```
# clone darknet repo
!git clone https://github.com/AlexeyAB/darknet
```

```
Cloning into 'darknet'...
remote: Enumerating objects: 15301, done.
remote: Total 15301 (delta 0), reused 0 (delta 0), pack-reused 15301
Receiving objects: 100% (15301/15301), 13.66 MiB | 18.90 MiB/s, done.
Resolving deltas: 100% (10399/10399), done.
```

```
# change makefile to have GPU and OPENCV enabled
%cd darknet
!sed -i 's/OPENCV=0/OPENCV=1/' Makefile
!sed -i 's/GPU=0/GPU=1/' Makefile
!sed -i 's/CUDNN=0/CUDNN=1/' Makefile
!sed -i 's/CUDNN_HALF=0/CUDNN_HALF=1/' Makefile
```

```
/content/darknet
```

```
# verify CUDA
!/usr/local/cuda/bin/nvcc --version
```

```
nvcc: NVIDIA (R) Cuda compiler driver
Copyright (c) 2005-2020 NVIDIA Corporation
Built on Wed_Jul_22_19:09:09_PDT_2020
Cuda compilation tools, release 11.0, V11.0.221
Build cuda_11.0_bu.TC445_37.28845127_0
```

```
# make darknet (builds darknet so that you can then use the darknet executable file to run
!make
```

```
mkdir -p ./obj/
mkdir -p backup
chmod +x *.sh
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config -
./src/image_opencv.cpp: In function ‘void draw_detections_cv_v3(void**, detection*
./src/image_opencv.cpp:946:23: warning: variable ‘rgb’ set but not used [-Wunused-
                 float rgb[3];
                       ^~~
./src/image_opencv.cpp: In function ‘void draw_train_loss(char*, void**, int, floa
./src/image_opencv.cpp:1147:13: warning: this ‘if’ clause does not guard... [-Wmis
             if (iteration_old == 0)
             ^~
./src/image_opencv.cpp:1150:10: note: ...this statement, but the latter is mislead
          if (iteration_old != 0){
          ^~
./src/image_opencv.cpp: In function ‘void cv_draw_object(image, float*, int, int,
./src/image_opencv.cpp:1444:14: warning: unused variable ‘buff’ [-Wunused-variable
         char buff[100];
              ^~~~
./src/image_opencv.cpp:1420:9: warning: unused variable ‘it_tb_res’ [-Wunused-vari
     int it_tb_res = cv::createTrackbar(it_trackbar_name, window_name, &it_trackba
         ^~~~~~~~~
./src/image_opencv.cpp:1424:9: warning: unused variable ‘lr_tb_res’ [-Wunused-vari
     int lr_tb_res = cv::createTrackbar(lr_trackbar_name, window_name, &lr_trackba
         ^~~~~~~~~
```

```
./src/image_opencv.cpp:1428:9: warning: unused variable ‘cl_tb_res’ [-Wunused-vari
     int cl_tb_res = cv::createTrackbar(cl_trackbar_name, window_name, &cl_trackba
         ^~~~~~~~~
./src/image_opencv.cpp:1431:9: warning: unused variable ‘bo_tb_res’ [-Wunused-vari
     int bo_tb_res = cv::createTrackbar(bo_trackbar_name, window_name, boxonly, 1)
         ^~~~~~~~~
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config -
./src/http_stream.cpp: In member function ‘bool JSON_sender::write(const char*)’:
./src/http_stream.cpp:253:21: warning: unused variable ‘n’ [-Wunused-variable]
                 int n = _write(client, outputbuf, outlen);
                     ^
./src/http_stream.cpp: In member function ‘bool MJPG_sender::write(const cv::Mat&)
./src/http_stream.cpp:511:113: warning: format ‘%zu’ expects argument of type ‘siz
                 sprintf(head, "--mjpegstream\r\nContent-Type: image/jpeg\r\nConte

./src/http_stream.cpp: In function ‘void set_track_id(detection*, int, float, floa
./src/http_stream.cpp:867:27: warning: comparison between signed and unsigned inte
         for (int i = 0; i < v.size(); ++i) {
                         ~~^~~~~~~~~~
./src/http_stream.cpp:875:33: warning: comparison between signed and unsigned inte
     for (int old_id = 0; old_id < old_dets.size(); ++old_id) {
                          ~~~~~~~~^~~~~~~~~~~~~~~~~
./src/http_stream.cpp:894:31: warning: comparison between signed and unsigned inte
     for (int index = 0; index < new_dets_num*old_dets.size(); ++index) {
                         ~~~~~~^~~~~~~~~~~~~~~~~~~~~~~~~~~~~
./src/http_stream.cpp:930:28: warning: comparison between signed and unsigned inte
     if (old_dets_dq.size() > deque_size) old_dets_dq.pop_front();
         ~~~~~~~~~~~~~~~~~~~^~~~~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags opencv4 2> /dev
./src/gemm.c: In function ‘convolution_2d’:
./src/gemm.c:2044:15: warning: unused variable ‘out_w’ [-Wunused-variable]
     const int out_w = (w + 2 * pad - ksize) / stride + 1;    // output_width=input
               ^~~~~
```

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

```
Mounted at /content/drive
```

```
# this is where my datasets are stored within my Google Drive (I created a yolov4 folder t
!ls /mydrive
```

```
ls: cannot access '/mydrive': No such file or directory
```

```
# copy over both datasets into the root directory of the Colab VM (comment out test.zip if
!cp /content/drive/MyDrive/Projects/yoloV4/obj.zip ../
!cp /content/drive/MyDrive/Projects/yoloV4/test.zip ../
```

```
# unzip the datasets and their contents so that they are now in /darknet/data/ folder
!unzip /content/obj.zip -d data/
!unzip /content/test.zip -d data/
```

```
Archive:  /content/obj.zip
   creating: data/obj/
  inflating: data/obj/BikesHelmets0.png
  inflating: data/obj/BikesHelmets0.txt
```

```
  extracting: data/obj/BikesHelmets1.png
   inflating: data/obj/BikesHelmets1.txt
  extracting: data/obj/BikesHelmets10.png
   inflating: data/obj/BikesHelmets10.txt
  extracting: data/obj/BikesHelmets11.png
   inflating: data/obj/BikesHelmets11.txt
   inflating: data/obj/BikesHelmets12.png
   inflating: data/obj/BikesHelmets12.txt
  extracting: data/obj/BikesHelmets13.png
   inflating: data/obj/BikesHelmets13.txt
  extracting: data/obj/BikesHelmets14.png
   inflating: data/obj/BikesHelmets14.txt
  extracting: data/obj/BikesHelmets146.png
   inflating: data/obj/BikesHelmets146.txt
  extracting: data/obj/BikesHelmets147.png
  extracting: data/obj/BikesHelmets147.txt
  extracting: data/obj/BikesHelmets148.png
   inflating: data/obj/BikesHelmets148.txt
  extracting: data/obj/BikesHelmets149.png
   inflating: data/obj/BikesHelmets149.txt
  extracting: data/obj/BikesHelmets15.png
   inflating: data/obj/BikesHelmets15.txt
  extracting: data/obj/BikesHelmets150.png
   inflating: data/obj/BikesHelmets150.txt
  extracting: data/obj/BikesHelmets151.png
   inflating: data/obj/BikesHelmets151.txt
  extracting: data/obj/BikesHelmets152.png
   inflating: data/obj/BikesHelmets152.txt
  extracting: data/obj/BikesHelmets153.png
   inflating: data/obj/BikesHelmets153.txt
  extracting: data/obj/BikesHelmets154.png
   inflating: data/obj/BikesHelmets154.txt
  extracting: data/obj/BikesHelmets155.png
   inflating: data/obj/BikesHelmets155.txt
  extracting: data/obj/BikesHelmets156.png
   inflating: data/obj/BikesHelmets156.txt
  extracting: data/obj/BikesHelmets157.png
   inflating: data/obj/BikesHelmets157.txt
  extracting: data/obj/BikesHelmets158.png
   inflating: data/obj/BikesHelmets158.txt
  extracting: data/obj/BikesHelmets159.png
   inflating: data/obj/BikesHelmets159.txt
   inflating: data/obj/BikesHelmets16.png
   inflating: data/obj/BikesHelmets16.txt
  extracting: data/obj/BikesHelmets160.png
   inflating: data/obj/BikesHelmets160.txt
  extracting: data/obj/BikesHelmets161.png
   inflating: data/obj/BikesHelmets161.txt
  extracting: data/obj/BikesHelmets162.png
   inflating: data/obj/BikesHelmets162.txt
  extracting: data/obj/BikesHelmets163.png
   inflating: data/obj/BikesHelmets163.txt
  extracting: data/obj/BikesHelmets164.png
   inflating: data/obj/BikesHelmets164.txt
  extracting: data/obj/BikesHelmets165.png
```

```
# upload the custom .cfg back to cloud VM from Google Drive
# !cp /content/yolov4-custom.cfg ./cfg
!cp /content/test.txt ./data
!cp /content/train.txt ./data
```

```
# upload the obj.names and obj.data files to cloud VM from Google Drive
!cp /content/drive/MyDrive/Projects/yoloV4/obj.names ./data
!cp /content/drive/MyDrive/Projects/yoloV4/obj.data  ./data


!wget https://github.com/AlexeyAB/darknet/releases/download/darknet_yolo_v3_optimal/yolov4
```

```
--2021-08-25 05:01:53--  https://github.com/AlexeyAB/darknet/releases/download/darkne
Resolving github.com (github.com)... 13.114.40.48
Connecting to github.com (github.com)|13.114.40.48|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://github-releases.githubusercontent.com/75388965/48bfe500-889d-11ea-8
--2021-08-25 05:01:53--  https://github-releases.githubusercontent.com/75388965/48bfe
Resolving github-releases.githubusercontent.com (github-releases.githubusercontent.cc
Connecting to github-releases.githubusercontent.com (github-releases.githubuserconter
HTTP request sent, awaiting response... 200 OK
Length: 170038676 (162M) [application/octet-stream]
Saving to: ‘yolov4.conv.137’

yolov4.conv.137     100%[===================>] 162.16M   155MB/s    in 1.0s

2021-08-25 05:01:54 (155 MB/s) - ‘yolov4.conv.137’ saved [170038676/170038676]
```

```
# train your custom detector! (uncomment %%capture below if you run into memory issues or
# %%capture
!./darknet detector train data/obj.data /content/yolov4-custom.cfg yolov4.conv.137 -dont_s
```

```
Streaming output truncated to the last 5000 lines.
 total_bbox = 125368, rewritten_bbox = 0.139589 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
 total_bbox = 125424, rewritten_bbox = 0.139527 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
 total_bbox = 125450, rewritten_bbox = 0.139498 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
 total_bbox = 125479, rewritten_bbox = 0.139466 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
 total_bbox = 125505, rewritten_bbox = 0.139437 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
 total_bbox = 125540, rewritten_bbox = 0.139398 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
 total_bbox = 125594, rewritten_bbox = 0.139338 %

 (next mAP calculation at 1000 iterations)
 198: 5.323485, 9.253886 avg loss, 0.000002 rate, 23.737865 seconds, 12672 images,
```

```
 Loaded: 0.000076 seconds
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
  total_bbox = 125648, rewritten_bbox = 0.139278 %
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
  total_bbox = 125697, rewritten_bbox = 0.139224 %
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
  total_bbox = 125741, rewritten_bbox = 0.139175 %
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
  total_bbox = 125821, rewritten_bbox = 0.139086 %
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
  total_bbox = 125864, rewritten_bbox = 0.139039 %
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
  total_bbox = 125919, rewritten_bbox = 0.138978 %
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0
 v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0
  total_bbox = 125955, rewritten_bbox = 0.138939 %
```

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

```
 Mounted at /content/drive
```

```
!pip install opencv-contrib-python==3.4.13.47 --force-reinstall
# !pip install opencv-python==3.4.2.16 --force-reinstall
```

```
Collecting opencv-contrib-python==3.4.13.47
  Using cached opencv_contrib_python-3.4.13.47-cp37-cp37m-manylinux2014_x86_64.whl (5
Collecting numpy>=1.14.5
```

```
import cv2
print(cv2.__version__)
```

```
3.4.13
```

```
      Successfully uninstalled numpy-1.21.2
```

```
import cv2
import numpy as np
from google.colab.patches import cv2_imshow
rpmLabel = ['With_helmet', 'Without_helmet']
rpmMissingWeight = "/content/drive/MyDrive/Projects/yoloV4/backup/yolov4-custom_last_25-08
rpmMissingConfig = "/content/yolov4-custom.cfg"
image = cv2.imread("/content/BikesHelmets2.png")

helmet = cv2.dnn.readNet(rpmMissingWeight, rpmMissingConfig)
(H, W) = image.shape[:2]

# determine only the "ouput" layers name which we need from YOLO
ln = helmet.getLayerNames()
ln = [ln[i[0] - 1] for i in helmet.getUnconnectedOutLayers()]

# construct a blob from the input image and then perform a forward pass of the YOLO object
# giving us our bounding boxes and associated probabilities
blob = cv2.dnn.blobFromImage(image, 1 / 255.0, (416, 416), swapRB=True, crop=False)
helmet.setInput(blob)
layerOutputs = helmet.forward(ln)

boxes = []
confidences = []
classIDs = []
threshold = 0.1

# loop over each of the layer outputs
for output in layerOutputs:
    # loop over each of the detections
    for detection in output:
        # extract the class ID and confidence (i.e., probability) of
        # the current object detection
        scores = detection[5:]
        classID = np.argmax(scores)
        confidence = scores[classID]

        # filter out weak predictions by ensuring the detected
        # probability is greater than the minimum probability
        # confidence type=float, default=0.5
        if confidence > threshold:
            # scale the bounding box coordinates back relative to the
            # size of the image, keeping in mind that YOLO actually
            # returns the center (x, y)-coordinates of the bounding
            # box followed by the boxes' width and height
            box = detection[0:4] * np.array([W, H, W, H])
            (centerX, centerY, width, height) = box.astype("int")
```

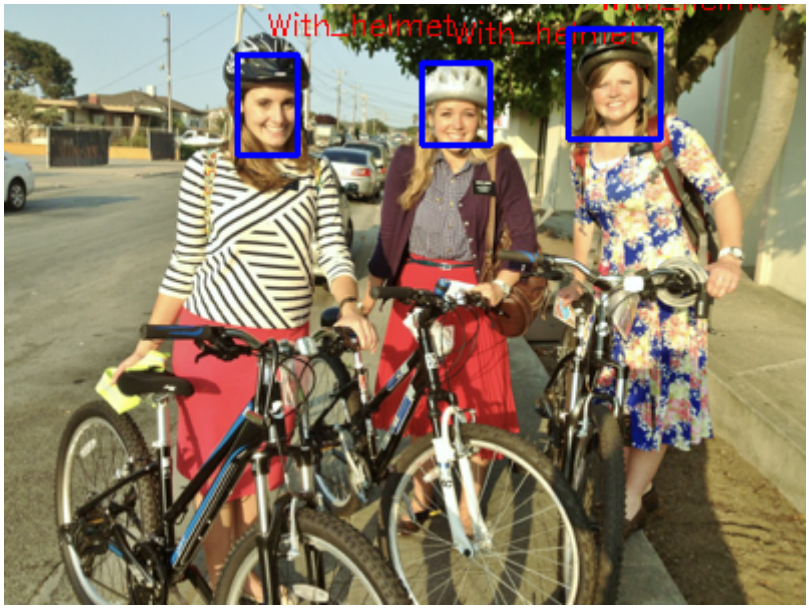
```
            # use the center (x, y)-coordinates to derive the top and
            # and left corner of the bounding box
            x = int(centerX - (width / 2))
            y = int(centerY - (height / 2))

            # update our list of bounding box coordinates, confidences,
            # and class IDs
            boxes.append([x, y, int(width), int(height)])
            confidences.append(float(confidence))
            classIDs.append(classID)

# apply non-maxima suppression to suppress weak, overlapping bounding boxes
idxs = cv2.dnn.NMSBoxes(boxes, confidences, threshold, 0.1)
color2 = (0,0,255)


# ensure at least one detection exists
if len(idxs) > 0:
    # loop over the indexes we are keeping
    for i in idxs.flatten():
        # extract the bounding box coordinates
        (x, y) = (boxes[i][0], boxes[i][1])
        (w, h) = (boxes[i][2], boxes[i][3])

        # draw a bounding box rectangle and label on the image
        color = (255,0,0)
        cv2.rectangle(image, (x, y), (x + w, y + h), color, 2)
        text = "{}".format(rpmLabel[classIDs[i]], confidences[i])
        cv2.putText(image, text, (x +15, y - 10), cv2.FONT_HERSHEY_SIMPLEX,0.5, color2, 1)
    cv2_imshow(image)
```



✓ 3s completed at 12:49 AM