## 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) + ".
 بjpg"
            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) + "u
 →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
             32 3 x 3 / 1
                                           -> 416 x 416 x 32
   0 conv
                           416 x 416 x 3
             64 3 x 3 / 2
                                                208 x 208 x 64
   1 conv
                           416 x 416 x 32
                                           ->
             32 1 x 1 / 1
                           208 x 208 x 64
                                                208 x 208 x 32
   2 conv
                                           ->
                           208 x 208 x 32
   3 conv
             64 3 x 3 / 1
                                                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
```

```
128 3 x 3 / 1
                           104 x 104 x 64
                                                 104 x 104 x 128
7 conv
                                            ->
8 shortcut 5
           64 1 x 1 / 1
                           104 x 104 x 128
                                                 104 x 104 x 64
9 conv
                                            ->
          128 3 x 3 / 1
                           104 x 104 x 64
                                                 104 x 104 x 128
10 conv
                                            ->
11 shortcut 8
          256 3 x 3 / 2
                           104 x 104 x 128
                                                  52 x 52 x 256
12 conv
                                             ->
13 conv
          128 1 x 1 / 1
                           52 x 52 x 256
                                                  52 x 52 x 128
                                             ->
                            52 x 52 x 128
14 conv
          256 3 x 3 / 1
                                            ->
                                                  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
               3 x 3 / 1
                                                  52 x 52 x 256
17 conv
          256
                           52 x 52 x 128
                                            ->
18 shortcut 15
19 conv
          128 1 x 1 / 1
                           52 x 52 x 256
                                                  52 x 52 x 128
                                             ->
                                                  52 x 52 x 256
20 conv
          256
               3 x 3 / 1
                            52 x 52 x 128
                                            ->
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
                            52 x 52 x 256
                                                  52 x 52 x 128
          128 1 x 1 / 1
                                             ->
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
                                             ->
          256 3 x 3 / 1
                                                  52 x 52 x 256
32 conv
                            52 x 52 x 128
                                            ->
33 shortcut 30
34 conv
         128 1 x 1 / 1
                            52 x 52 x 256
                                             ->
                                                  52 x 52 x 128
               3 x 3 / 1
                            52 x 52 x 128
                                                  52 x 52 x 256
35 conv
          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
                                             ->
               3 x 3 / 1
                                                  26 x 26 x 512
42 conv
          512
                            26 x 26 x 256
                                             ->
43 shortcut 40
44 conv
          256 1 x 1 / 1
                            26 x 26 x 512
                                                  26 x 26 x 256
                                             ->
          512 3 x 3 / 1
                                                  26 x 26 x 512
45 conv
                            26 x 26 x 256
                                            ->
46 shortcut 43
47 conv
          256 1 x 1 / 1
                            26 x 26 x 512
                                                  26 x 26 x 256
                                             ->
          512 3 x 3 / 1
                            26 x 26 x 256
                                                  26 x 26 x 512
48 conv
                                            ->
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
           512 3 x 3 / 1
57 conv
                             26 x 26 x 256
                                                    26 x 26 x 512
                                              ->
58 shortcut 55
59 conv
           256
                                                         26 x 256
                1 x 1 / 1
                             26 x 26 x 512
                                              ->
                                                    26 x
60 conv
           512
                3 x 3 / 1
                             26 x 26 x 256
                                                    26 x
                                                         26 x 512
                                              ->
61 shortcut 58
                                                    13 x
62 conv
          1024
                3 x 3 / 2
                             26 x 26 x 512
                                              ->
                                                         13 x1024
63 conv
           512 1 x 1 / 1
                             13 x 13 x1024
                                                    13 x 13 x 512
                                              ->
          1024
                3 x 3 / 1
                             13 x 13 x 512
                                                    13 x 13 x1024
64 conv
                                              ->
65 shortcut 62
66 conv
           512 1 x 1 / 1
                             13 x 13 x1024
                                                    13 x 13 x 512
                                              ->
67 conv
                3 x 3 / 1
                             13 x 13 x 512
                                                    13 x 13 x1024
          1024
                                              ->
68 shortcut 65
69 conv
           512 1 x 1 / 1
                             13 x 13 x1024
                                              ->
                                                    13 x 13 x 512
                                                    13 x 13 x1024
70 conv
          1024 3 x 3 / 1
                             13 x 13 x 512
                                              ->
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
                                                    13 x 13 x 512
75 conv
           512
                1 x 1 / 1
                             13 x 13 x1024
                                              ->
76 conv
          1024
                3 x 3 / 1
                                                    13 x 13 x1024
                             13 x 13 x 512
                                              ->
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
                                                    26 x 26 x 256
85 upsample
                      * 2
                             13 x 13 x 256
                                              ->
86 route 85 61
87 conv
                                                    26 x 26 x 256
           256 1 x 1 / 1
                             26 x 26 x 768
                                              ->
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
                                              ->
           512 3 x 3 / 1
                             26 x 26 x 256
90 conv
                                              ->
                                                    26 x 26 x 512
           256 1 x 1 / 1
                             26 x 26 x 512
                                                    26 x 26 x 256
91 conv
                                              ->
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
                             52 x 52 x 384
                                                    52 x 52 x 128
           128 1 x 1 / 1
                                              ->
                                                    52 x 52 x 256
100 conv
           256 3 x 3 / 1
                             52 x 52 x 128
                                              ->
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
                                              ->
           256 3 x 3 / 1
                             52 x 52 x 128
                                                    52 x 52 x 256
104 conv
                                              ->
                                                    52 x 52 x 255
105 conv
           255 1 x 1 / 1
                             52 x 52 x 256
                                              ->
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 =

31 conv

32 conv

128 1 x 1 / 1

256 3 x 3 / 1

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. size laver filters input output 32 3 x 3 / 1 0 conv 416 x 416 x 3 416 x 416 x 32 -> 1 conv 64 3 x 3 / 2 416 x 416 x 208 x 208 x 32 -> 32 1 x 1 / 1 2 conv 208 x 208 x 64 -> 208 x 208 x 208 x 208 x 64 208 x 208 x 32 3 conv 64 3 x 3 / 1 -> 4 shortcut 1 5 conv 128 3 x 3 / 2 208 x 208 x 64 104 x 104 x 128 -> 104 x 104 x 128 104 x 104 x 64 6 conv 64 1 x 1 / 1 -> 7 conv 128 3 x 3 / 1 104 x 104 x 64 -> 104 x 104 x 128

8 shortcut 5 104 x 104 x 128 104 x 104 x 64 9 conv 64 1 x 1 / 1 -> 128 3 x 3 / 1 104 x 104 x 64 104 x 104 x 128 10 conv -> 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 -> 3 x 3 / 1 52 x 52 x 128 52 x 52 x 256 14 conv 256 -> 15 shortcut 12 16 conv 128 52 x 52 x 256 52 x 52 x 128 1 x 1 / 1 -> 17 conv 256 3 x 3 / 1 52 x 52 x 128 -> 52 x 52 x 256 18 shortcut 15 19 conv 1 x 1 / 1 52 x 52 x 256 52 x 52 x 128 128 -> 256 3 x 3 / 1 52 x 52 x 256 20 conv 52 x 52 x 128 -> 21 shortcut 18 22 conv 128 1 x 1 / 1 52 x 52 x 256 -> 52 x 52 x 128 3 x 3 / 1 23 conv 256 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 -> 52 x 52 x 256 29 conv 256 3 x 3 / 1 52 x 52 x 128 30 shortcut 27

->

->

52 x 52 x 128

52 x 52 x 256

52 x 52 x 256

52 x 52 x 128

33	shortcut 30						
	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						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 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	
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 x 512
76	conv 1024	3 x 3 / 1	13 x	13 x 512	->	13 x	13 x1024
77	conv 512		13 x	13 x1024	->	13 x	
			13 x		->	13 x	
79	conv 512	1 x 1 / 1			->		
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
                                                ->
                        * 2
                               13 x 13 x 256
                                                      26 x 26 x 256
  85 upsample
                                                ->
  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
                               26 x 26 x 512
                                                      26 x 26 x 256
  89 conv
             256 1 x 1 / 1
                                                ->
             512 3 x 3 / 1
  90 conv
                               26 x 26 x 256
                                                ->
                                                      26 x 26 x 512
             256 1 x 1 / 1
                               26 x 26 x 512
                                                      26 x 26 x 256
  91 conv
                                                ->
  92 conv
             512 3 x 3 / 1
                               26 x 26 x 256
                                                      26 x 26 x 512
                                                ->
                               26 x 26 x 512
             255 1 x 1 / 1
                                                      26 x 26 x 255
  93 conv
                                                ->
  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
                                                ->
                                                      52 x 52 x 256
  100 conv
             256 3 x 3 / 1
                               52 x 52 x 128
                                                ->
                               52 x 52 x 256
                                                      52 x 52 x 128
  101 conv
             128 1 x 1 / 1
                                                ->
  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
                                                ->
               64 3 x 3 / 2
   1 conv
                              416 x 416 x 32
                                                ->
                                                     208 x 208 x 64
                              208 x 208 x 64
                                                     208 x 208 x 32
   2 conv
              32 1 x 1 / 1
                                                ->
                                                     208 x 208 x 64
   3 conv
               64
                  3 x 3 / 1
                              208 x 208 x 32
                                                ->
   4 shortcut 1
   5 conv
             128
                  3 x 3 / 2
                              208 x 208 x 64
                                                ->
                                                     104 x 104 x 128
                              104 x 104 x 128
                                                     104 x 104 x 64
   6 conv
               64 1 x 1 / 1
                                                ->
   7 conv
             128 3 x 3 / 1
                              104 x 104 x 64
                                                     104 x 104 x 128
                                                ->
   8 shortcut 5
                              104 x 104 x 128
                                                     104 x 104 x 64
   9 conv
               64 1 x 1 / 1
                                                ->
                              104 x 104 x 64
                                                     104 x 104 x 128
   10 conv
             128
                  3 x 3 / 1
                                                ->
   11 shortcut 8
   12 conv
             256 3 x 3 / 2
                              104 x 104 x 128
                                                ->
                                                      52 x 52 x 256
```

52 x 52 x 256

52 x 52 x 128

52 x 52 x 256

52 x 52 x 128

->

->

->

->

128

256

13 conv

14 conv

16 conv

17 conv

15 shortcut 12

1 x 1 / 1

3 x 3 / 1

128 1 x 1 / 1

256 3 x 3 / 1

52 x 52 x 128

52 x 52 x 256

52 x 52 x 128

52 x 52 x 256

18	shortcut 15																
	conv 128	1	x	1	/	1	52	x	52	x	256	->	52	x	52	x	128
	conv 256			3			52				128	->	52				256
	shortcut 18	_		Ī	′	_	-		-			·	-		-		
	conv 128	1	v	1	/	1	52	x	52	v	256	->	52	v	52	v	128
	conv 256			3			52				128	->					256
	shortcut 21	Ü	11	Ŭ	′	_	02	21	02	21	120	ŕ	02		02		200
	conv 128	1	v	1	/	1	52	v	52	v	256	->	52	v	52	v	128
	conv 256			3			52				128	->	52				256
	shortcut 24		Λ	Ü	′	_	02	Λ	02	1	120		02	Λ.	02	Λ.	200
	conv 128	1	v	1	/	1	52	v	52	v	256	->	52	v	52	v	128
	conv 256			3			52				128	->	52				256
	shortcut 27	3	Y	J	/	1	02	х	52	Y	120	-/	52	А	02	A	230
	conv 128	4		1	,	1	52		EΩ		256		E 0		E٥		128
				1							128	->	52 52				256
		3	X	3	/	1	52	Х	52	X	120	->	52	X	52	Х	250
	shortcut 30	4		,	,		го.		Ε0		056		Ε0		го.		100
	conv 128			1			52				256	->					128
	conv 256	3	X	3	/	1	52	Х	52	Х	128	->	52	X	52	X	256
	shortcut 33	_		_	,	_					050						
	conv 512			3			52				256	->	26				512
	conv 256			1			26				512	->	26				256
	conv 512	3	X	3	/	1	26	Х	26	X	256	->	26	X	26	X	512
	shortcut 37																
	conv 256			1			26				512	->	26				256
	conv 512	3	X	3	/	1	26	Х	26	Х	256	->	26	X	26	X	512
43	shortcut 40																
	conv 256			1			26	X	26	X	512	->	26				256
45	conv 512	3	X	3	/	1	26	X	26	X	256	->	26	x	26	X	512
	shortcut 43																
47	conv 256			1			26	x			512	->	26	x	26	X	256
	conv 512	3	X	3	/	1	26	x	26	Х	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	Х	3	/	1	26	Х	26	X	256	->	26	x	26	X	512
52	shortcut 49																
53	conv 256									X	512	->	26	x	26	x	256
54	conv 512	3	х	3	/	1	26	х	26	Х	256	->	26	x	26	х	512
55	shortcut 52																
56	conv 256	1	х	1	/	1	26	Х	26	х	512	->	26	x	26	x	256
57	conv 512	3	х	3	/	1	26	Х	26	х	256	->	26	x	26	x	512
58	shortcut 55																
59	conv 256	1	х	1	/	1	26	х	26	х	512	->	26	x	26	x	256
60	conv 512	3	х	3	/	1	26	х	26	х	256	->	26	x	26	х	512
61	shortcut 58																
	conv 1024	3	х	3	/	2	26	х	26	х	512	->	13	X	13	x1	024
	conv 512																512
	conv 1024																024
	shortcut 62																

```
66 conv
           512 1 x 1 / 1
                             13 x 13 x1024
                                                    13 x 13 x 512
                                              ->
          1024
                3 x 3 / 1
                             13 x 13 x 512
                                                    13 x 13 x1024
67 conv
                                              ->
68 shortcut 65
69 conv
                1 x 1 / 1
                             13 x 13 x1024
                                              ->
                                                    13 x 13 x 512
           512
70 conv
                3 x 3 / 1
                             13 x 13 x 512
                                                    13 x 13 x1024
          1024
                                              ->
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
          1024
                3 x 3 / 1
                             13 x 13 x 512
                                                    13 x 13 x1024
76 conv
                                              ->
77 conv
           512 1 x 1 / 1
                             13 x 13 x1024
                                                    13 x 13 x 512
                                              ->
          1024 3 x 3 / 1
78 conv
                             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
                                              ->
                3 x 3 / 1
80 conv
          1024
                             13 x 13 x 512
                                              ->
                                                    13 x 13 x1024
81 conv
           255 1 x 1 / 1
                             13 x 13 x1024
                                                    13 \times 13 \times 255
                                              ->
82 detection
83 route 79
84 conv
           256 1 x 1 / 1
                             13 x 13 x 512
                                                    13 x 13 x 256
                                              ->
                                                    26 x 26 x 256
85 upsample
                      * 2
                             13 x 13 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
                                              ->
           255 1 x 1 / 1
                             26 x 26 x 512
                                                    26 x 26 x 255
93 conv
                                              ->
94 detection
95 route 91
96 conv
           128 1 x 1 / 1
                             26 x 26 x 256
                                                    26 x 26 x 128
                                              ->
                                                    52 x 52 x 128
97 upsample
                      * 2
                             26 x 26 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
                                              ->
           128 1 x 1 / 1
                             52 x 52 x 256
                                                    52 x 52 x 128
101 conv
                                              ->
102 conv
           256 3 x 3 / 1
                             52 x 52 x 128
                                                    52 x 52 x 256
                                              ->
               1 x 1 / 1
103 conv
           128
                             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
                                                    416 x 416 x 32
   0 conv
              32 3 x 3 / 1
                              416 x 416 x
                                           3
                                                ->
                              416 x 416 x 32
   1 conv
              64 3 x 3 / 2
                                                ->
                                                    208 x 208 x 64
    2 conv
              32 1 x 1 / 1
                              208 x 208 x 64
                                               ->
                                                    208 x 208 x 32
```

```
64 3 x 3 / 1
                           208 x 208 x 32
                                                  208 x 208 x 64
 3 conv
                                             ->
 4 shortcut 1
          128 3 x 3 / 2
                           208 x 208 x 64
                                                  104 x 104 x 128
 5 conv
                                             ->
              1 x 1 / 1
 6 conv
           64
                           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
          128 1 x 1 / 1
                           52 x 52 x 256
13 conv
                                                   52 x 52 x 128
                                             ->
               3 x 3 / 1
                            52 x 52 x 128
                                                   52 x 52 x 256
14 conv
          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
                                             ->
                                                   52 x 52 x 256
23 conv
          256 3 x 3 / 1
                            52 x 52 x 128
                                             ->
24 shortcut 21
25 conv
          128 1 x 1 / 1
                            52 x 52 x 256
                                             ->
                                                   52 x 52 x 128
          256 3 x 3 / 1
                            52 x 52 x 128
                                                   52 x 52 x 256
26 conv
                                             ->
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
                            26 x 26 x 512
41 conv
          256 1 x 1 / 1
                                             ->
                                                   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
                                                   26 x 26 x 256
          256 1 x 1 / 1
                            26 x 26 x 512
                                             ->
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
                                             ->
          512 3 x 3 / 1
                                                   26 x 26 x 512
48 conv
                            26 x 26 x 256
                                             ->
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
                            26 x 26 x 512
                                                   26 x 26 x 256
53 conv
          256
              1 x 1 / 1
                                             ->
54 conv
          512
               3 x 3 / 1
                            26 x 26 x 256
                                                   26 x 26 x 512
                                             ->
55 shortcut 52
56 conv
                            26 x 26 x 512
                                                   26 x
                                                         26 x 256
          256
               1 x 1 / 1
                                             ->
57 conv
          512
               3 x 3 / 1
                            26 x 26 x 256
                                                   26 x 26 x 512
                                             ->
58 shortcut 55
59 conv
                            26 x 26 x 512
                                                   26 x 26 x 256
          256
               1 x 1 / 1
                                             ->
               3 x 3 / 1
                            26 x 26 x 256
60 conv
          512
                                             ->
                                                   26 x
                                                         26 x 512
61 shortcut 58
62 conv
         1024 3 x 3 / 2
                            26 x 26 x 512
                                                   13 x 13 x1024
                                             ->
          512 1 x 1 / 1
                            13 x 13 x1024
63 conv
                                                   13 x 13 x 512
                                             ->
         1024
               3 x 3 / 1
                            13 x 13 x 512
                                                   13 x 13 x1024
64 conv
                                             ->
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
                                             ->
         1024 3 x 3 / 1
78 conv
                            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
                                             ->
                            13 x 13 x 256
                                                   26 x 26 x 256
85 upsample
                     * 2
                                             ->
86 route 85 61
                                                   26 x 26 x 256
87 conv
          256 1 x 1 / 1
                            26 x 26 x 768
                                             ->
88 conv
          512 3 x 3 / 1
                            26 x 26 x 256
                                                   26 x 26 x 512
                                             ->
          256 1 x 1 / 1
                            26 x 26 x 512
                                                   26 x 26 x 256
89 conv
                                             ->
          512 3 x 3 / 1
90 conv
                            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
                        52 x 52 x 384
                                            52 x 52 x 128
         128 1 x 1 / 1
                                         ->
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
          128 1 x 1 / 1
                         52 x 52 x 256
                                         -> 52 x 52 x 128
103 conv
                                         ->
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.

```
[]: # 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)
```