Setup enviroment

Download dependices.

In [1]:
```
!pip install ultralytics
```

```
Collecting ultralytics
  Downloading ultralytics-8.0.221-py3-none-any.whl (646 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 646.6/646.6 kB 6.8 MB/s eta
0:00:00
Requirement already satisfied: matplotlib>=3.3.0 in /usr/local/lib/python3.1
0/dist-packages (from ultralytics) (3.7.1)
Requirement already satisfied: numpy>=1.22.2 in /usr/local/lib/python3.10/di
st-packages (from ultralytics) (1.23.5)
Requirement already satisfied: opencv-python>=4.6.0 in /usr/local/lib/python
3.10/dist-packages (from ultralytics) (4.8.0.76)
Requirement already satisfied: pillow>=7.1.2 in /usr/local/lib/python3.10/di
st-packages (from ultralytics) (9.4.0)
Requirement already satisfied: pyyaml>=5.3.1 in /usr/local/lib/python3.10/di
st-packages (from ultralytics) (6.0.1)
Requirement already satisfied: requests>=2.23.0 in /usr/local/lib/python3.1
0/dist-packages (from ultralytics) (2.31.0)
Requirement already satisfied: scipy>=1.4.1 in /usr/local/lib/python3.10/dis
t-packages (from ultralytics) (1.11.4)
Requirement already satisfied: torch>=1.8.0 in /usr/local/lib/python3.10/dis
t-packages (from ultralytics) (2.1.0+cu118)
Requirement already satisfied: torchvision>=0.9.0 in /usr/local/lib/python3.
10/dist-packages (from ultralytics) (0.16.0+cu118)
Requirement already satisfied: tqdm>=4.64.0 in /usr/local/lib/python3.10/dis
t-packages (from ultralytics) (4.66.1)
Requirement already satisfied: pandas>=1.1.4 in /usr/local/lib/python3.10/di
st-packages (from ultralytics) (1.5.3)
Requirement already satisfied: seaborn>=0.11.0 in /usr/local/lib/python3.10/
dist-packages (from ultralytics) (0.12.2)
Requirement already satisfied: psutil in /usr/local/lib/python3.10/dist-pack
ages (from ultralytics) (5.9.5)
Requirement already satisfied: py-cpuinfo in /usr/local/lib/python3.10/dist-
packages (from ultralytics) (9.0.0)
Collecting thop>=0.1.1 (from ultralytics)
  Downloading thop-0.1.1.post2209072238-py3-none-any.whl (15 kB)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.1
0/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.2.0)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dis
t-packages (from matplotlib>=3.3.0->ultralytics) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.1
0/dist-packages (from matplotlib>=3.3.0->ultralytics) (4.45.1)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.1
```

```
0/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.4.5)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/
dist-packages (from matplotlib>=3.3.0->ultralytics) (23.2)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.1
0/dist-packages (from matplotlib>=3.3.0->ultralytics) (3.1.1)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python
3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dis
t-packages (from pandas>=1.1.4->ultralytics) (2023.3.post1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/py
thon3.10/dist-packages (from requests>=2.23.0->ultralytics) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dis
t-packages (from requests>=2.23.0->ultralytics) (3.6)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.
10/dist-packages (from requests>=2.23.0->ultralytics) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.
10/dist-packages (from requests>=2.23.0->ultralytics) (2023.11.17)
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-pa
ckages (from torch>=1.8.0->ultralytics) (3.13.1)
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.1
0/dist-packages (from torch>=1.8.0->ultralytics) (4.5.0)
Requirement already satisfied: sympy in /usr/local/lib/python3.10/dist-packa
ges (from torch>=1.8.0->ultralytics) (1.12)
Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-pa
ckages (from torch>=1.8.0->ultralytics) (3.2.1)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.10/dist-pack
ages (from torch>=1.8.0->ultralytics) (3.1.2)
Requirement already satisfied: fsspec in /usr/local/lib/python3.10/dist-pack
ages (from torch>=1.8.0->ultralytics) (2023.6.0)
Requirement already satisfied: triton==2.1.0 in /usr/local/lib/python3.10/di
st-packages (from torch>=1.8.0->ultralytics) (2.1.0)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-pa
ckages (from python-dateutil>=2.7->matplotlib>=3.3.0->ultralytics) (1.16.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/
dist-packages (from jinja2->torch>=1.8.0->ultralytics) (2.1.3)
Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.10/dis
t-packages (from sympy->torch>=1.8.0->ultralytics) (1.3.0)
Installing collected packages: thop, ultralytics
Successfully installed thop-0.1.1.post2209072238 ultralytics-8.0.221
```

Necesary Libraries

In [2]:
```
from google.colab import drive
import ultralytics
from ultralytics import YOLO
import os
import cv2
```

Check for sofware and hardware

In [3]:
```
ultralytics.checks()
```

```
Ultralytics YOLOv8.0.221 🚀 Python-3.10.12 torch-2.1.0+cu118 CUDA:0 (Tesla
T4, 15102MiB)
Setup complete ✅ (2 CPUs, 12.7 GB RAM, 26.9/78.2 GB disk)
```

In [5]:
```
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, cal
l drive.mount("/content/drive", force_remount=True).
```

Model and Trainig

In [4]:
```
# Import directory data
directory = '/content/drive/MyDrive/Pistols'
```

In [6]:
```
# Load Model
model = YOLO("yolov8n.yaml") # Build model from scratch
```

```
                   from  n    params  module
arguments
  0                  -1  1       464  ultralytics.nn.modules.conv.Conv
[3, 16, 3, 2]
  1                  -1  1      4672  ultralytics.nn.modules.conv.Conv
[16, 32, 3, 2]
  2                  -1  1      7360  ultralytics.nn.modules.block.C2f
[32, 32, 1, True]
  3                  -1  1     18560  ultralytics.nn.modules.conv.Conv
[32, 64, 3, 2]
  4                  -1  2     49664  ultralytics.nn.modules.block.C2f
[64, 64, 2, True]
  5                  -1  1     73984  ultralytics.nn.modules.conv.Conv
[64, 128, 3, 2]
  6                  -1  2    197632  ultralytics.nn.modules.block.C2f
[128, 128, 2, True]
  7                  -1  1    295424  ultralytics.nn.modules.conv.Conv
[128, 256, 3, 2]
  8                  -1  1    460288  ultralytics.nn.modules.block.C2f
[256, 256, 1, True]
  9                  -1  1    164608  ultralytics.nn.modules.block.SPPF
[256, 256, 5]
 10                  -1  1         0  torch.nn.modules.upsampling.Upsample
[None, 2, 'nearest']
 11             [-1, 6]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 12                  -1  1    148224  ultralytics.nn.modules.block.C2f
[384, 128, 1]
 13                  -1  1         0  torch.nn.modules.upsampling.Upsample
[None, 2, 'nearest']
 14             [-1, 4]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 15                  -1  1     37248  ultralytics.nn.modules.block.C2f
[192, 64, 1]
 16                  -1  1     36992  ultralytics.nn.modules.conv.Conv
[64, 64, 3, 2]
 17            [-1, 12]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 18                  -1  1    123648  ultralytics.nn.modules.block.C2f
[192, 128, 1]
 19                  -1  1    147712  ultralytics.nn.modules.conv.Conv
[128, 128, 3, 2]
 20             [-1, 9]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 21                  -1  1    493056  ultralytics.nn.modules.block.C2f
[384, 256, 1]
 22        [15, 18, 21]  1    897664  ultralytics.nn.modules.head.Detect
[80, [64, 128, 256]]
YOLOv8n summary: 225 layers, 3157200 parameters, 3157184 gradients, 8.9 GFLO
Ps
```

Train model

In [7]:
```
# Training
results = model.train(data=os.path.join(directory, "data.yaml"), epochs=50)
```

```
Ultralytics YOLOv8.0.221 🚀 Python-3.10.12 torch-2.1.0+cu118 CUDA:0 (Tesla
T4, 15102MiB)
engine/trainer: task=detect, mode=train, model=yolov8n.yaml, data=/content/d
rive/MyDrive/Pistols/data.yaml, epochs=50, patience=50, batch=16, imgsz=640,
save=True, save_period=-1, cache=False, device=None, workers=8, project=Non
e, name=train, exist_ok=False, pretrained=True, optimizer=auto, verbose=Tru
e, seed=0, deterministic=True, single_cls=False, rect=False, cos_lr=False, c
lose_mosaic=10, resume=False, amp=True, fraction=1.0, profile=False, freeze=
None, overlap_mask=True, mask_ratio=4, dropout=0.0, val=True, split=val, sav
e_json=False, save_hybrid=False, conf=None, iou=0.7, max_det=300, half=Fals
e, dnn=False, plots=True, source=None, vid_stride=1, stream_buffer=False, vi
sualize=False, augment=False, agnostic_nms=False, classes=None, retina_masks
=False, show=False, save_frames=False, save_txt=False, save_conf=False, save
_crop=False, show_labels=True, show_conf=True, show_boxes=True, line_width=N
one, format=torchscript, keras=False, optimize=False, int8=False, dynamic=Fa
lse, simplify=False, opset=None, workspace=4, nms=False, 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, box=7.5, cls=0.5, dfl=1.5, pose=12.0, kobj=1.0, label_sm
oothing=0.0, nbs=64, hsv_h=0.015, hsv_s=0.7, hsv_v=0.4, degrees=0.0, transla
te=0.1, scale=0.5, shear=0.0, perspective=0.0, flipud=0.0, fliplr=0.5, mosai
c=1.0, mixup=0.0, copy_paste=0.0, cfg=None, tracker=botsort.yaml, save_dir=r
uns/detect/train
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultra
lytics/Arial.ttf'...
100%|██████████| 755k/755k [00:00<00:00, 23.5MB/s]
Overriding model.yaml nc=80 with nc=1

                   from  n    params  module
arguments
  0                  -1  1       464  ultralytics.nn.modules.conv.Conv
[3, 16, 3, 2]
  1                  -1  1      4672  ultralytics.nn.modules.conv.Conv
[16, 32, 3, 2]
  2                  -1  1      7360  ultralytics.nn.modules.block.C2f
[32, 32, 1, True]
  3                  -1  1     18560  ultralytics.nn.modules.conv.Conv
[32, 64, 3, 2]
  4                  -1  2     49664  ultralytics.nn.modules.block.C2f
[64, 64, 2, True]
  5                  -1  1     73984  ultralytics.nn.modules.conv.Conv
[64, 128, 3, 2]
  6                  -1  2    197632  ultralytics.nn.modules.block.C2f
[128, 128, 2, True]
  7                  -1  1    295424  ultralytics.nn.modules.conv.Conv
```

```
[128, 256, 3, 2]
  8                  -1  1    460288  ultralytics.nn.modules.block.C2f
[256, 256, 1, True]
  9                  -1  1    164608  ultralytics.nn.modules.block.SPPF
[256, 256, 5]
 10                  -1  1         0  torch.nn.modules.upsampling.Upsample
[None, 2, 'nearest']
 11             [-1, 6]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 12                  -1  1    148224  ultralytics.nn.modules.block.C2f
[384, 128, 1]
 13                  -1  1         0  torch.nn.modules.upsampling.Upsample
[None, 2, 'nearest']
 14             [-1, 4]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 15                  -1  1     37248  ultralytics.nn.modules.block.C2f
[192, 64, 1]
 16                  -1  1     36992  ultralytics.nn.modules.conv.Conv
[64, 64, 3, 2]
 17            [-1, 12]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 18                  -1  1    123648  ultralytics.nn.modules.block.C2f
[192, 128, 1]
 19                  -1  1    147712  ultralytics.nn.modules.conv.Conv
[128, 128, 3, 2]
 20             [-1, 9]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 21                  -1  1    493056  ultralytics.nn.modules.block.C2f
[384, 256, 1]
 22        [15, 18, 21]  1    751507  ultralytics.nn.modules.head.Detect
[1, [64, 128, 256]]
YOLOv8n summary: 225 layers, 3011043 parameters, 3011027 gradients, 8.2 GFLO
Ps

TensorBoard: Start with 'tensorboard --logdir runs/detect/train', view at ht
tp://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
Downloading https://github.com/ultralytics/assets/releases/download/v0.0.0/y
olov8n.pt to 'yolov8n.pt'...
100%|██████████| 6.23M/6.23M [00:00<00:00, 116MB/s]
AMP: checks passed ✅
train: Scanning /content/drive/MyDrive/Pistols/export/labels/train.cache...
2971 images, 0 backgrounds, 0 corrupt: 100%|██████████| 2971/2971 [00:00<?,
?it/s]
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_lim
it=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01, clip_limit=(1, 4.0), tile_grid_siz
e=(8, 8))
val: Scanning /content/drive/MyDrive/Pistols/export/labels/train.cache... 29
71 images, 0 backgrounds, 0 corrupt: 100%|██████████| 2971/2971 [00:00<?, ?
it/s]
```

```
Plotting labels to runs/detect/train/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937'
and determining best 'optimizer', 'lr0' and 'momentum' automatically...
optimizer: AdamW(lr=0.002, momentum=0.9) with parameter groups 57 weight(dec
ay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train
Starting training for 50 epochs...

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Siz
e
       1/50      2.53G      2.994      3.434      3.857         24         64
0: 100%|██████████| 186/186 [01:30<00:00,  2.06it/s]
                 Class     Images  Instances      Box(P          R      mAP5
0  mAP50-95): 100%|██████████| 93/93 [00:39<00:00,  2.38it/s]
                   all       2971       3432      0.186      0.357      0.14
8     0.0691

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Siz
e
       2/50      2.43G      2.295      2.977      2.892         22         64
0: 100%|██████████| 186/186 [01:09<00:00,  2.68it/s]
                 Class     Images  Instances      Box(P          R      mAP5
0  mAP50-95): 100%|██████████| 93/93 [00:36<00:00,  2.56it/s]
                   all       2971       3432      0.286      0.291      0.16
6     0.0614

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Siz
e
       3/50      2.43G      1.939      2.414      2.461         25         64
0: 100%|██████████| 186/186 [01:17<00:00,  2.40it/s]
                 Class     Images  Instances      Box(P          R      mAP5
0  mAP50-95): 100%|██████████| 93/93 [00:34<00:00,  2.67it/s]
                   all       2971       3432      0.374       0.35      0.24
1     0.0826

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Siz
e
       4/50      2.42G      1.769      2.204      2.267         40         64
0: 100%|██████████| 186/186 [01:11<00:00,  2.62it/s]
                 Class     Images  Instances      Box(P          R      mAP5
0  mAP50-95): 100%|██████████| 93/93 [00:35<00:00,  2.64it/s]
                   all       2971       3432      0.619      0.384      0.43
6      0.252

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Siz
e
       5/50      2.41G      1.618      1.977       2.12         33         64
0: 100%|██████████| 186/186 [01:09<00:00,  2.67it/s]
                 Class     Images  Instances      Box(P          R      mAP5
0  mAP50-95): 100%|██████████| 93/93 [00:35<00:00,  2.62it/s]
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Siz
e
      50/50       2.4G     0.7726      0.774      1.358         11         64
0: 100%|██████████| 186/186 [01:03<00:00,  2.93it/s]
                 Class     Images  Instances      Box(P          R      mAP5
0  mAP50-95): 100%|██████████| 93/93 [00:34<00:00,  2.71it/s]
                   all       2971       3432      0.896      0.777      0.88
4      0.711

50 epochs completed in 1.442 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 6.3MB
Optimizer stripped from runs/detect/train/weights/best.pt, 6.3MB

Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.0.221 🚀 Python-3.10.12 torch-2.1.0+cu118 CUDA:0 (Tesla
T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GF
LOPs
                 Class     Images  Instances      Box(P          R      mAP5
0  mAP50-95): 100%|██████████| 93/93 [00:37<00:00,  2.51it/s]
                   all       2971       3432      0.897      0.777      0.88
4       0.71
Speed: 0.3ms preprocess, 2.2ms inference, 0.0ms loss, 2.0ms postprocess per
image
Results saved to runs/detect/train
```

Prediction

In [24]:
```
# Provide video path
video_path = '/content/drive/MyDrive/Pistols/hangun_vid1.mp4'
video_out = '{}_out.mp4'.format(video_path)
```

In [25]:
```
# Select Pretrained Model
model = YOLO('/content/best.pt')
```

In [26]:
```
# Capture video frames
cap = cv2.VideoCapture(video_path)
ret, frame = cap.read()
H, W, _ = frame.shape
out = cv2.VideoWriter(video_out, cv2.VideoWriter_fourcc(*'MP4V'), int(cap.ge
```

In [27]:
```
# Threshold dectection
threshold = 0.5

# Loop over frames
while ret:

    # Get predictions for the current frame using the model
    results = model(frame)[0]

    # Box coordinates
    for result in results.boxes.data.tolist():
        x1, y1, x2, y2, score, class_id = result

        if score > threshold:

            # Label with class name a cf score
            label = f'{results.names[int(class_id)].upper()}: {score:.2f}'

            # Display bounding box
            cv2.rectangle(frame, (int(x1), int(y1)), (int(x2), int(y2)), (0,

            # Display class name and confidence score
            cv2.putText(frame, label, (int(x1), int(y1 - 10)),
                        cv2.FONT_HERSHEY_SIMPLEX, 1.3, (0, 255, 0), 3, cv2.L

    # Out
    out.write(frame)

    # Next Frame
    ret, frame = cap.read()

# Release
cap.release()
out.release()
cv2.destroyAllWindows()
```

Streaming output truncated to the last 5000 lines.

```
0: 416x640 3 pistols, 9.8ms
Speed: 6.3ms preprocess, 9.8ms inference, 1.6ms postprocess per image at sha
pe (1, 3, 416, 640)

0: 416x640 3 pistols, 11.5ms
Speed: 3.2ms preprocess, 11.5ms inference, 2.7ms postprocess per image at sh
ape (1, 3, 416, 640)

0: 416x640 3 pistols, 9.4ms
Speed: 3.2ms preprocess, 9.4ms inference, 1.8ms postprocess per image at sha
pe (1, 3, 416, 640)

0: 416x640 3 pistols, 10.6ms
Speed: 3.4ms preprocess, 10.6ms inference, 1.4ms postprocess per image at sh
ape (1, 3, 416, 640)
```