yolo3

June 7, 2019

[1]:
```
import os
import sys
import time
import cv2
from PIL import Image, ImageDraw
from utils import *
from darknet import Darknet
```

[2]:
```
def detect(cfgfile, weightfile, videoFile):
    frame_stream = cv2.VideoCapture(videoFile)

    m = Darknet(cfgfile)

    m.print_network()
    m.load_weights(weightfile)

    num_classes = 80
    if num_classes == 20:
        namesfile = 'data/voc.names'
    elif num_classes == 80:
        namesfile = 'data/coco.names'
    else:
        namesfile = 'data/names'

    use_cuda = 1
    if use_cuda:
        m.cuda()


    is_valid, frame = frame_stream.read()
    frame = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
    frame = Image.fromarray(frame)
    resized = frame.resize((m.width, m.height))
    frame_count = 0
    total_time = 0
    output_dir = videoFile[:-4]+'_detections'
    os.mkdir(output_dir)
```

```
    while(1):
        if not is_valid:
            break
        else:
            #for i in range(2):
            #    t_start = time.time()
            #    boxes = do_detect(m, resized, 0.5, 0.4, use_cuda)
            #    t_finish = time.time()
            t_start = time.time()
            boxes = do_detect(m, resized, 0.5, 0.4, use_cuda)
            t_finish = time.time()
            #print("curr time: " + str(t_finish-t_start))
            total_time += t_finish-t_start
            class_names = load_class_names(namesfile)
            classified_frame = output_dir + "/output_" + str(frame_count) + ".
 ↪jpg"
            plot_boxes(resized, boxes, classified_frame, class_names)
            is_valid, frame = frame_stream.read()
            if not is_valid:
                break
            frame = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
            frame = Image.fromarray(frame)
            resized = frame.resize((m.width, m.height))
        frame_count += 1

    avgtime_per_frame = total_time/frame_count
    time_elapsed_mins = (total_time/60) - ((total_time/60) % 1)
    time_elapsed_secs = ((total_time/60)%1)*60
    print("---------yolo3" + str(videoFile) + " frames classified-----------")
    print("Average computation time per frame: " + str(avgtime_per_frame))
    print("Completed. Total time for computation: " + str(time_elapsed_mins) + "␣
 ↪minutes, " + str(time_elapsed_secs) + " seconds.")


if __name__ == '__main__':
    for veh_cam in ['camera_1.mp4', 'camera_2.mp4', 'camera_5.mp4', 'camera_6.
 ↪mp4']:
        detect('cfg/yolov3.cfg', 'yolov3.weights', veh_cam)
```

```
layer     filters    size              input                output
    0 conv     32  3 x 3 / 1   416 x 416 x   3   ->   416 x 416 x  32
    1 conv     64  3 x 3 / 2   416 x 416 x  32   ->   208 x 208 x  64
    2 conv     32  1 x 1 / 1   208 x 208 x  64   ->   208 x 208 x  32
    3 conv     64  3 x 3 / 1   208 x 208 x  32   ->   208 x 208 x  64
    4 shortcut 1
    5 conv    128  3 x 3 / 2   208 x 208 x  64   ->   104 x 104 x 128
    6 conv     64  1 x 1 / 1   104 x 104 x 128   ->   104 x 104 x  64
```

```
 7 conv    128  3 x 3 / 1   104 x 104 x  64   ->   104 x 104 x 128
 8 shortcut 5
 9 conv     64  1 x 1 / 1   104 x 104 x 128   ->   104 x 104 x  64
10 conv    128  3 x 3 / 1   104 x 104 x  64   ->   104 x 104 x 128
11 shortcut 8
12 conv    256  3 x 3 / 2   104 x 104 x 128   ->    52 x  52 x 256
13 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
14 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
15 shortcut 12
16 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
17 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
18 shortcut 15
19 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
20 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
21 shortcut 18
22 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
23 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
24 shortcut 21
25 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
26 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
27 shortcut 24
28 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
29 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
30 shortcut 27
31 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
32 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
33 shortcut 30
34 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
35 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
36 shortcut 33
37 conv    512  3 x 3 / 2    52 x  52 x 256   ->    26 x  26 x 512
38 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
39 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
40 shortcut 37
41 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
42 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
43 shortcut 40
44 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
45 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
46 shortcut 43
47 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
48 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
49 shortcut 46
50 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
51 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
52 shortcut 49
53 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
54 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
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```
 55 shortcut 52
 56 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
 57 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
 58 shortcut 55
 59 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
 60 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
 61 shortcut 58
 62 conv   1024  3 x 3 / 2    26 x  26 x 512   ->    13 x  13 x1024
 63 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
 64 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
 65 shortcut 62
 66 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
 67 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
 68 shortcut 65
 69 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
 70 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
 71 shortcut 68
 72 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
 73 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
 74 shortcut 71
 75 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
 76 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
 77 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
 78 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
 79 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
 80 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
 81 conv    255  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 255
 82 detection
 83 route  79
 84 conv    256  1 x 1 / 1    13 x  13 x 512   ->    13 x  13 x 256
 85 upsample           * 2    13 x  13 x 256   ->    26 x  26 x 256
 86 route  85 61
 87 conv    256  1 x 1 / 1    26 x  26 x 768   ->    26 x  26 x 256
 88 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
 89 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
 90 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
 91 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
 92 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
 93 conv    255  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 255
 94 detection
 95 route  91
 96 conv    128  1 x 1 / 1    26 x  26 x 256   ->    26 x  26 x 128
 97 upsample           * 2    26 x  26 x 128   ->    52 x  52 x 128
 98 route  97 36
 99 conv    128  1 x 1 / 1    52 x  52 x 384   ->    52 x  52 x 128
100 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
101 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
102 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
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  103 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
  104 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
  105 conv    255  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 255
  106 detection

/home/dfpazr/Documents/ECE/ECE285/ece285-final-project/yolo3/utils.py:141:
UserWarning: Implicit dimension choice for softmax has been deprecated. Change
the call to include dim=X as an argument.
  cls_confs =
torch.nn.Softmax()(Variable(output[5:5+num_classes].transpose(0,1))).data

---------yolo3camera_1.mp4 frames classified-----------
Average computation time per frame: 0.07218461484501401
Completed. Total time for computation: 5.0 minutes, 42.80473589897157 seconds.
layer     filters    size              input                output
    0 conv     32  3 x 3 / 1   416 x 416 x   3   ->   416 x 416 x  32
    1 conv     64  3 x 3 / 2   416 x 416 x  32   ->   208 x 208 x  64
    2 conv     32  1 x 1 / 1   208 x 208 x  64   ->   208 x 208 x  32
    3 conv     64  3 x 3 / 1   208 x 208 x  32   ->   208 x 208 x  64
    4 shortcut 1
    5 conv    128  3 x 3 / 2   208 x 208 x  64   ->   104 x 104 x 128
    6 conv     64  1 x 1 / 1   104 x 104 x 128   ->   104 x 104 x  64
    7 conv    128  3 x 3 / 1   104 x 104 x  64   ->   104 x 104 x 128
    8 shortcut 5
    9 conv     64  1 x 1 / 1   104 x 104 x 128   ->   104 x 104 x  64
   10 conv    128  3 x 3 / 1   104 x 104 x  64   ->   104 x 104 x 128
   11 shortcut 8
   12 conv    256  3 x 3 / 2   104 x 104 x 128   ->    52 x  52 x 256
   13 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   14 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
   15 shortcut 12
   16 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   17 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
   18 shortcut 15
   19 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   20 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
   21 shortcut 18
   22 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   23 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
   24 shortcut 21
   25 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   26 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
   27 shortcut 24
   28 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   29 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
   30 shortcut 27
   31 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   32 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
```

```
33 shortcut 30
34 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
35 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
36 shortcut 33
37 conv    512  3 x 3 / 2    52 x  52 x 256   ->    26 x  26 x 512
38 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
39 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
40 shortcut 37
41 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
42 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
43 shortcut 40
44 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
45 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
46 shortcut 43
47 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
48 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
49 shortcut 46
50 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
51 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
52 shortcut 49
53 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
54 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
55 shortcut 52
56 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
57 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
58 shortcut 55
59 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
60 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
61 shortcut 58
62 conv   1024  3 x 3 / 2    26 x  26 x 512   ->    13 x  13 x1024
63 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
64 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
65 shortcut 62
66 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
67 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
68 shortcut 65
69 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
70 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
71 shortcut 68
72 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
73 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
74 shortcut 71
75 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
76 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
77 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
78 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
79 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
80 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
```

```
  81 conv    255  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 255
  82 detection
  83 route  79
  84 conv    256  1 x 1 / 1    13 x  13 x 512   ->    13 x  13 x 256
  85 upsample           * 2    13 x  13 x 256   ->    26 x  26 x 256
  86 route  85 61
  87 conv    256  1 x 1 / 1    26 x  26 x 768   ->    26 x  26 x 256
  88 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
  89 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
  90 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
  91 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
  92 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
  93 conv    255  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 255
  94 detection
  95 route  91
  96 conv    128  1 x 1 / 1    26 x  26 x 256   ->    26 x  26 x 128
  97 upsample           * 2    26 x  26 x 128   ->    52 x  52 x 128
  98 route  97 36
  99 conv    128  1 x 1 / 1    52 x  52 x 384   ->    52 x  52 x 128
 100 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
 101 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
 102 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
 103 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
 104 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
 105 conv    255  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 255
 106 detection
---------yolo3camera_2.mp4 frames classified-----------
Average computation time per frame: 0.06996914090684082
Completed. Total time for computation: 5.0 minutes, 42.91875958442688 seconds.
layer     filters    size              input                output
    0 conv     32  3 x 3 / 1   416 x 416 x   3   ->   416 x 416 x  32
    1 conv     64  3 x 3 / 2   416 x 416 x  32   ->   208 x 208 x  64
    2 conv     32  1 x 1 / 1   208 x 208 x  64   ->   208 x 208 x  32
    3 conv     64  3 x 3 / 1   208 x 208 x  32   ->   208 x 208 x  64
    4 shortcut 1
    5 conv    128  3 x 3 / 2   208 x 208 x  64   ->   104 x 104 x 128
    6 conv     64  1 x 1 / 1   104 x 104 x 128   ->   104 x 104 x  64
    7 conv    128  3 x 3 / 1   104 x 104 x  64   ->   104 x 104 x 128
    8 shortcut 5
    9 conv     64  1 x 1 / 1   104 x 104 x 128   ->   104 x 104 x  64
   10 conv    128  3 x 3 / 1   104 x 104 x  64   ->   104 x 104 x 128
   11 shortcut 8
   12 conv    256  3 x 3 / 2   104 x 104 x 128   ->    52 x  52 x 256
   13 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   14 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
   15 shortcut 12
   16 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
   17 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
```

```
18 shortcut 15
19 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
20 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
21 shortcut 18
22 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
23 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
24 shortcut 21
25 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
26 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
27 shortcut 24
28 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
29 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
30 shortcut 27
31 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
32 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
33 shortcut 30
34 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
35 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
36 shortcut 33
37 conv    512  3 x 3 / 2    52 x  52 x 256   ->    26 x  26 x 512
38 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
39 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
40 shortcut 37
41 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
42 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
43 shortcut 40
44 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
45 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
46 shortcut 43
47 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
48 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
49 shortcut 46
50 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
51 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
52 shortcut 49
53 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
54 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
55 shortcut 52
56 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
57 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
58 shortcut 55
59 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
60 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
61 shortcut 58
62 conv   1024  3 x 3 / 2    26 x  26 x 512   ->    13 x  13 x1024
63 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
64 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
65 shortcut 62
```

```
   66 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
   67 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
   68 shortcut 65
   69 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
   70 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
   71 shortcut 68
   72 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
   73 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
   74 shortcut 71
   75 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
   76 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
   77 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
   78 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
   79 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
   80 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
   81 conv    255  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 255
   82 detection
   83 route  79
   84 conv    256  1 x 1 / 1    13 x  13 x 512   ->    13 x  13 x 256
   85 upsample           * 2    13 x  13 x 256   ->    26 x  26 x 256
   86 route  85 61
   87 conv    256  1 x 1 / 1    26 x  26 x 768   ->    26 x  26 x 256
   88 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
   89 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
   90 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
   91 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
   92 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
   93 conv    255  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 255
   94 detection
   95 route  91
   96 conv    128  1 x 1 / 1    26 x  26 x 256   ->    26 x  26 x 128
   97 upsample           * 2    26 x  26 x 128   ->    52 x  52 x 128
   98 route  97 36
   99 conv    128  1 x 1 / 1    52 x  52 x 384   ->    52 x  52 x 128
  100 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
  101 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
  102 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
  103 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
  104 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
  105 conv    255  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 255
  106 detection
---------yolo3camera_5.mp4 frames classified-----------
Average computation time per frame: 0.06913487994018923
Completed. Total time for computation: 5.0 minutes, 32.469637632369995 seconds.
layer     filters    size              input                output
    0 conv     32  3 x 3 / 1   416 x 416 x   3   ->   416 x 416 x  32
    1 conv     64  3 x 3 / 2   416 x 416 x  32   ->   208 x 208 x  64
    2 conv     32  1 x 1 / 1   208 x 208 x  64   ->   208 x 208 x  32
```

```
 3 conv     64  3 x 3 / 1   208 x 208 x  32   ->   208 x 208 x  64
 4 shortcut 1
 5 conv    128  3 x 3 / 2   208 x 208 x  64   ->   104 x 104 x 128
 6 conv     64  1 x 1 / 1   104 x 104 x 128   ->   104 x 104 x  64
 7 conv    128  3 x 3 / 1   104 x 104 x  64   ->   104 x 104 x 128
 8 shortcut 5
 9 conv     64  1 x 1 / 1   104 x 104 x 128   ->   104 x 104 x  64
10 conv    128  3 x 3 / 1   104 x 104 x  64   ->   104 x 104 x 128
11 shortcut 8
12 conv    256  3 x 3 / 2   104 x 104 x 128   ->    52 x  52 x 256
13 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
14 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
15 shortcut 12
16 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
17 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
18 shortcut 15
19 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
20 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
21 shortcut 18
22 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
23 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
24 shortcut 21
25 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
26 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
27 shortcut 24
28 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
29 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
30 shortcut 27
31 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
32 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
33 shortcut 30
34 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
35 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
36 shortcut 33
37 conv    512  3 x 3 / 2    52 x  52 x 256   ->    26 x  26 x 512
38 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
39 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
40 shortcut 37
41 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
42 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
43 shortcut 40
44 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
45 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
46 shortcut 43
47 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
48 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
49 shortcut 46
50 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
```

```
51 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
52 shortcut 49
53 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
54 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
55 shortcut 52
56 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
57 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
58 shortcut 55
59 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
60 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
61 shortcut 58
62 conv   1024  3 x 3 / 2    26 x  26 x 512   ->    13 x  13 x1024
63 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
64 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
65 shortcut 62
66 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
67 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
68 shortcut 65
69 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
70 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
71 shortcut 68
72 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
73 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
74 shortcut 71
75 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
76 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
77 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
78 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
79 conv    512  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 512
80 conv   1024  3 x 3 / 1    13 x  13 x 512   ->    13 x  13 x1024
81 conv    255  1 x 1 / 1    13 x  13 x1024   ->    13 x  13 x 255
82 detection
83 route  79
84 conv    256  1 x 1 / 1    13 x  13 x 512   ->    13 x  13 x 256
85 upsample           * 2    13 x  13 x 256   ->    26 x  26 x 256
86 route  85 61
87 conv    256  1 x 1 / 1    26 x  26 x 768   ->    26 x  26 x 256
88 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
89 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
90 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
91 conv    256  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 256
92 conv    512  3 x 3 / 1    26 x  26 x 256   ->    26 x  26 x 512
93 conv    255  1 x 1 / 1    26 x  26 x 512   ->    26 x  26 x 255
94 detection
95 route  91
96 conv    128  1 x 1 / 1    26 x  26 x 256   ->    26 x  26 x 128
97 upsample           * 2    26 x  26 x 128   ->    52 x  52 x 128
98 route  97 36
```

```
  99 conv    128  1 x 1 / 1    52 x  52 x 384   ->    52 x  52 x 128
 100 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
 101 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
 102 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
 103 conv    128  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 128
 104 conv    256  3 x 3 / 1    52 x  52 x 128   ->    52 x  52 x 256
 105 conv    255  1 x 1 / 1    52 x  52 x 256   ->    52 x  52 x 255
 106 detection
---------yolo3camera_6.mp4 frames classified-----------
Average computation time per frame: 0.07069558704379388
Completed. Total time for computation: 5.0 minutes, 40.6113383769989 seconds.
```

[ ]:
```python
# Extract Frames of choice

frame_stream = cv2.VideoCapture("camera_6.mp4")
imgs = [2381, 4581, 3748, 3767, 3857, 4208]
for img in imgs:
    frame_stream.set(1, img)
    is_valid, frame = frame_stream.read()
    cv2.imwrite("camera6_"+str(img)+".png", frame)
```