Object Detection on Images using YOLO

```
from google.colab import drive
drive.mount('/content/drive')
```

```
# Importing necessary libraries
import numpy as np
import cv2
import matplotlib.pyplot as plt
import time
```

```
# Opening file, reading, eliminating whitespaces, and splitting by '\n', which in turn creates list
labels = open('/content/drive/MyDrive/AI_Video_Monitoring/Task3/coco.names').read().strip().split('\n')
```

```
# Defining paths to the weights and configuration file with model of Neural Network
weights_path = '/content/drive/MyDrive/AI_Video_Monitoring/Task3/yolov3.weights'
configuration_path = '/content/drive/MyDrive/AI_Video_Monitoring/Task3/yolov3.cfg'

# Setting minimum probability to eliminate weak predictions
probability_minimum = 0.5

# Setting threshold for non maximum suppression
threshold = 0.3
```

```
network = cv2.dnn.readNetFromDarknet(configuration_path, weights_path)

# Getting names of all layers
layers_names_all = network.getLayerNames()  # list of layers' names
```

```
# Getting only output layers' names that we need from YOLO algorithm
layers_names_output = [layers_names_all[i[0] - 1] for i in network.getUnconnectedOutLayers()]  # list of l

print(layers_names_output)
```

```
    ['yolo_82', 'yolo_94', 'yolo_106']
```

```
# Our image initially is in RGB format
# But now we open it in BGR format as function 'cv2.imread' opens it so
image_input = cv2.imread('/content/drive/MyDrive/AI_Video_Monitoring/Task3/images.jpeg')

# Getting image shape
image_input_shape = image_input.shape

# Check point
print(image_input_shape)
```

```
    (917, 1222, 3)
```

```
# Showing RGB image but firstly converting it from BGR format
%matplotlib inline
plt.rcParams['figure.figsize'] = (10.0, 10.0)
plt.imshow(cv2.cvtColor(image_input, cv2.COLOR_BGR2RGB))
plt.show()
```

```
blob = cv2.dnn.blobFromImage(image_input, 1 / 255.0, (416, 416), swapRB=True, crop=False)

# Check point
print(image_input.shape)  # (917, 1222, 3)
print(blob.shape)  # (1, 3, 416, 416)
```

```
(917, 1222, 3)
(1, 3, 416, 416)
```

```
# Slicing blob and transposing to make channels come at the end
blob_to_show = blob[0, :, :, :].transpose(1, 2, 0)
print(blob_to_show.shape)  # (416, 416, 3)

# Showing 'blob_to_show'
%matplotlib inline
plt.rcParams['figure.figsize'] = (5.0, 5.0)
plt.imshow(blob_to_show)
plt.show()
```

```
(416, 416, 3)
```

```
# Calculating at the same time, needed time for forward pass
network.setInput(blob)  # setting blob as input to the network
start = time.time()
output_from_network = network.forward(layers_names_output)
end = time.time()

# Showing spent time for forward pass
print('YOLO v3 took {:.5f} seconds'.format(end - start))
```

```
YOLO v3 took 0.99887 seconds
```

```
# Check point
print(type(output_from_network))  # <class 'list'>
print(type(output_from_network[0]))  # <class 'numpy.ndarray'>
```

```
<class 'list'>
<class 'numpy.ndarray'>
```

```
np.random.seed(42)
colours = np.random.randint(0, 255, size=(len(labels), 3), dtype='uint8')

# Check point
print(colours.shape)  # (80, 3)
print(colours[0])  # [102 220 225]
```

```
(80, 3)
[102 220 225]
```

```
# Preparing lists for detected bounding boxes, obtained confidences and class's number
bounding_boxes = []
confidences = []
class_numbers = []
```

```
# Getting spacial dimension of input image
h, w = image_input_shape[:2]  # Slicing from tuple only first two elements

# Check point
print(h, w)  # 917 1222
```

```
917 1222
```

Going through all output layers after feed forward and answer from network

```
for result in output_from_network:
    # Going through all detections from current output layer
    for detection in result:
        # Getting class for current object
        scores = detection[5:]
        class_current = np.argmax(scores)

        # Getting confidence (probability) for current object
        confidence_current = scores[class_current]

        # Eliminating weak predictions by minimum probability
        if confidence_current > probability_minimum:
            # Scaling bounding box coordinates to the initial image size
            # YOLO data format keeps center of detected box and its width and height
            # That is why we can just elementwise multiply them to the width and height of the image
            box_current = detection[0:4] * np.array([w, h, w, h])

            # From current box with YOLO format getting top left corner coordinates
            # that are x_min and y_min
            x_center, y_center, box_width, box_height = box_current.astype('int')
            x_min = int(x_center - (box_width / 2))
            y_min = int(y_center - (box_height / 2))

            # Adding results into prepared lists
            bounding_boxes.append([x_min, y_min, int(box_width), int(box_height)])
            confidences.append(float(confidence_current))
            class_numbers.append(class_current)
```

Implementing non maximum suppression of given boxes and corresponding scores

```
results = cv2.dnn.NMSBoxes(bounding_boxes, confidences, probability_minimum, threshold)

# Showing labels of the detected objects
for i in range(len(class_numbers)):
    print(labels[int(class_numbers[i])])

# Saving found labels
```

```
with open('found_labels.txt', 'w') as f:
    for i in range(len(class_numbers)):
        f.write(labels[int(class_numbers[i])])
```

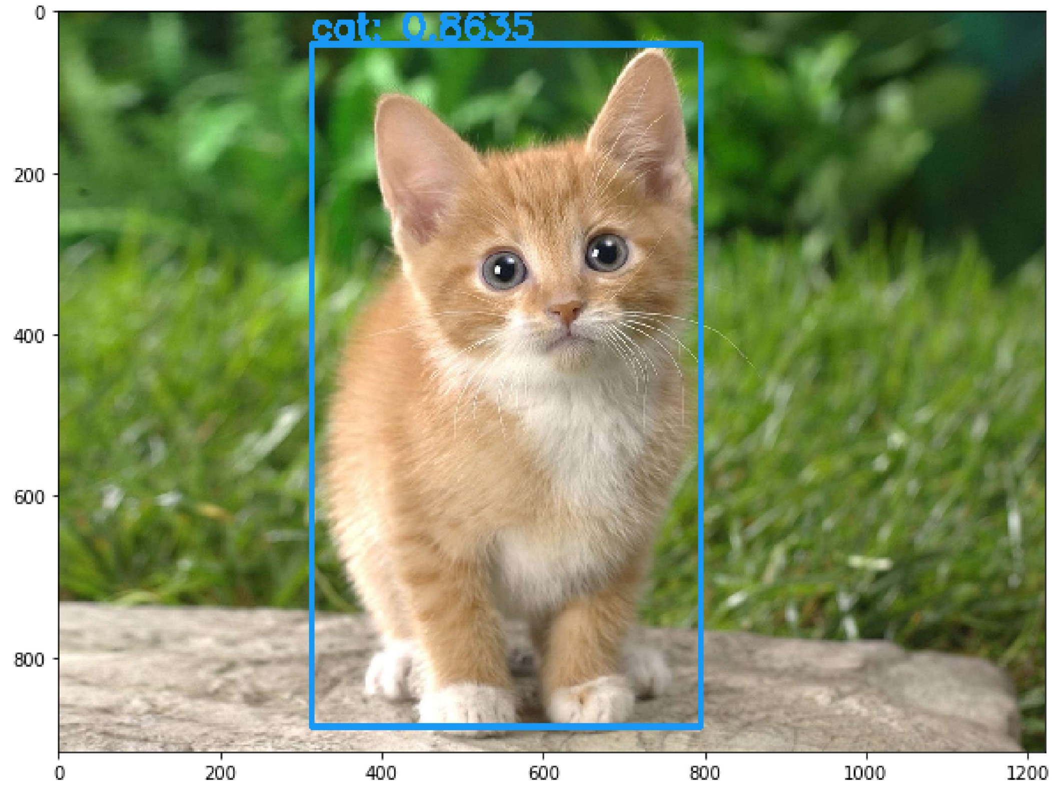
```
cat
```

Drawing bounding boxes and labels

```
# Checking if there is at least one detected object
if len(results) > 0:
    # Going through indexes of results
    for i in results.flatten():
        # Getting current bounding box coordinates
        x_min, y_min = bounding_boxes[i][0], bounding_boxes[i][1]
        box_width, box_height = bounding_boxes[i][2], bounding_boxes[i][3]

        # Preparing colour for current bounding box
        colour_box_current = [int(j) for j in colours[class_numbers[i]]]

        # Drawing bounding box on the original image
        cv2.rectangle(image_input, (x_min, y_min), (x_min + box_width, y_min + box_height),
                      colour_box_current, 5)

        # Preparing text with label and confidence for current bounding box
        text_box_current = '{}: {:.4f}'.format(labels[int(class_numbers[i])], confidences[i])

        # Putting text with label and confidence on the original image
        cv2.putText(image_input, text_box_current, (x_min, y_min - 7), cv2.FONT_HERSHEY_SIMPLEX,
                    1.5, colour_box_current, 5)
```

Showing RGB image with bounding boxes and labels

```
%matplotlib inline
plt.rcParams['figure.figsize'] = (10.0, 10.0)
plt.imshow(cv2.cvtColor(image_input, cv2.COLOR_BGR2RGB))
plt.show()
```


cat: 0.8635
0
200
400
600
800
0
200
400
600
800
1000
1200