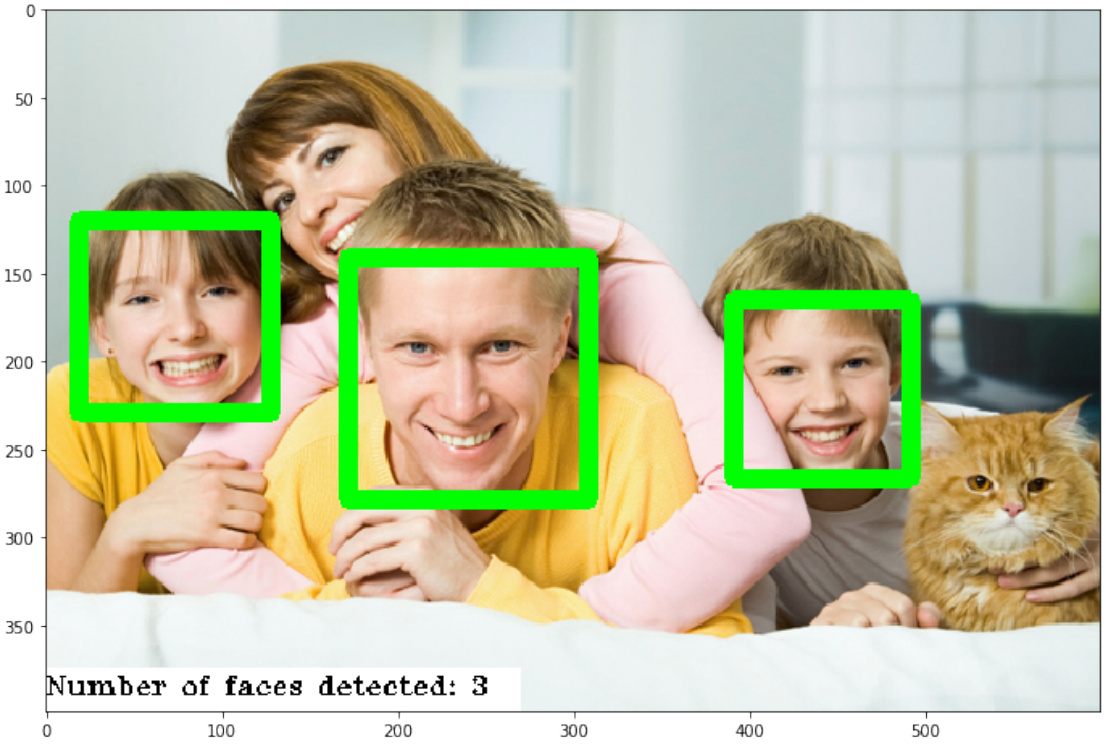
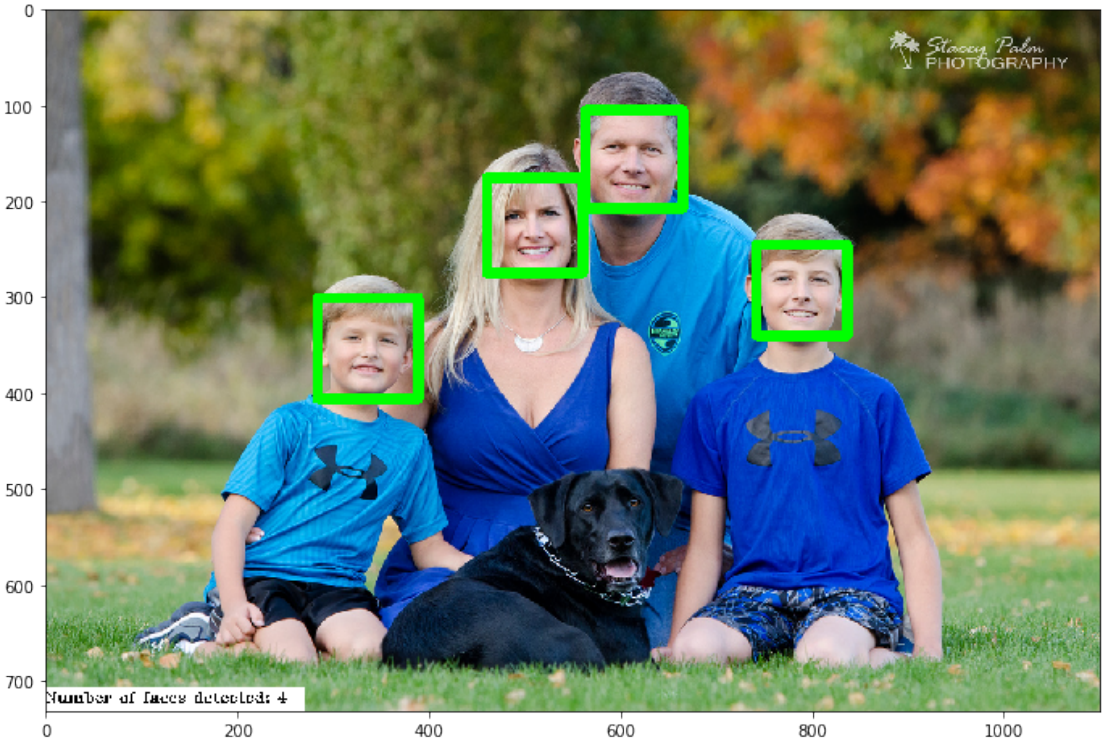
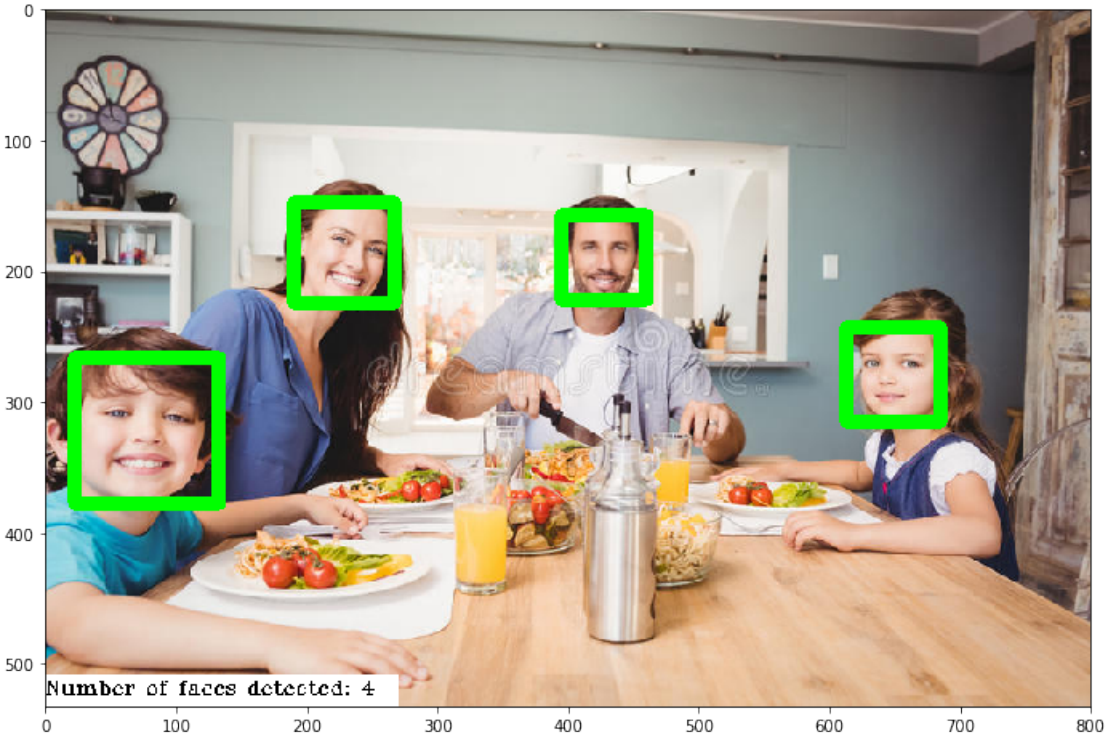

Number of faces detected: 3


Stacey Palm
PHOTOGRAPHY
Number of faces detected: 4


Number of faces detected: 4


Number of faces detected: 1

1.1.3 Part 1.3 - Real Time Face Detection with WebCam

After we improved our model, we wanted to further develop our model. Therefore, in this part, we implemented real time face detection using WebCam. You can click on the button below to release the cam. Press "Q" to quit the cam.

In [6]:
```
'''


    Press Q to close the camera
    If the cam doesn't close, that is an error introduced by 'opencv' package on MacOS syste
    You can simply leave the window and go to the next section.


    '''


    cfw.face_dectect_webcam()
```

1.2 Part 2 - Object Detection using Tensorflow API

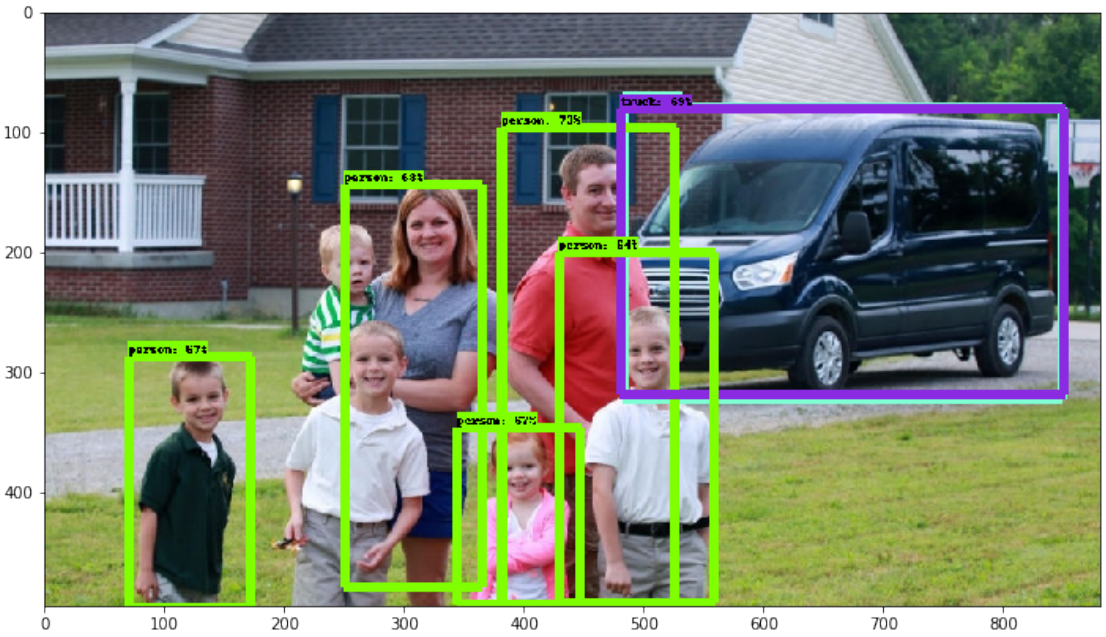
After we constructed our model in Part 1, we realized there exist some limitations in cascade model. Cascade model tends to have lower accuracy in side faces or partially showed faces. Also, cascade cannot detect highly rotated faces. To overcome such limitations, a popular and powerful approach is the application of Convolutional Neural Network through TensorFlow. In this section, we implement object detection using a frozen inference graphical model from Tensorflow Object Detection API -- 'ssd_mobilenet_v1_coco'. This model requires intallation of tensorflow. Further instruction of the installation can be referred to https://github.com/tensorflow/models/tree/master/research/object_detection. This model can detect and categorize object, including person, bottle, cellphone, etc. However, cascada model would result better if only faces are showed on an image while this API model would result better if more parts of human body are showed.

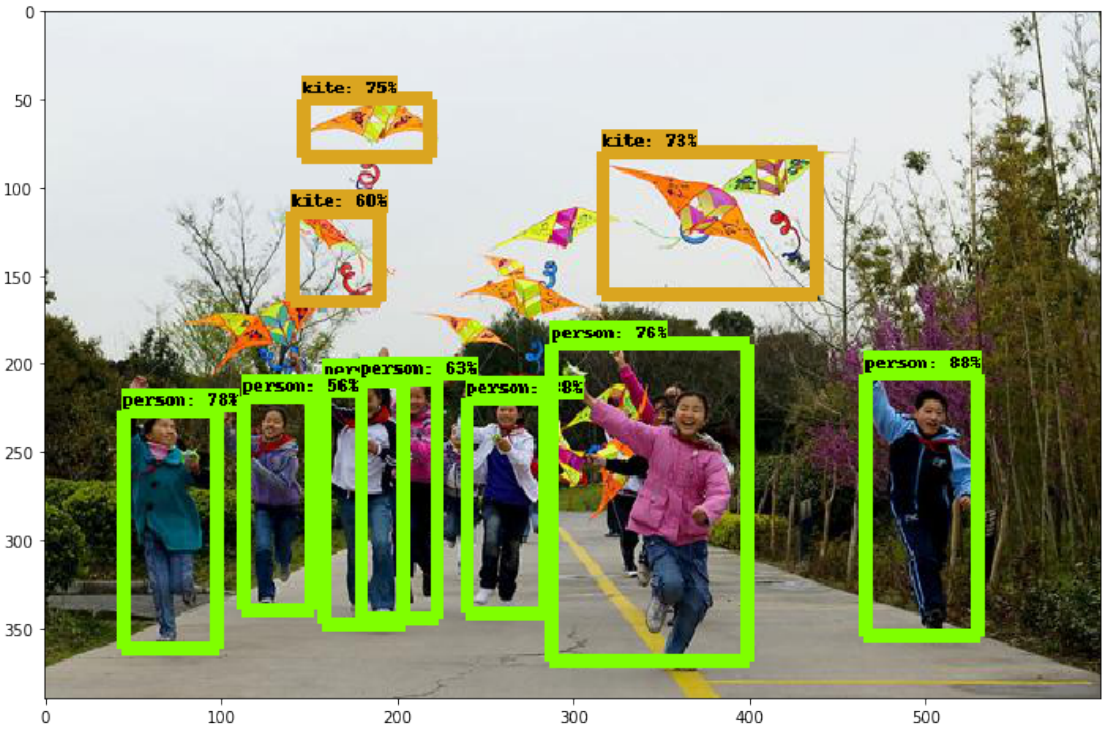
1.2.1 Part 2.1 - Object Detection API with Tensorflow on Image

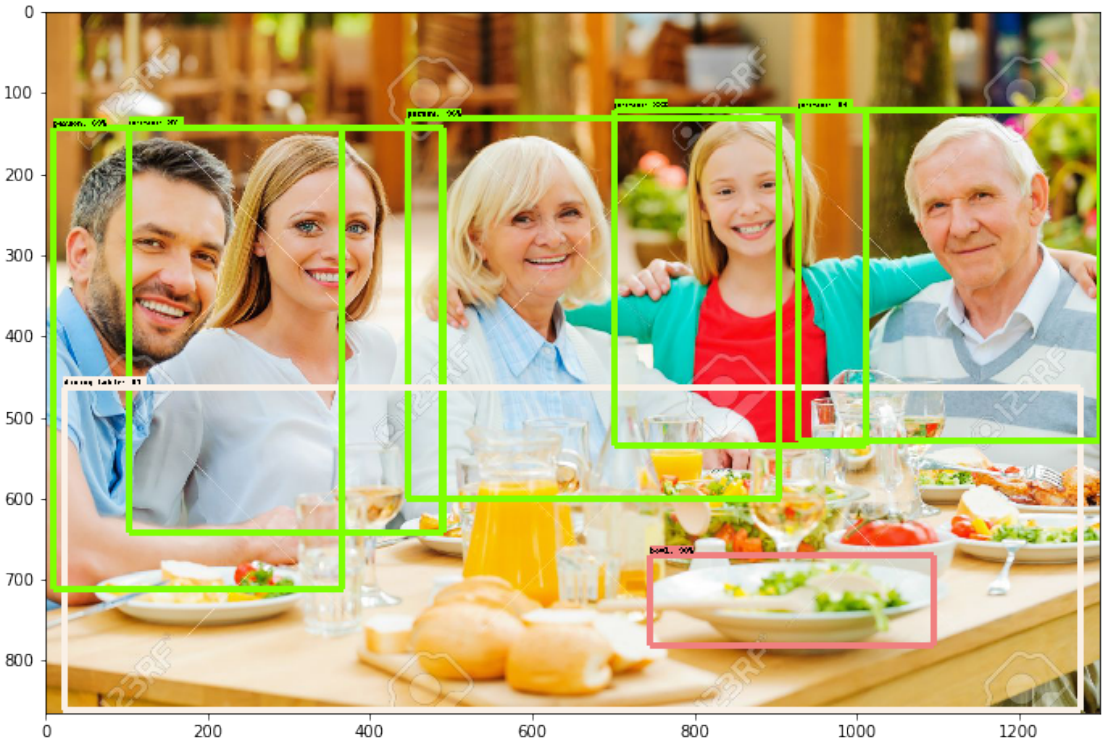
Similar to Part 1.1, we started off with object detection using image. We can see now the model can not only detect human faces but the entire human figure. Moreover, this more advanced model allows us to detect objects other than human, for example, dogs, cats, bottles, cell phones, clocks and so on.

In [5]:
```
'''


    You can put your own images into the directory: '../data/test_image/tensorflow'
    It may take a few seconds to do the detection. So please be patient.
```

```
'''

tf_image.objectDetection('../../data/test_image/tensorflow')
```



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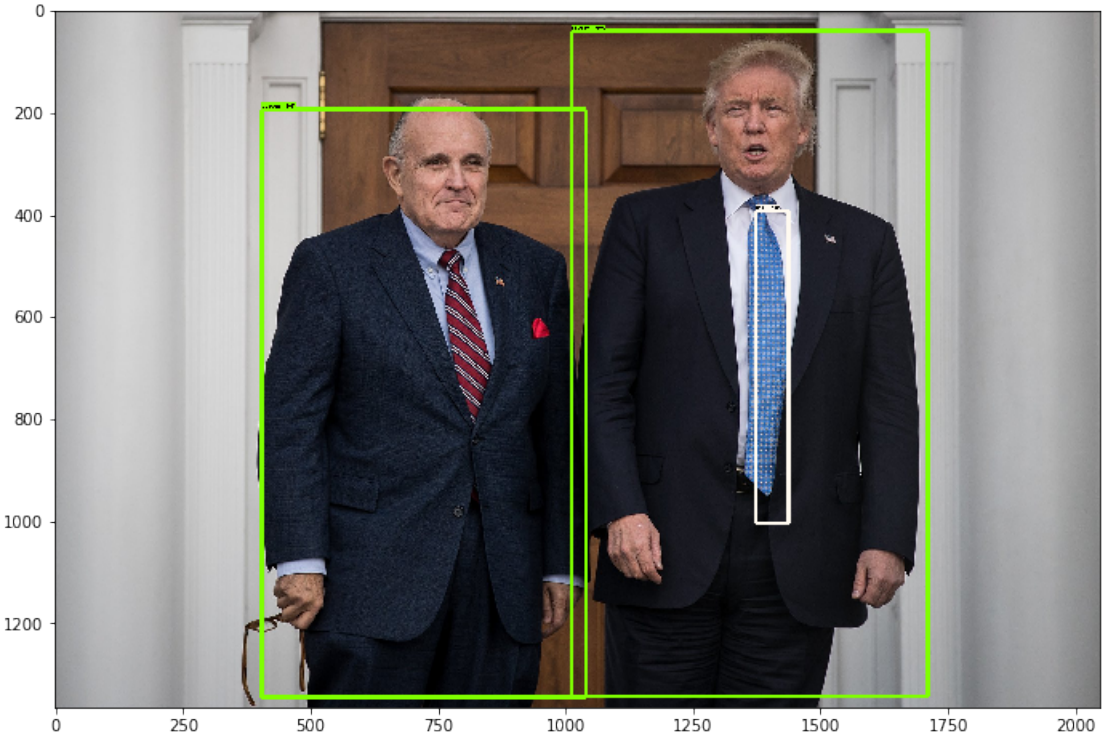
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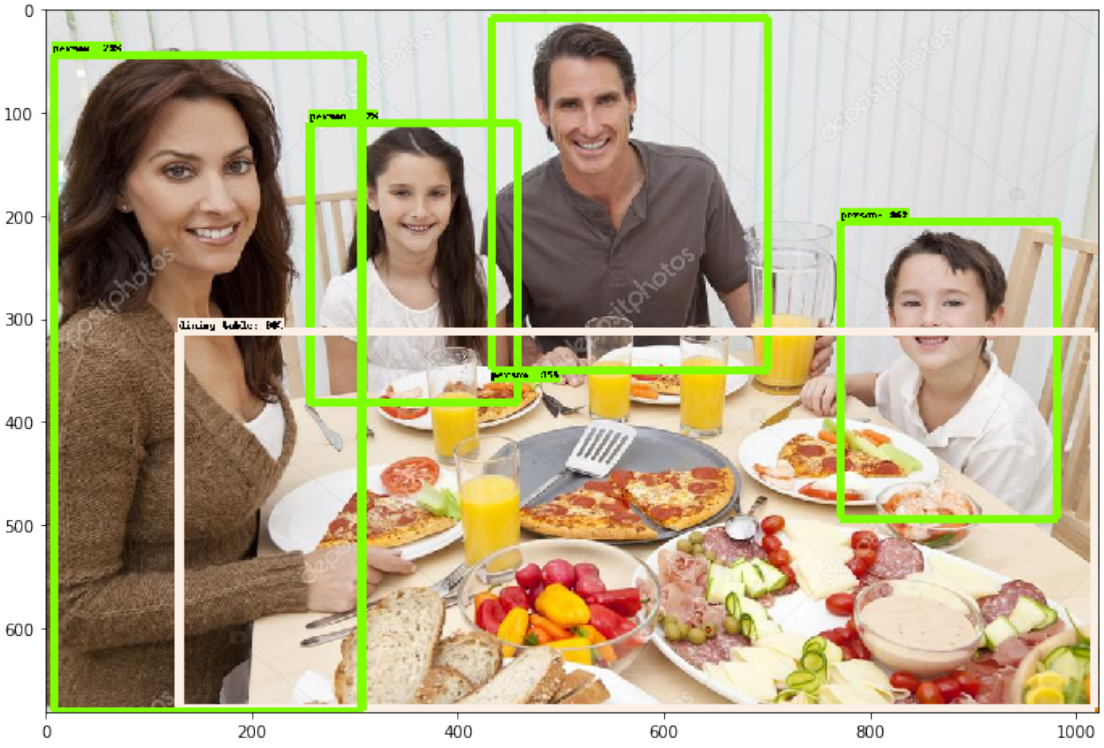
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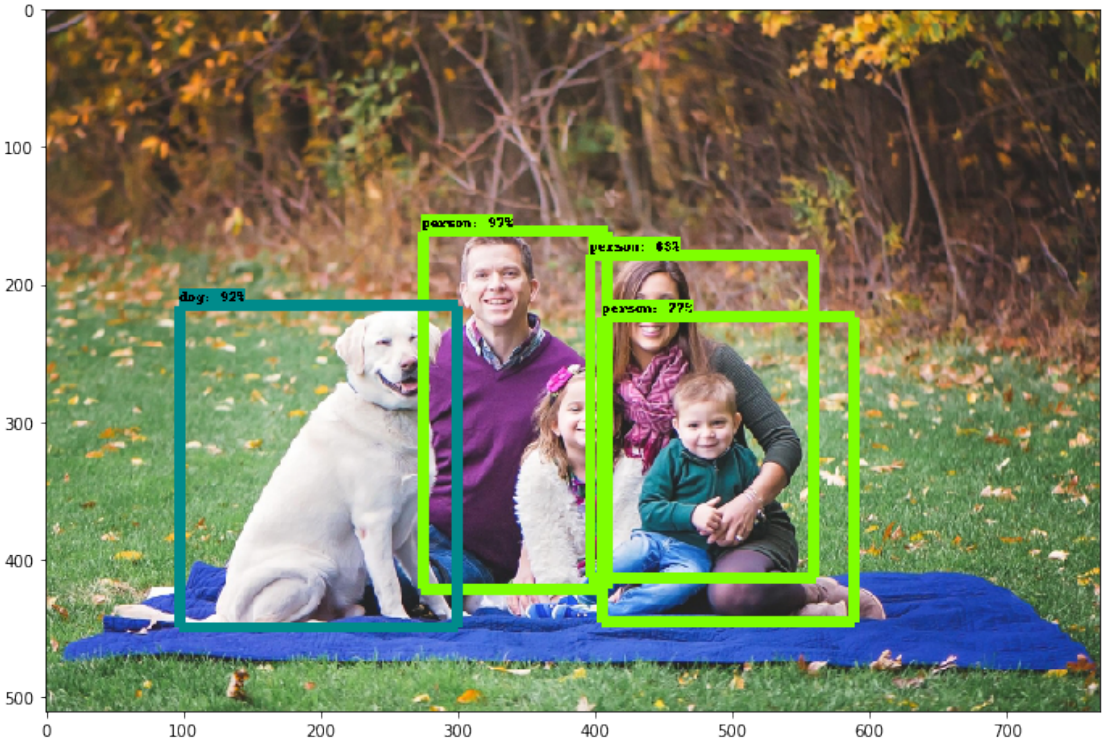
person: 97%
dog: 92%
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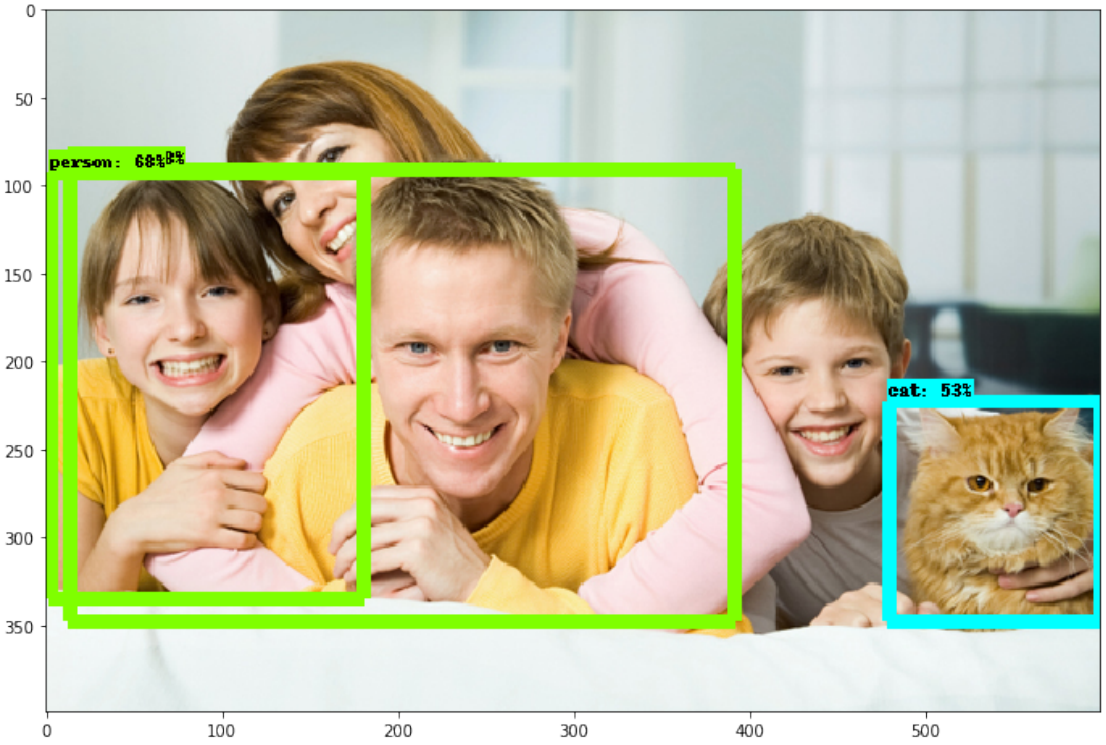
person: 68%
cat: 53%
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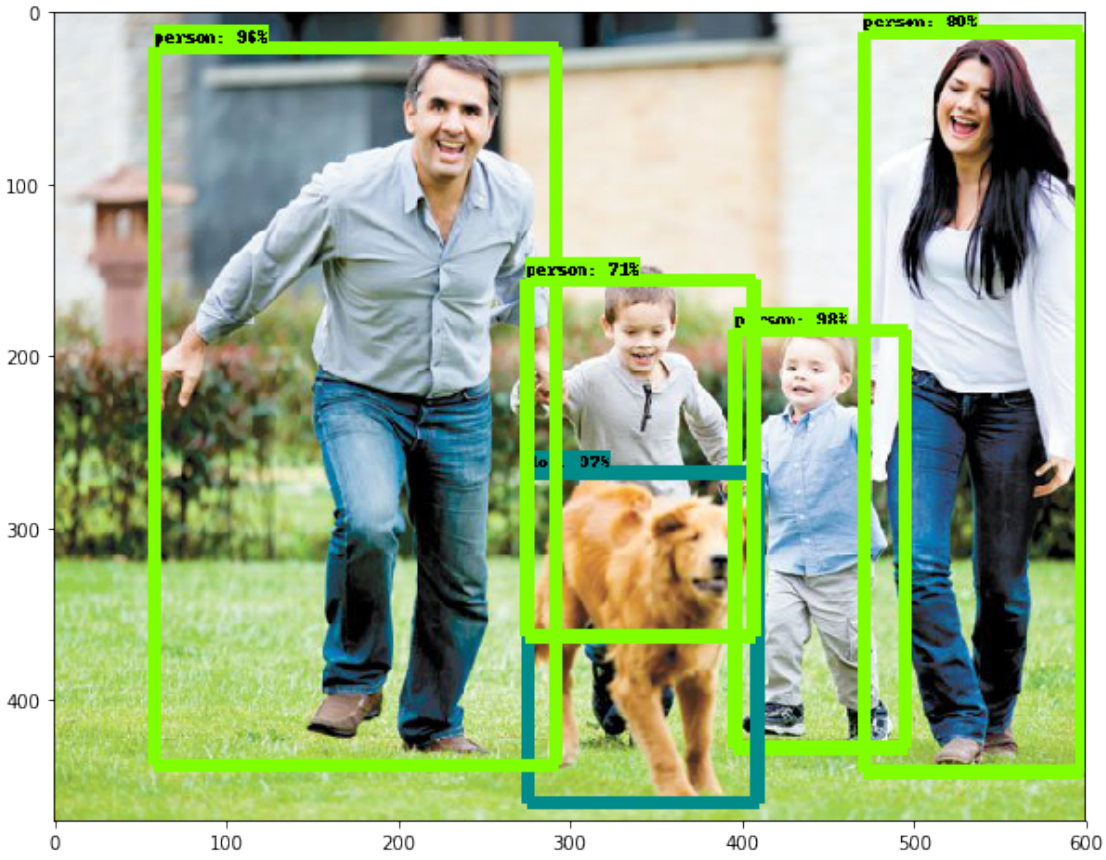
person: 96%
person: 80%
person: 71%
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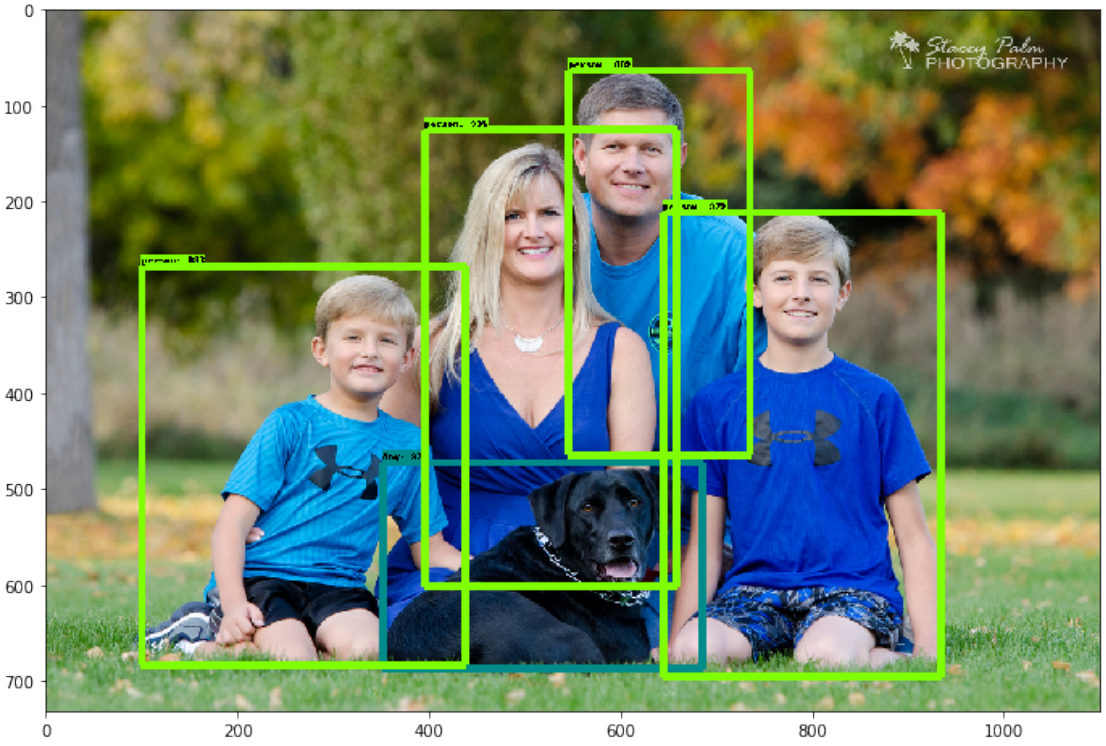
Stacey Palm
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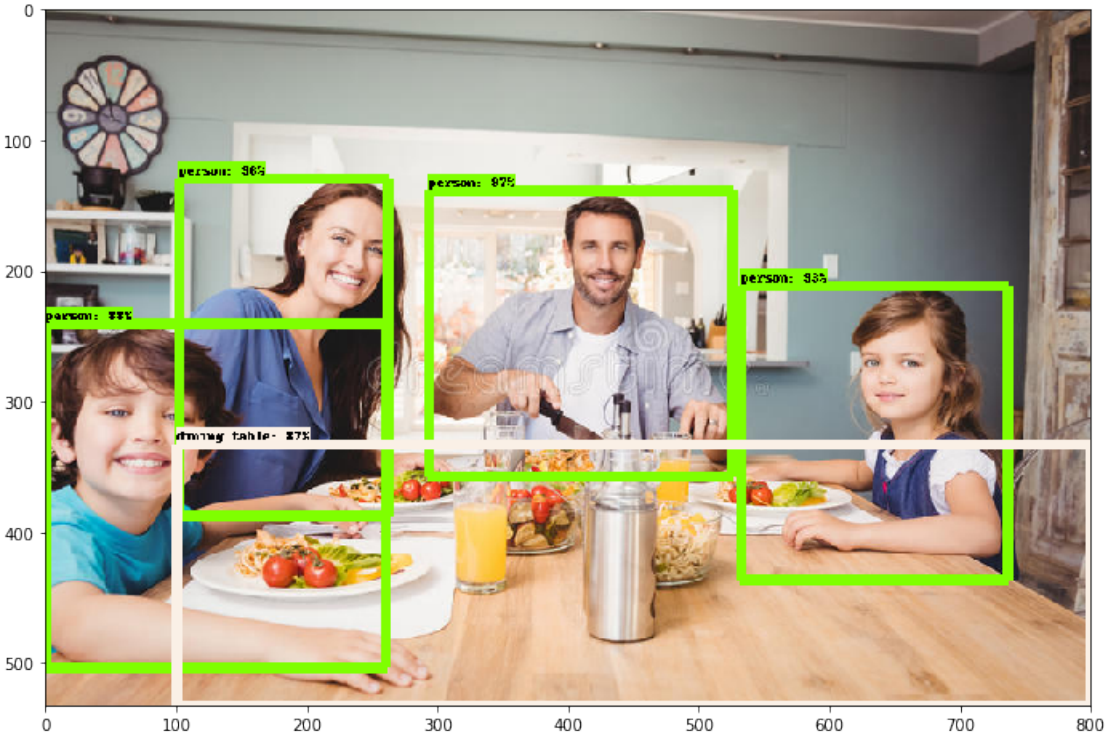
person: 96%
person: 97%
person: 88%
person: 88%
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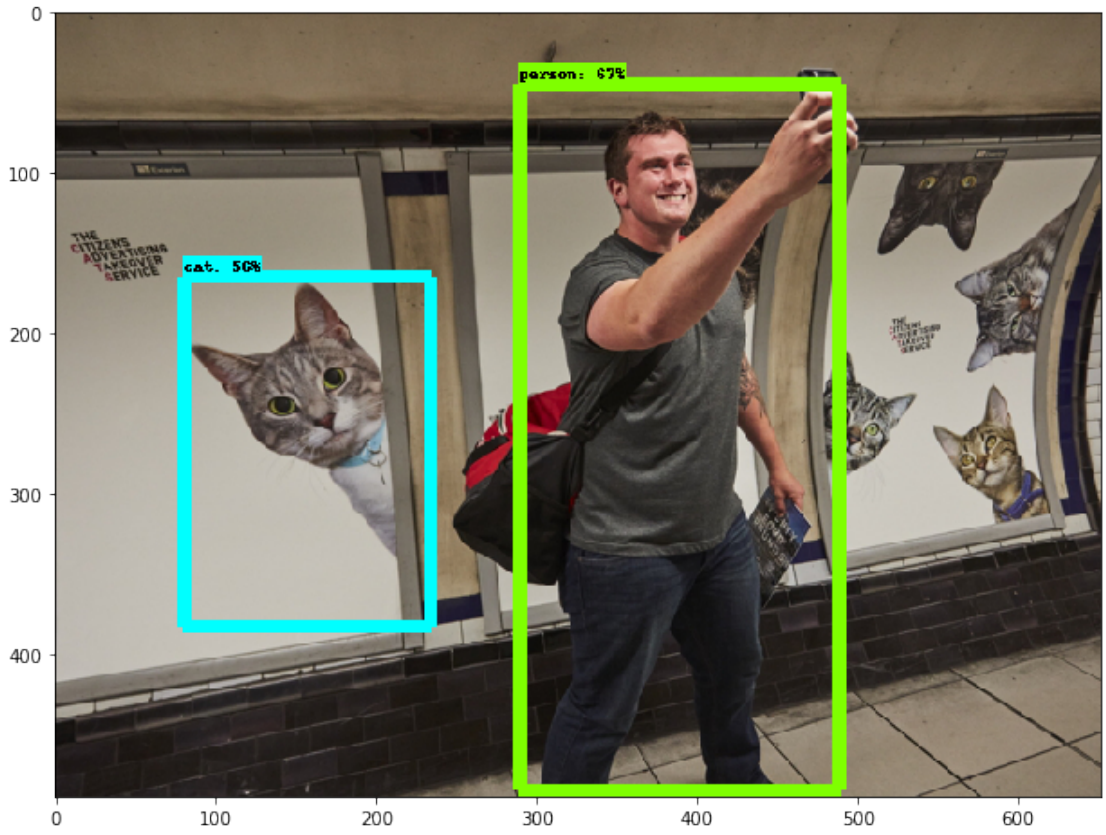

1.2.2 Part 2.2 - Real Time Object Detection API with Tensorflow using WebCam

Part 2.1 resulted in highly accurate result detecting most of the objects into their corresponding categories. We further improved the model by implementing the model using WebCam as an input. The result was again very accurate. You can click on the button below to release the cam. Press "Q" to quit the cam.

In [7]:
```
'''

    Press Q to close the camera

'''

tf_video.objectDetectionCap()
```