```
1  !nvidia-smi
```

```
Sun Apr 10 23:08:23 2022
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 460.32.03    Driver Version: 460.32.03    CUDA Version: 11.2     |
|-------------------------------+----------------------+----------------------+
| GPU  Name        Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|         Memory-Usage | GPU-Util  Compute M. |
|                               |                      |               MIG M. |
|===============================+======================+======================|
|   0  Tesla T4            Off  | 00000000:00:04.0 Off |                    0 |
| N/A   37C    P8     9W /  70W |      0MiB / 15109MiB |      0%      Default |
|                               |                      |                  N/A |
+-------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes:                                                                  |
|  GPU   GI   CI        PID   Type   Process name                  GPU Memory |
|        ID   ID                                                   Usage      |
|=============================================================================|
|  No running processes found                                                 |
+-----------------------------------------------------------------------------+
```

```
1  !sudo apt-get install tree -qq > /dev/null
```

```
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (This frontend requires a controlling tty.)
debconf: falling back to frontend: Teletype
dpkg-preconfigure: unable to re-open stdin:
```

```
1  #install libraries
2  !pip install torch==1.5.1+cu101 torchvision==0.6.1+cu101 -f https://download.pytorch.org/whl/torch_stable.html
3  !pip install numpy==1.17.3
4  !pip install PyYAML==5.3.1
5  !pip install git+https://github.com/cocodataset/cocoapi.git#subdirectory=PythonAPI
```

```
Looking in links: https://download.pytorch.org/whl/torch_stable.html
Collecting torch==1.5.1+cu101
  Downloading https://download.pytorch.org/whl/cu101/torch-1.5.1%2Bcu101-cp37-cp37m-linu
     |████████████████████████████████| 704.4 MB 1.3 kB/s
Collecting torchvision==0.6.1+cu101
  Downloading https://download.pytorch.org/whl/cu101/torchvision-0.6.1%2Bcu101-cp37-cp37
     |████████████████████████████████| 6.6 MB 40.6 MB/s
Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-packages (from tor
Requirement already satisfied: future in /usr/local/lib/python3.7/dist-packages (from to
Requirement already satisfied: pillow>=4.1.1 in /usr/local/lib/python3.7/dist-packages (
Installing collected packages: torch, torchvision
  Attempting uninstall: torch
    Found existing installation: torch 1.10.0+cu111
    Uninstalling torch-1.10.0+cu111:
      Successfully uninstalled torch-1.10.0+cu111
  Attempting uninstall: torchvision
    Found existing installation: torchvision 0.11.1+cu111
    Uninstalling torchvision-0.11.1+cu111:
      Successfully uninstalled torchvision-0.11.1+cu111
ERROR: pip's dependency resolver does not currently take into account all the packages t
torchtext 0.11.0 requires torch==1.10.0, but you have torch 1.5.1+cu101 which is incompa
torchaudio 0.10.0+cu111 requires torch==1.10.0, but you have torch 1.5.1+cu101 which is
Successfully installed torch-1.5.1+cu101 torchvision-0.6.1+cu101
Collecting numpy==1.17.3
  Downloading numpy-1.17.3-cp37-cp37m-manylinux1_x86_64.whl (20.0 MB)
     |████████████████████████████████| 20.0 MB 31.4 MB/s
Installing collected packages: numpy
  Attempting uninstall: numpy
    Found existing installation: numpy 1.21.5
    Uninstalling numpy-1.21.5:
      Successfully uninstalled numpy-1.21.5
ERROR: pip's dependency resolver does not currently take into account all the packages t
tensorflow 2.8.0 requires tf-estimator-nightly==2.8.0.dev2021122109, which is not instal
torchtext 0.11.0 requires torch==1.10.0, but you have torch 1.5.1+cu101 which is incompa
tensorflow 2.8.0 requires numpy>=1.20, but you have numpy 1.17.3 which is incompatible.
tables 3.7.0 requires numpy>=1.19.0, but you have numpy 1.17.3 which is incompatible.
kapre 0.3.7 requires numpy>=1.18.5, but you have numpy 1.17.3 which is incompatible.
jaxlib 0.3.2+cuda11.cudnn805 requires numpy>=1.19, but you have numpy 1.17.3 which is ir
jax 0.3.4 requires numpy>=1.19, but you have numpy 1.17.3 which is incompatible.
datascience 0.10.6 requires folium==0.2.1, but you have folium 0.8.3 which is incompatib
albumentations 0.1.12 requires imgaug<0.2.7,>=0.2.5, but you have imgaug 0.2.9 which is
Successfully installed numpy-1.17.3
Collecting PyYAML==5.3.1
  Downloading PyYAML-5.3.1.tar.gz (269 kB)
     |████████████████████████████████| 269 kB 29.4 MB/s
Building wheels for collected packages: PyYAML
  Building wheel for PyYAML (setup.py) ... done
  Created wheel for PyYAML: filename=PyYAML-5.3.1-cp37-cp37m-linux_x86_64.whl size=4463
  Stored in directory: /root/.cache/pip/wheels/5e/03/1e/e1e954795d6f35dfc7b637fe2277bff
Successfully built PyYAML
Installing collected packages: PyYAML
  Attempting uninstall: PyYAML
    Found existing installation: PyYAML 3.13
    Uninstalling PyYAML-3.13:
      Successfully uninstalled PyYAML-3.13
Successfully installed PyYAML-5.3.1
Collecting git+https://github.com/cocodataset/cocoapi.git#subdirectory=PythonAPI
  Cloning https://github.com/cocodataset/cocoapi.git to /tmp/pip-req-build-2ofmk09r
  Running command git clone -q https://github.com/cocodataset/cocoapi.git /tmp/pip-req-b
Requirement already satisfied: setuptools>=18.0 in /usr/local/lib/python3.7/dist-package
Requirement already satisfied: cython>=0.27.3 in /usr/local/lib/python3.7/dist-packages
Requirement already satisfied: matplotlib>=2.1.0 in /usr/local/lib/python3.7/dist-packag
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /usr/local/li
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packag
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-packages (f
Requirement already satisfied: numpy>=1.11 in /usr/local/lib/python3.7/dist-packages (fr
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-pac
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.7/dist-packag
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from
Building wheels for collected packages: pycocotools
  Building wheel for pycocotools (setup.py) ... done
  Created wheel for pycocotools: filename=pycocotools-2.0-cp37-cp37m-linux_x86_64.whl si
  Stored in directory: /tmp/pip-ephem-wheel-cache-i872y92t/wheels/e2/6b/1d/344ac773c749
Successfully built pycocotools
Installing collected packages: pycocotools
  Attempting uninstall: pycocotools
    Found existing installation: pycocotools 2.0.4
    Uninstalling pycocotools-2.0.4:
      Successfully uninstalled pycocotools-2.0.4
Successfully installed pycocotools-2.0
```

Build the Dataset

```
# imports
from pathlib import Path
from tqdm import tqdm
import numpy as np
import json
import urllib
import PIL.Image as Image
import cv2
import torch
import torchvision
from IPython.display import display
from sklearn.model_selection import train_test_split
import os
import PIL

import seaborn as sns
from pylab import rcParams
import matplotlib.pyplot as plt
from matplotlib import rc

%matplotlib inline
%config InlineBackend.figure_format='retina'
sns.set(style='whitegrid', palette='muted', font_scale=1.2)
rcParams['figure.figsize'] = 16, 10

np.random.seed(42)
```

```
# our data directories
!tree   Weapon-detection-1 -L 2
```

```
Weapon-detection-1 [error opening dir]

0 directories, 0 files
```

```
!pip install roboflow

from roboflow import Roboflow
rf = Roboflow(api_key="HAAZzUmIip5OvdPutJ9O")
project = rf.workspace("alon-barak").project("weapon-detection-dp9bo")
dataset = project.version(1).download("yolov5")

```

```
# cloning the git repo
!git clone https://github.com/ultralytics/yolov5
%cd yolov5
!git checkout 741fac815e366d74eed020efb8c68a23828ee3e9
```

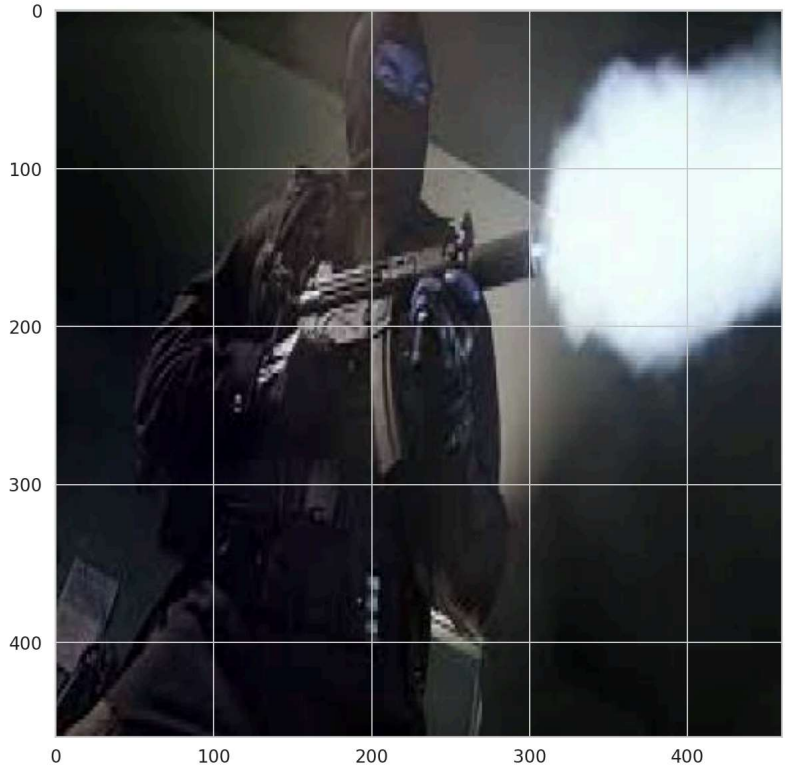
```
# show the dimensions of the images in the dataset
img = cv2.imread('/content/yolov5/Weapon-detection-1/train/images/107_jpeg.rf.22d3c90341d7af62ed4cb51f334ce3dc.jpg', cv2.IMREAD_UNCHANGED
dimensions = img.shape
# height, width, number of channels in image
height = img.shape[0]
width = img.shape[1]
channels = img.shape[2]

print('Image Dimension    : ',dimensions)
print('Image Height       : ',height)
print('Image Width        : ',width)
print('Number of Channels : ',channels)
```

```
Image Dimension    :  (460, 460, 3)
Image Height       :  460
Image Width        :  460
Number of Channels :  3
```

```
img = cv2.imread('/content/yolov5/Weapon-detection-1/train/images/107_jpeg.rf.22d3c90341d7af62ed4cb51f334ce3dc.jpg', cv2.IMREAD_UNCHANGED
plt.imshow(img)
```

```
<matplotlib.image.AxesImage at 0x7fcda14ee150>
```




```
# now the data is in YOLO format [num_of_classes_in_pic [x_center, y_center, width, height]]
!cat /content/yolov5/Weapon-detection-1/train/labels/101_jpeg.rf.862e32bcad46dd649654db9c788a5c47.txt
```

```
0 0.5880434782608696 0.34347826086956523 0.15108695652173912 0.3684782608695652
```

```
!python train.py --img 480 --batch 4 --epochs 30 --data ./data/data.yaml --cfg ./models/yolov5x.yaml --weights yolov5x.pt --name yolov5x
```

```
train: weights=yolov5x.pt, cfg=./models/yolov5x.yaml, data=./data/data.yaml, hyp=data/hyps/hyp.scratch-low.yaml, epochs=30, batch_siz
github: ⚠️ YOLOv5 is out of date by 20 commits. Use `git pull` or `git clone https://github.com/ultralytics/yolov5` to update.
YOLOv5 🚀 v6.1-104-g741fac8 torch 1.11.0+cu102 CUDA:0 (Tesla T4, 15110MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warmup_bias_lr=0.1,
Weights & Biases: run 'pip install wandb' to automatically track and visualize YOLOv5 🚀 runs (RECOMMENDED)
TensorBoard: Start with 'tensorboard --logdir runs/train', view at http://localhost:6006/

                 from  n    params  module                                  arguments
  0                -1  1      8800  models.common.Conv                      [3, 80, 6, 2, 2]
  1                -1  1    115520  models.common.Conv                      [80, 160, 3, 2]
  2                -1  4    309120  models.common.C3                        [160, 160, 4]
  3                -1  1    461440  models.common.Conv                      [160, 320, 3, 2]
  4                -1  8   2259200  models.common.C3                        [320, 320, 8]
  5                -1  1   1844480  models.common.Conv                      [320, 640, 3, 2]
  6                -1 12  13125120  models.common.C3                        [640, 640, 12]
  7                -1  1   7375360  models.common.Conv                      [640, 1280, 3, 2]
  8                -1  4  19676160  models.common.C3                        [1280, 1280, 4]
  9                -1  1   4099840  models.common.SPPF                      [1280, 1280, 5]
 10                -1  1    820480  models.common.Conv                      [1280, 640, 1, 1]
 11                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 12           [-1, 6]  1         0  models.common.Concat                    [1]
 13                -1  4   5332480  models.common.C3                        [1280, 640, 4, False]
 14                -1  1    205440  models.common.Conv                      [640, 320, 1, 1]
 15                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 16           [-1, 4]  1         0  models.common.Concat                    [1]
 17                -1  4   1335040  models.common.C3                        [640, 320, 4, False]
 18                -1  1    922240  models.common.Conv                      [320, 320, 3, 2]
 19          [-1, 14]  1         0  models.common.Concat                    [1]
 20                -1  4   4922880  models.common.C3                        [640, 640, 4, False]
 21                -1  1   3687680  models.common.Conv                      [640, 640, 3, 2]
 22          [-1, 10]  1         0  models.common.Concat                    [1]
 23                -1  4  19676160  models.common.C3                        [1280, 1280, 4, False]
 24      [17, 20, 23]  1     40374  models.yolo.Detect                      [1, [[10, 13, 16, 30, 33, 23], [30, 61, 62, 45, 59, 119],
YOLOv5x summary: 567 layers, 86217814 parameters, 86217814 gradients

Transferred 738/745 items from yolov5x.pt
Scaled weight_decay = 0.0005
optimizer: SGD with parameter groups 123 weight (no decay), 126 weight, 126 bias
```

```
albumentations: version 1.0.3 required by YOLOv5, but version 0.1.12 is currently installed
train: Scanning '/content/yolov5/Weapon-detection-1/train/labels' images and labels...437 found, 0 missing, 0 empty, 0 corrupt: 100%
train: New cache created: /content/yolov5/Weapon-detection-1/train/labels.cache
val: Scanning '/content/yolov5/Weapon-detection-1/valid/labels' images and labels...30 found, 0 missing, 0 empty, 0 corrupt: 100% 30/
val: New cache created: /content/yolov5/Weapon-detection-1/valid/labels.cache
Plotting labels to runs/train/yolov5x_weapon2/labels.jpg...

AutoAnchor: 4.61 anchors/target, 1.000 Best Possible Recall (BPR). Current anchors are a good fit to dataset ✅
Image sizes 480 train, 480 val
Using 2 dataloader workers
Logging results to runs/train/yolov5x_weapon2
Starting training for 30 epochs...

     Epoch   gpu_mem       box       obj       cls    labels  img_size
      0/29      3.4G   0.09619   0.02528         0         3       480: 100% 110/110 [00:28<00:00,  3.87it/s]
                Class     Images     Labels          P          R     mAP@.5 mAP@.5:.95: 100% 4/4 [00:00<00:00,  6.75it/s]
                  all         30         47      0.218      0.383      0.139      0.039
```

```
1  # view some predictions
2  img = cv2.imread('/content/yolov5/runs/train/yolov5x_weapon2/val_batch2_pred.jpg', cv2.IMREAD_UNCHANGED)
3  plt.imshow(img)
```

```
<matplotlib.image.AxesImage at 0x7fcd9f7fbc90>
```