handgesture

April 1, 2025

0.1 Importing required Libraries

[ ]:
```
import os
```

[ ]:
```
import glob
```

[ ]:
```
from IPython.display import display, Image
```

[ ]:
```
from IPython import display
```

[ ]:
```
display.clear_output()
```

0.2 Check for the access for GPU

[ ]:
```
!nvidia-smi
```

```
Sun Mar 30 18:15:51 2025
+-----------------------------------------------------------------------------
----------+
| NVIDIA-SMI 550.54.15              Driver Version: 550.54.15      CUDA Version:
12.4     |
|-----------------------------------------+------------------------+-----------
----------+
| 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   40C    P8             10W /   70W |       0MiB /  15360MiB |      0%
Default |
|                                         |                        |
N/A |
+-----------------------------------------+------------------------+-----------
```

```
----------+

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

[ ]:
```
HOME = os.getcwd()
```

[ ]:
```
print(HOME)
```

```
/content
```

0.3 Install Ultralytics using PIP

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

```
Requirement already satisfied: ultralytics in /usr/local/lib/python3.11/dist-
packages (8.3.99)
Requirement already satisfied: numpy<=2.1.1,>=1.23.0 in
/usr/local/lib/python3.11/dist-packages (from ultralytics) (2.0.2)
Requirement already satisfied: matplotlib>=3.3.0 in
/usr/local/lib/python3.11/dist-packages (from ultralytics) (3.10.0)
Requirement already satisfied: opencv-python>=4.6.0 in
/usr/local/lib/python3.11/dist-packages (from ultralytics) (4.11.0.86)
Requirement already satisfied: pillow>=7.1.2 in /usr/local/lib/python3.11/dist-
packages (from ultralytics) (11.1.0)
Requirement already satisfied: pyyaml>=5.3.1 in /usr/local/lib/python3.11/dist-
packages (from ultralytics) (6.0.2)
Requirement already satisfied: requests>=2.23.0 in
/usr/local/lib/python3.11/dist-packages (from ultralytics) (2.32.3)
Requirement already satisfied: scipy>=1.4.1 in /usr/local/lib/python3.11/dist-
packages (from ultralytics) (1.14.1)
Requirement already satisfied: torch>=1.8.0 in /usr/local/lib/python3.11/dist-
packages (from ultralytics) (2.6.0+cu124)
Requirement already satisfied: torchvision>=0.9.0 in
/usr/local/lib/python3.11/dist-packages (from ultralytics) (0.21.0+cu124)
Requirement already satisfied: tqdm>=4.64.0 in /usr/local/lib/python3.11/dist-
```

```
packages (from ultralytics) (4.67.1)
Requirement already satisfied: psutil in /usr/local/lib/python3.11/dist-packages
(from ultralytics) (5.9.5)
Requirement already satisfied: py-cpuinfo in /usr/local/lib/python3.11/dist-
packages (from ultralytics) (9.0.0)
Requirement already satisfied: pandas>=1.1.4 in /usr/local/lib/python3.11/dist-
packages (from ultralytics) (2.2.2)
Requirement already satisfied: seaborn>=0.11.0 in
/usr/local/lib/python3.11/dist-packages (from ultralytics) (0.13.2)
Requirement already satisfied: ultralytics-thop>=2.0.0 in
/usr/local/lib/python3.11/dist-packages (from ultralytics) (2.0.14)
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics)
(1.3.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.11/dist-
packages (from matplotlib>=3.3.0->ultralytics) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics)
(4.56.0)
Requirement already satisfied: kiwisolver>=1.3.1 in
/usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics)
(1.4.8)
Requirement already satisfied: packaging>=20.0 in
/usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics)
(24.2)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics)
(3.2.1)
Requirement already satisfied: python-dateutil>=2.7 in
/usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics)
(2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-
packages (from pandas>=1.1.4->ultralytics) (2025.1)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-
packages (from pandas>=1.1.4->ultralytics) (2025.1)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics)
(3.4.1)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-
packages (from requests>=2.23.0->ultralytics) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics)
(2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics)
(2025.1.31)
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-
packages (from torch>=1.8.0->ultralytics) (3.18.0)
```

```
Requirement already satisfied: typing-extensions>=4.10.0 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(4.12.2)
Requirement already satisfied: networkx in /usr/local/lib/python3.11/dist-
packages (from torch>=1.8.0->ultralytics) (3.4.2)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.11/dist-packages
(from torch>=1.8.0->ultralytics) (3.1.6)
Requirement already satisfied: fsspec in /usr/local/lib/python3.11/dist-packages
(from torch>=1.8.0->ultralytics) (2025.3.0)
Requirement already satisfied: nvidia-cuda-nvrtc-cu12==12.4.127 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(12.4.127)
Requirement already satisfied: nvidia-cuda-runtime-cu12==12.4.127 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(12.4.127)
Requirement already satisfied: nvidia-cuda-cupti-cu12==12.4.127 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(12.4.127)
Requirement already satisfied: nvidia-cudnn-cu12==9.1.0.70 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(9.1.0.70)
Requirement already satisfied: nvidia-cublas-cu12==12.4.5.8 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(12.4.5.8)
Requirement already satisfied: nvidia-cufft-cu12==11.2.1.3 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(11.2.1.3)
Requirement already satisfied: nvidia-curand-cu12==10.3.5.147 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(10.3.5.147)
Requirement already satisfied: nvidia-cusolver-cu12==11.6.1.9 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(11.6.1.9)
Requirement already satisfied: nvidia-cusparse-cu12==12.3.1.170 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(12.3.1.170)
Requirement already satisfied: nvidia-cusparselt-cu12==0.6.2 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (0.6.2)
Requirement already satisfied: nvidia-nccl-cu12==2.21.5 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(2.21.5)
Requirement already satisfied: nvidia-nvtx-cu12==12.4.127 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(12.4.127)
Requirement already satisfied: nvidia-nvjitlink-cu12==12.4.127 in
/usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
(12.4.127)
Requirement already satisfied: triton==3.2.0 in /usr/local/lib/python3.11/dist-
```

```
packages (from torch>=1.8.0->ultralytics) (3.2.0)
Requirement already satisfied: sympy==1.13.1 in /usr/local/lib/python3.11/dist-
packages (from torch>=1.8.0->ultralytics) (1.13.1)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in
/usr/local/lib/python3.11/dist-packages (from
sympy==1.13.1->torch>=1.8.0->ultralytics) (1.3.0)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-
packages (from python-dateutil>=2.7->matplotlib>=3.3.0->ultralytics) (1.17.0)
Requirement already satisfied: MarkupSafe>=2.0 in
/usr/local/lib/python3.11/dist-packages (from jinja2->torch>=1.8.0->ultralytics)
(3.0.2)
```

Checking if YOLOv8 is Installed and is working fine

[ ]:
```
import ultralytics
```

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

```
Ultralytics 8.3.99  Python-3.11.11 torch-2.6.0+cu124 CUDA:0 (Tesla T4,
15095MiB)
Setup complete  (8 CPUs, 51.0 GB RAM, 41.4/235.7 GB disk)
```

0.4 Import Hand Gesture ASL from roboflow

[ ]:
```
!mkdir /content/datasets
```

```
mkdir: cannot create directory ‘/content/datasets’: File exists
```

[ ]:
```
!pwd
```

```
/content
```

[ ]:
```
%cd /content/datasets
```

```
/content/datasets
```

[ ]:
```
!pwd
```

```
/content/datasets
```

[ ]:
```
!pip install roboflow

from roboflow import Roboflow
rf = Roboflow(api_key="fKCJGst3X0agvb8zVqh4")
project = rf.workspace("cecilia-ggvz6").project("asldetection-o5fgv")
version = project.version(1)
dataset = version.download("yolov8")
```

```
Requirement already satisfied: roboflow in /usr/local/lib/python3.11/dist-
packages (1.1.58)
Requirement already satisfied: certifi in /usr/local/lib/python3.11/dist-
packages (from roboflow) (2025.1.31)
Requirement already satisfied: idna==3.7 in /usr/local/lib/python3.11/dist-
packages (from roboflow) (3.7)
Requirement already satisfied: cycler in /usr/local/lib/python3.11/dist-packages
(from roboflow) (0.12.1)
Requirement already satisfied: kiwisolver>=1.3.1 in
/usr/local/lib/python3.11/dist-packages (from roboflow) (1.4.8)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.11/dist-
packages (from roboflow) (3.10.0)
Requirement already satisfied: numpy>=1.18.5 in /usr/local/lib/python3.11/dist-
packages (from roboflow) (2.0.2)
Requirement already satisfied: opencv-python-headless==4.10.0.84 in
/usr/local/lib/python3.11/dist-packages (from roboflow) (4.10.0.84)
Requirement already satisfied: Pillow>=7.1.2 in /usr/local/lib/python3.11/dist-
packages (from roboflow) (11.1.0)
Requirement already satisfied: pillow-heif>=0.18.0 in
/usr/local/lib/python3.11/dist-packages (from roboflow) (0.22.0)
Requirement already satisfied: python-dateutil in
/usr/local/lib/python3.11/dist-packages (from roboflow) (2.8.2)
Requirement already satisfied: python-dotenv in /usr/local/lib/python3.11/dist-
packages (from roboflow) (1.1.0)
Requirement already satisfied: requests in /usr/local/lib/python3.11/dist-
packages (from roboflow) (2.32.3)
Requirement already satisfied: six in /usr/local/lib/python3.11/dist-packages
(from roboflow) (1.17.0)
Requirement already satisfied: urllib3>=1.26.6 in
/usr/local/lib/python3.11/dist-packages (from roboflow) (2.3.0)
Requirement already satisfied: tqdm>=4.41.0 in /usr/local/lib/python3.11/dist-
packages (from roboflow) (4.67.1)
Requirement already satisfied: PyYAML>=5.3.1 in /usr/local/lib/python3.11/dist-
packages (from roboflow) (6.0.2)
Requirement already satisfied: requests-toolbelt in
/usr/local/lib/python3.11/dist-packages (from roboflow) (1.0.0)
Requirement already satisfied: filetype in /usr/local/lib/python3.11/dist-
packages (from roboflow) (1.2.0)
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.11/dist-packages (from matplotlib->roboflow) (1.3.1)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.11/dist-packages (from matplotlib->roboflow) (4.56.0)
Requirement already satisfied: packaging>=20.0 in
/usr/local/lib/python3.11/dist-packages (from matplotlib->roboflow) (24.2)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.11/dist-packages (from matplotlib->roboflow) (3.2.1)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.11/dist-packages (from requests->roboflow) (3.4.1)
```

```
loading Roboflow workspace…
loading Roboflow project…
```

0.5 Train the custom dataset

[ ]:
```
%cd /content/datasets
```

```
/content/datasets
```

[ ]:
```
%cd /content/datasets/ASLDetection-1
```

```
/content/datasets/ASLDetection-1
```

[ ]:
```
#as this is a small dataset so I only train for 70 epochs, but you can adjust␣
 ↪based on your desire
%cd {HOME}

!yolo task=detect mode=train model=yolov8m.pt data=/content/datasets/
 ↪ASLDetection-1/data.yaml epochs=70 imgsz=640
```

```
/content
Downloading
https://github.com/ultralytics/assets/releases/download/v8.3.0/yolov8m.pt to
'yolov8m.pt'…
100% 49.7M/49.7M [00:00<00:00, 238MB/s]
Ultralytics 8.3.99  Python-3.11.11 torch-2.6.0+cu124 CUDA:0 (Tesla T4,
15095MiB)
engine/trainer: task=detect, mode=train, model=yolov8m.pt,
data=/content/datasets/ASLDetection-1/data.yaml, epochs=70, time=None,
patience=100, batch=16, imgsz=640, save=True, save_period=-1, cache=False,
device=None, workers=8, project=None, name=train, exist_ok=False,
pretrained=True, optimizer=auto, verbose=True, seed=0, deterministic=True,
single_cls=False, rect=False, cos_lr=False, close_mosaic=10, resume=False,
amp=True, fraction=1.0, profile=False, freeze=None, multi_scale=False,
overlap_mask=True, mask_ratio=4, dropout=0.0, val=True, split=val,
save_json=False, save_hybrid=False, conf=None, iou=0.7, max_det=300, half=False,
dnn=False, plots=True, source=None, vid_stride=1, stream_buffer=False,
visualize=False, augment=False, agnostic_nms=False, classes=None,
retina_masks=False, embed=None, 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=None, format=torchscript, keras=False,
optimize=False, int8=False, dynamic=False, simplify=True, opset=None,
workspace=None, 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, nbs=64, hsv_h=0.015, hsv_s=0.7,
hsv_v=0.4, degrees=0.0, translate=0.1, scale=0.5, shear=0.0, perspective=0.0,
flipud=0.0, fliplr=0.5, bgr=0.0, mosaic=1.0, mixup=0.0, copy_paste=0.0,
copy_paste_mode=flip, auto_augment=randaugment, erasing=0.4, crop_fraction=1.0,
```

```
cfg=None, tracker=botsort.yaml, save_dir=runs/detect/train
Downloading https://ultralytics.com/assets/Arial.ttf to
'/root/.config/Ultralytics/Arial.ttf'…
100% 755k/755k [00:00<00:00, 14.5MB/s]
WARNING: All log messages before absl::InitializeLog() is called are written to
STDERR
E0000 00:00:1743358599.240115   11447 cuda_dnn.cc:8310] Unable to register cuDNN
factory: Attempting to register factory for plugin cuDNN when one has already
been registered
E0000 00:00:1743358599.245101   11447 cuda_blas.cc:1418] Unable to register
cuBLAS factory: Attempting to register factory for plugin cuBLAS when one has
already been registered
Overriding model.yaml nc=80 with nc=10

                   from  n    params  module
arguments
  0                  -1  1      1392  ultralytics.nn.modules.conv.Conv
[3, 48, 3, 2]
  1                  -1  1     41664  ultralytics.nn.modules.conv.Conv
[48, 96, 3, 2]
  2                  -1  2    111360  ultralytics.nn.modules.block.C2f
[96, 96, 2, True]
  3                  -1  1    166272  ultralytics.nn.modules.conv.Conv
[96, 192, 3, 2]
  4                  -1  4    813312  ultralytics.nn.modules.block.C2f
[192, 192, 4, True]
  5                  -1  1    664320  ultralytics.nn.modules.conv.Conv
[192, 384, 3, 2]
  6                  -1  4   3248640  ultralytics.nn.modules.block.C2f
[384, 384, 4, True]
  7                  -1  1   1991808  ultralytics.nn.modules.conv.Conv
[384, 576, 3, 2]
  8                  -1  2   3985920  ultralytics.nn.modules.block.C2f
[576, 576, 2, True]
  9                  -1  1    831168  ultralytics.nn.modules.block.SPPF
[576, 576, 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  2   1993728  ultralytics.nn.modules.block.C2f
[960, 384, 2]
 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  2    517632  ultralytics.nn.modules.block.C2f
[576, 192, 2]
```

```
 16                  -1  1    332160  ultralytics.nn.modules.conv.Conv
[192, 192, 3, 2]
 17            [-1, 12]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 18                  -1  2   1846272  ultralytics.nn.modules.block.C2f
[576, 384, 2]
 19                  -1  1   1327872  ultralytics.nn.modules.conv.Conv
[384, 384, 3, 2]
 20             [-1, 9]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 21                  -1  2   4207104  ultralytics.nn.modules.block.C2f
[960, 576, 2]
 22        [15, 18, 21]  1   3781486  ultralytics.nn.modules.head.Detect
[10, [192, 384, 576]]
Model summary: 169 layers, 25,862,110 parameters, 25,862,094 gradients, 79.1
GFLOPs

Transferred 469/475 items from pretrained weights
TensorBoard: Start with 'tensorboard --logdir runs/detect/train',
view at http://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks…
Downloading
https://github.com/ultralytics/assets/releases/download/v8.3.0/yolo11n.pt to
'yolo11n.pt'…
100% 5.35M/5.35M [00:00<00:00, 66.7MB/s]
AMP: checks passed
train: Scanning /content/datasets/ASLDetection-1/train/labels…
490 images, 0 backgrounds, 0 corrupt: 100% 490/490 [00:00<00:00, 1618.71it/s]
train: New cache created:
/content/datasets/ASLDetection-1/train/labels.cache
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01,
blur_limit=(3, 7)), ToGray(p=0.01, num_output_channels=3,
method='weighted_average'), CLAHE(p=0.01, clip_limit=(1.0, 4.0),
tile_grid_size=(8, 8))
val: Scanning /content/datasets/ASLDetection-1/valid/labels… 140
images, 0 backgrounds, 0 corrupt: 100% 140/140 [00:00<00:00, 1592.95it/s]
val: New cache created:
/content/datasets/ASLDetection-1/valid/labels.cache
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=0.000714, momentum=0.9) with parameter groups
77 weight(decay=0.0), 84 weight(decay=0.0005), 83 bias(decay=0.0)
TensorBoard: model graph visualization added
Image sizes 640 train, 640 val
Using 8 dataloader workers
```

```
Logging results to runs/detect/train
Starting training for 70 epochs…

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       1/70      6.36G      1.239      3.296      1.831         24        640:
100% 31/31 [00:15<00:00,  1.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:02<00:00,  1.94it/s]
                   all        140        140      0.293      0.761      0.464
0.375

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       2/70      7.56G     0.8619      2.075      1.451         32        640:
100% 31/31 [00:14<00:00,  2.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.75it/s]
                   all        140        140      0.479       0.71      0.672
0.519

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       3/70      7.63G     0.8809       1.77      1.444         28        640:
100% 31/31 [00:14<00:00,  2.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.76it/s]
                   all        140        140      0.499      0.706      0.703
0.493

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       4/70       7.7G     0.9042      1.634      1.437         24        640:
100% 31/31 [00:15<00:00,  2.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.70it/s]
                   all        140        140      0.633      0.747       0.77
0.608

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       5/70      7.76G       0.88      1.512      1.414         28        640:
100% 31/31 [00:15<00:00,  2.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.70it/s]
                   all        140        140      0.736      0.846      0.929
0.654

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       6/70      7.83G     0.8323      1.416      1.377         32        640:
100% 31/31 [00:15<00:00,  1.98it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.58it/s]
```

```
                 all        140        140      0.827      0.694      0.796
0.598

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       7/70      7.89G     0.7996      1.338      1.375         31        640:
100% 31/31 [00:16<00:00,  1.92it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.53it/s]
                 all        140        140      0.742       0.87      0.918
0.649

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       8/70      7.96G     0.7747      1.308      1.361         25        640:
100% 31/31 [00:15<00:00,  1.94it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                 all        140        140      0.763       0.89      0.948
0.744

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       9/70      8.03G      0.805      1.295      1.357         26        640:
100% 31/31 [00:15<00:00,  1.98it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.66it/s]
                 all        140        140      0.881      0.934      0.978
0.804

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      10/70      8.58G     0.7712      1.213      1.324         27        640:
100% 31/31 [00:15<00:00,  1.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                 all        140        140      0.893      0.894      0.931
0.689

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      11/70      8.65G     0.7612       1.22      1.352         25        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.62it/s]
                 all        140        140      0.827      0.623      0.848
0.558

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      12/70      8.72G     0.7601      1.185      1.331         25        640:
100% 31/31 [00:15<00:00,  1.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.58it/s]
```

```
                   all        140        140      0.937      0.945      0.991
0.804

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      13/70      8.78G     0.7682      1.164      1.344         24        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                   all        140        140       0.89      0.911      0.972
0.734

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      14/70      8.85G     0.7285      1.131      1.308         25        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.54it/s]
                   all        140        140      0.889      0.932      0.984
0.83

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      15/70      8.92G     0.7562      1.109      1.321         29        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
                   all        140        140      0.888      0.921      0.986
0.83

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      16/70      8.98G     0.7325      1.065      1.308         22        640:
100% 31/31 [00:15<00:00,  1.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                   all        140        140      0.977       0.98      0.994
0.828

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      17/70      9.05G     0.7385      1.078      1.309         29        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.57it/s]
                   all        140        140      0.884      0.893      0.972
0.787

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      18/70      9.12G     0.6951     0.9856      1.306         23        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
```

```
                 all        140        140      0.956      0.951      0.986
0.823

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      19/70      9.18G     0.7051      1.011      1.285         23        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.975      0.974      0.994
0.806

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      20/70      9.25G     0.6708     0.9731      1.275         27        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                 all        140        140      0.926      0.984      0.995
0.843

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      21/70      9.32G     0.6974     0.9679      1.289         23        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
                 all        140        140      0.991      0.983      0.995
0.836

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      22/70      9.87G     0.6704     0.9252      1.254         26        640:
100% 31/31 [00:15<00:00,  1.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140       0.96      0.943      0.994
0.849

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      23/70      9.94G     0.6773     0.8984      1.278         25        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.967      0.963      0.995
0.836

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      24/70        10G     0.6792     0.9201      1.259         28        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.59it/s]
```

```
                 all        140        140      0.977      0.965      0.993
0.849

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      25/70      10.1G     0.6354      0.883      1.245         31        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.56it/s]
                 all        140        140      0.981      0.985      0.995
0.847

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      26/70      10.1G     0.6604     0.8782      1.256         25        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.975      0.996      0.995
0.855

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      27/70      10.2G     0.6436      0.876      1.244         26        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.978      0.992      0.995
0.857

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      28/70      10.3G     0.6382     0.8581      1.229         32        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.62it/s]
                 all        140        140      0.951      0.943      0.985
0.834

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      29/70      10.3G     0.6354     0.8572      1.239         28        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                 all        140        140      0.984      0.988      0.995
0.84

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      30/70      10.9G     0.6573     0.8605       1.26         22        640:
100% 31/31 [00:15<00:00,  1.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
```

```
                 all        140        140      0.973       0.98      0.995
0.798

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      31/70        11G     0.6424     0.8208      1.228         28        640:
100% 31/31 [00:15<00:00,  1.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.979       0.96      0.995
0.864

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      32/70        11G     0.6276     0.7863      1.231         30        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
                 all        140        140      0.971      0.984      0.995
0.849

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      33/70      11.1G     0.6402     0.8056      1.251         22        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.65it/s]
                 all        140        140      0.981      0.994      0.995
0.814

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      34/70      11.2G     0.6284     0.7746      1.226         25        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
                 all        140        140      0.987          1      0.995
0.857

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      35/70      11.2G     0.6533     0.7961      1.241         29        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                 all        140        140      0.988      0.966      0.995
0.858

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      36/70      11.3G      0.632       0.79      1.222         31        640:
100% 31/31 [00:15<00:00,  1.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
```

```
                 all        140        140      0.989      0.986      0.995
0.854

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      37/70      11.4G     0.6197     0.7386       1.24         32        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
                 all        140        140      0.965      0.988      0.995
0.852

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      38/70      11.6G     0.6087     0.7738      1.231         27        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.993      0.999      0.995
0.858

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      39/70      11.7G     0.6209     0.7719      1.226         32        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.58it/s]
                 all        140        140      0.994      0.999      0.995
0.864

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      40/70      11.9G      0.592     0.7729      1.229         22        640:
100% 31/31 [00:15<00:00,  1.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.59it/s]
                 all        140        140      0.989      0.997      0.995
0.84

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      41/70        12G     0.6093      0.742      1.228         28        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.62it/s]
                 all        140        140      0.991      0.998      0.995
0.842

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      42/70      12.2G     0.6008     0.7688       1.22         25        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
```

```
                 all        140        140      0.985      0.988      0.995
0.852

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      43/70      12.3G     0.5973     0.7427      1.211         33        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                 all        140        140      0.981      0.962      0.994
0.858

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      44/70      12.5G       0.59     0.7387      1.214         36        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.62it/s]
                 all        140        140      0.995          1      0.995
0.868

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      45/70      12.6G     0.6018     0.6936      1.212         38        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.66it/s]
                 all        140        140       0.99          1      0.995
0.857

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      46/70      12.8G     0.5946     0.7396      1.224         19        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.62it/s]
                 all        140        140      0.986      0.998      0.995
0.841

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      47/70      12.9G     0.5843     0.7691      1.213         25        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.59it/s]
                 all        140        140      0.988          1      0.995
0.846

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      48/70      13.1G     0.5991     0.7143      1.209         35        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
```

```
                 all        140        140      0.991      0.996      0.995
0.86

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      49/70      13.2G     0.5856     0.6779      1.196         32        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                 all        140        140      0.994      0.994      0.995
0.855

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      50/70      13.4G     0.5791      0.703      1.192         28        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                 all        140        140      0.991          1      0.995
0.856

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      51/70      6.71G     0.5647     0.6736      1.201         31        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.59it/s]
                 all        140        140      0.993          1      0.995
0.865

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      52/70      6.71G     0.5796     0.6518      1.199         26        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.65it/s]
                 all        140        140      0.989      0.996      0.995
0.866

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      53/70      6.71G     0.5608     0.6197      1.188         28        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.59it/s]
                 all        140        140      0.992      0.997      0.995
0.872

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      54/70       7.2G      0.579     0.6658      1.209         17        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.58it/s]
```

```
                 all        140        140       0.99      0.997      0.995
0.871

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      55/70       7.2G      0.556     0.6615      1.187         21        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.65it/s]
                 all        140        140      0.993          1      0.995
0.867

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      56/70       7.2G     0.5477     0.6415       1.19         25        640:
100% 31/31 [00:15<00:00,  1.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.988          1      0.995
0.873

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      57/70       7.2G     0.5453     0.6352      1.172         29        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.66it/s]
                 all        140        140       0.99          1      0.995
0.865

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      58/70       7.2G     0.5563     0.6227      1.184         29        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.992          1      0.995
0.874

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      59/70      7.23G     0.5626     0.6177      1.183         30        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                 all        140        140      0.995          1      0.995
0.868

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      60/70       7.3G     0.5311     0.5734      1.174         23        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.59it/s]
```

```
                   all        140        140      0.994      0.998      0.995
0.872
Closing dataloader mosaic
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01,
blur_limit=(3, 7)), ToGray(p=0.01, num_output_channels=3,
method='weighted_average'), CLAHE(p=0.01, clip_limit=(1.0, 4.0),
tile_grid_size=(8, 8))

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      61/70      7.37G     0.4484     0.2938      1.212         10        640:
100% 31/31 [00:16<00:00,  1.90it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.57it/s]
                   all        140        140      0.988          1      0.995
0.842

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      62/70      7.92G     0.4259     0.2366      1.224         10        640:
100% 31/31 [00:15<00:00,  1.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
                   all        140        140      0.993      0.997      0.995
0.869

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      63/70      7.98G     0.4127      0.221       1.21         10        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
                   all        140        140      0.993          1      0.995
0.871

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      64/70      8.05G     0.4235     0.2122      1.201         10        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                   all        140        140      0.989          1      0.995
0.875

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      65/70      8.12G     0.4234     0.2129      1.208         10        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.66it/s]
                   all        140        140      0.992          1      0.995
0.873
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      66/70      8.19G     0.4103       0.22      1.187         10        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.60it/s]
                   all        140        140      0.991          1      0.995
0.874

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      67/70      8.25G     0.4258     0.2136      1.194         10        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                   all        140        140      0.994          1      0.995
0.869

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      68/70      8.32G     0.4154     0.2071      1.198         10        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                   all        140        140      0.994          1      0.995
0.875

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      69/70      8.48G     0.3964     0.2058      1.168         10        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.63it/s]
                   all        140        140      0.995          1      0.995
0.877

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      70/70      9.04G     0.3938      0.205      1.211         10        640:
100% 31/31 [00:15<00:00,  1.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:01<00:00,  2.64it/s]
                   all        140        140      0.994          1      0.995
0.876

70 epochs completed in 0.360 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 52.0MB
Optimizer stripped from runs/detect/train/weights/best.pt, 52.0MB

Validating runs/detect/train/weights/best.pt…
Ultralytics 8.3.99  Python-3.11.11 torch-2.6.0+cu124 CUDA:0 (Tesla T4,
15095MiB)
Model summary (fused): 92 layers, 25,845,550 parameters, 0 gradients, 78.7
```

```
GFLOPs
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 5/5 [00:02<00:00,  2.47it/s]
                   all        140        140      0.995          1      0.995
0.877
                     0         14         14      0.993          1      0.995
0.972
                     1         14         14      0.996          1      0.995
0.679
                     2         14         14      0.996          1      0.995
0.821
                     3         14         14      0.993          1      0.995
0.905
                     4         15         15          1          1      0.995
0.913
                     5         13         13       0.99          1      0.995
0.983
                     6         14         14      0.996          1      0.995
0.844
                     7         14         14      0.995          1      0.995
0.896
                     8         14         14      0.994          1      0.995
0.879
                     9         14         14      0.993          1      0.995
0.881
Speed: 0.2ms preprocess, 10.4ms inference, 0.0ms loss, 1.5ms postprocess per
image
Results saved to runs/detect/train
  Learn more at https://docs.ultralytics.com/modes/train
```

[ ]:
```
!ls {HOME}/runs/detect/train
```

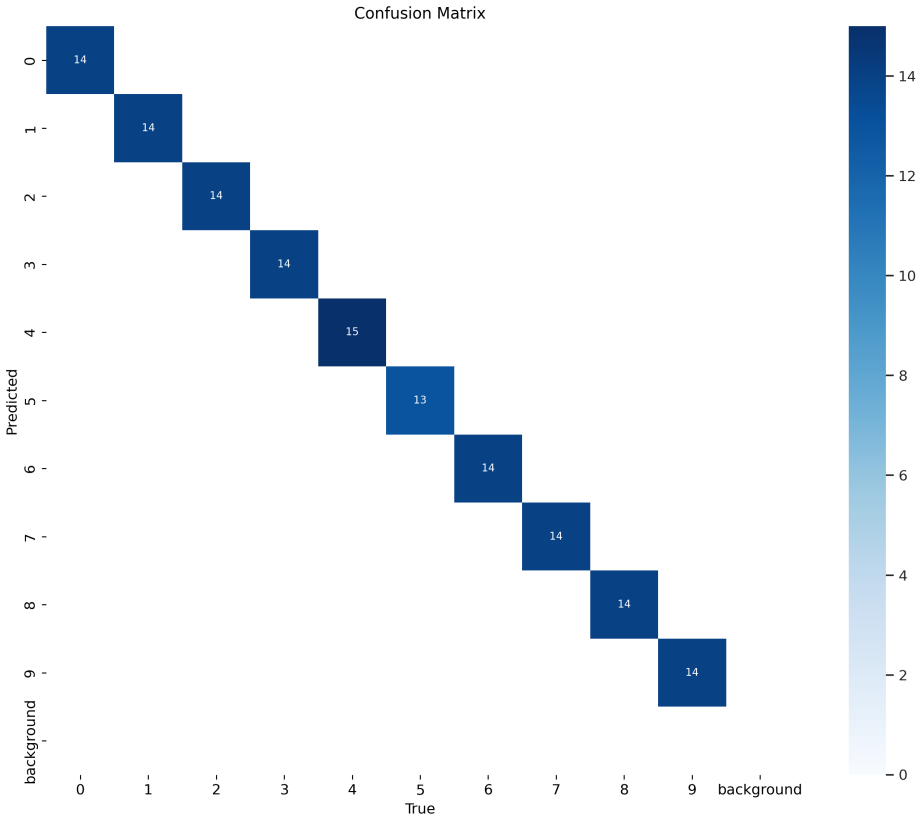
```
args.yaml                                          R_curve.png
val_batch0_labels.jpg
confusion_matrix_normalized.png                    results.csv
val_batch0_pred.jpg
confusion_matrix.png                               results.png
val_batch1_labels.jpg
events.out.tfevents.1743358603.f00a355f0e34.11447.0  train_batch0.jpg
val_batch1_pred.jpg
F1_curve.png                                       train_batch1860.jpg
val_batch2_labels.jpg
labels_correlogram.jpg                             train_batch1861.jpg
val_batch2_pred.jpg
labels.jpg                                         train_batch1862.jpg
weights
P_curve.png                                        train_batch1.jpg
PR_curve.png                                       train_batch2.jpg
```

0.6 Displaying Confusion Matrix

[ ]:
```
# the clean confusion matrix shows that it has very high precision
%cd /content
Image(filename=f'{HOME}/runs/detect/train/confusion_matrix.png', width=900)
```

```
/content
```

[ ]:

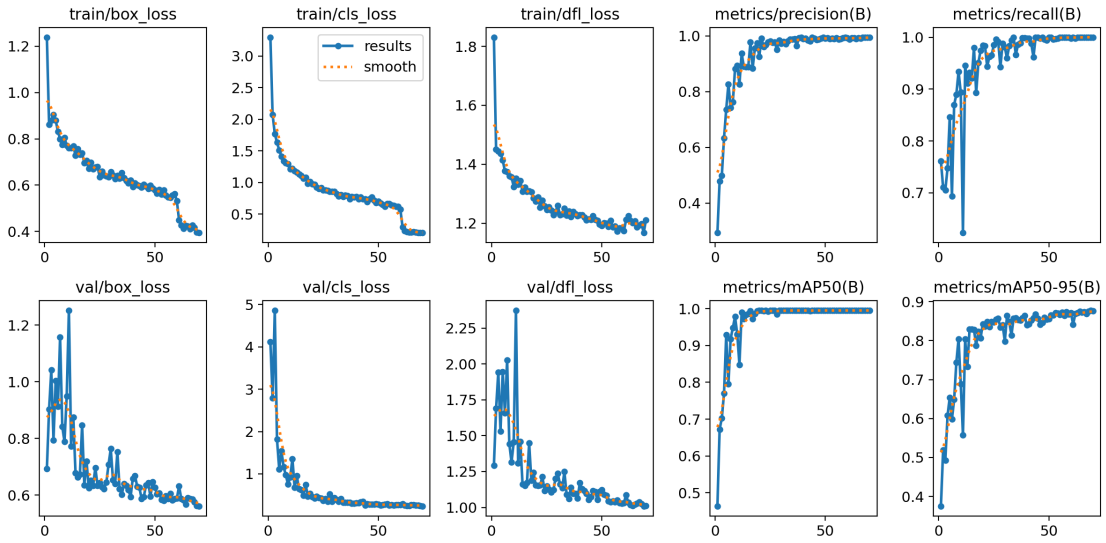


0.7 Training and Validation Loss

[ ]:
```
%cd {HOME}
Image (filename=f'{HOME}/runs/detect/train/results.png', width=900)
```

```
/content
```

[ ]:



[ ]:
```
#taking a look of how the model is behaving
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train/val_batch0_pred.jpg', width=600)
```

```
/content
```

[ ]:

0.8 Validating Custom Model

[ ]:
```
#taking model best weights and use them to validate model
#the difference between previous and this session is that in here we use our␣
  ↪mode=val instead of train

%cd {HOME}
!yolo task=detect mode=val model=/content/runs/detect/train/weights/best.pt␣
  ↪data=/content/datasets/ASLDetection-1/data.yaml
```

```
/content
Ultralytics 8.3.99  Python-3.11.11 torch-2.6.0+cu124 CUDA:0 (Tesla T4,
15095MiB)
```

```
Model summary (fused): 92 layers, 25,845,550 parameters, 0 gradients, 78.7
GFLOPs
val: Scanning
/content/datasets/ASLDetection-1/valid/labels.cache… 140 images, 0
backgrounds, 0 corrupt: 100% 140/140 [00:00<?, ?it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100% 9/9 [00:03<00:00,  2.27it/s]
                   all        140        140      0.995          1      0.995
0.877
                     0         14         14      0.993          1      0.995
0.968
                     1         14         14      0.996          1      0.995
0.677
                     2         14         14      0.996          1      0.995
0.821
                     3         14         14      0.993          1      0.995
0.905
                     4         15         15          1          1      0.995
0.913
                     5         13         13       0.99          1      0.995
0.983
                     6         14         14      0.996          1      0.995
0.844
                     7         14         14      0.995          1      0.995
0.896
                     8         14         14      0.994          1      0.995
0.88
                     9         14         14      0.993          1      0.995
0.881
Speed: 1.6ms preprocess, 21.3ms inference, 0.0ms loss, 1.6ms postprocess per
image
Results saved to runs/detect/val
 Learn more at https://docs.ultralytics.com/modes/val
```

0.9 Inference with Custom Model

[ ]:
```
#test the model on test dataset images with no annotation
%cd {HOME}
!yolo task=detect mode=predict model={HOME}/runs/detect/train/weights/best.pt␣
 ↪conf=0.25 source=/content/datasets/ASLDetection-1/test/images
```

```
/content
Ultralytics 8.3.99  Python-3.11.11 torch-2.6.0+cu124 CUDA:0 (Tesla T4,
15095MiB)
Model summary (fused): 92 layers, 25,845,550 parameters, 0 gradients, 78.7
GFLOPs

image 1/70 /content/datasets/ASLDetection-1/test/images/hand1_0_bot_seg_1_croppe
```

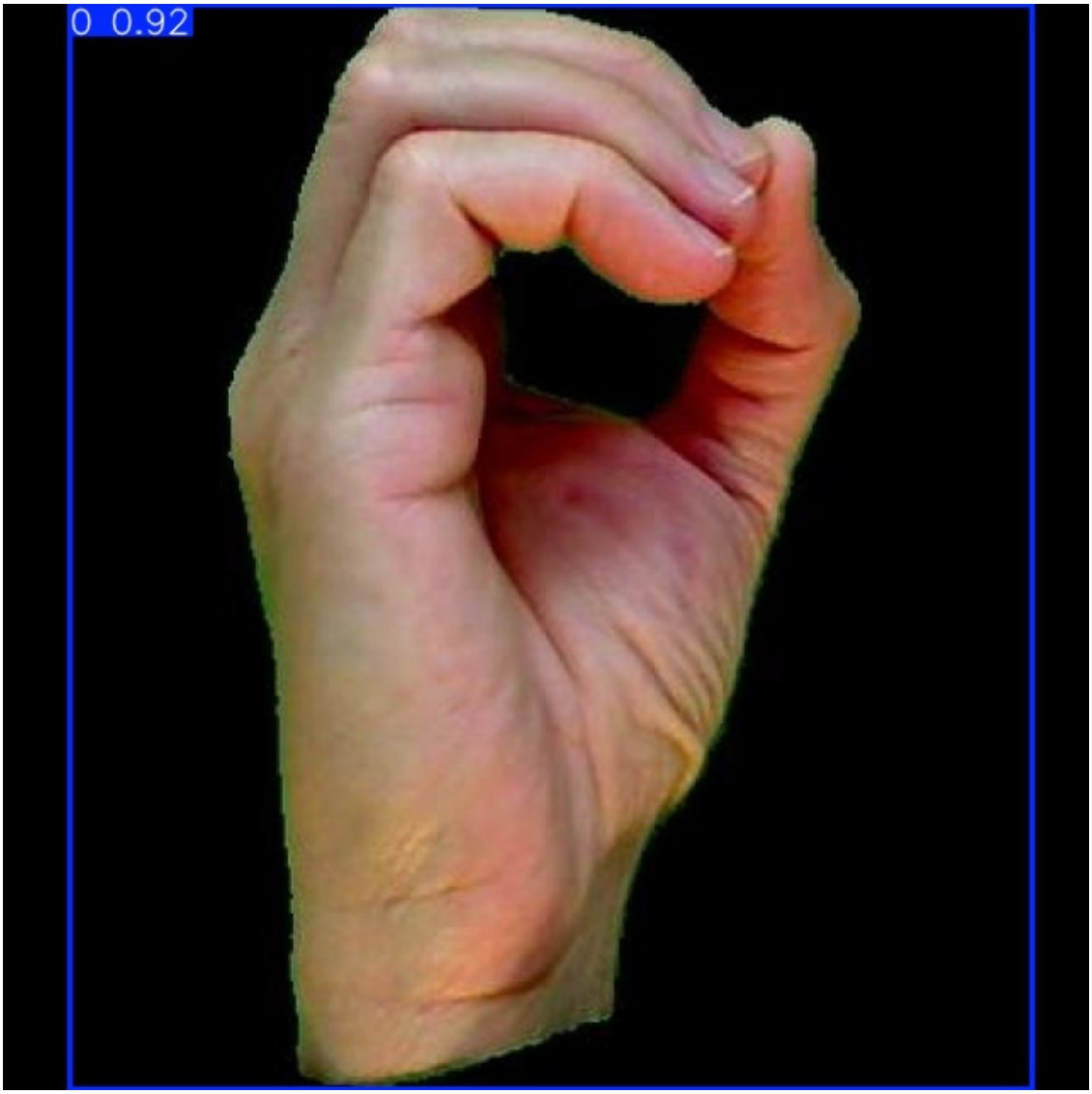
```
d_jpeg.rf.5442952bcbd49bde784d3e52a6597b57.jpg: 640x640 1 0, 37.0ms
image 2/70 /content/datasets/ASLDetection-1/test/images/hand1_0_right_seg_5_crop
ped_jpeg.rf.56eb7a9b5a63da0d0edb53266763fad1.jpg: 640x640 1 0, 37.1ms
image 3/70 /content/datasets/ASLDetection-1/test/images/hand1_0_top_seg_4_croppe
d_jpeg.rf.692acb8418e991e2aaf79cedf84aedfc.jpg: 640x640 1 0, 37.0ms
image 4/70 /content/datasets/ASLDetection-1/test/images/hand1_1_dif_seg_3_croppe
d_jpeg.rf.714bc8a0f502680c18ba820eb2379a03.jpg: 640x640 1 1, 37.0ms
image 5/70 /content/datasets/ASLDetection-1/test/images/hand1_1_top_seg_1_croppe
d_jpeg.rf.051579963107b7d0df1790b3b18f35fa.jpg: 640x640 1 1, 37.0ms
image 6/70 /content/datasets/ASLDetection-1/test/images/hand1_1_top_seg_4_croppe
d_jpeg.rf.dc54135b69c5c69381a005997fa994f5.jpg: 640x640 1 1, 37.0ms
image 7/70 /content/datasets/ASLDetection-1/test/images/hand1_2_dif_seg_4_croppe
d_jpeg.rf.43e9f7dbd532162411d33ce9b0203664.jpg: 640x640 1 2, 37.0ms
image 8/70 /content/datasets/ASLDetection-1/test/images/hand1_3_dif_seg_5_croppe
d_jpeg.rf.ed14babbe037a197ec27157b7c359ff7.jpg: 640x640 1 3, 24.2ms
image 9/70 /content/datasets/ASLDetection-1/test/images/hand1_3_left_seg_4_cropp
ed_jpeg.rf.e0398f68f1d603eb073753829e9c4227.jpg: 640x640 1 3, 20.8ms
image 10/70 /content/datasets/ASLDetection-1/test/images/hand1_4_left_seg_3_crop
ped_jpeg.rf.43641ada762a2fb89e17fec8268b76b8.jpg: 640x640 1 4, 20.8ms
image 11/70 /content/datasets/ASLDetection-1/test/images/hand1_5_top_seg_2_cropp
ed_jpeg.rf.d1421e90ec65e0d946fb519a41235a9a.jpg: 640x640 1 5, 20.8ms
image 12/70 /content/datasets/ASLDetection-1/test/images/hand1_5_top_seg_3_cropp
ed_jpeg.rf.1fe0f5d55811f6248565d2a83d4d0ad7.jpg: 640x640 1 5, 20.3ms
image 13/70 /content/datasets/ASLDetection-1/test/images/hand1_6_dif_seg_5_cropp
ed_jpeg.rf.27e0ca58d4cd0a44febf757fc5c32803.jpg: 640x640 1 6, 20.2ms
image 14/70 /content/datasets/ASLDetection-1/test/images/hand1_6_left_seg_5_crop
ped_jpeg.rf.fd2e291a39f9b8a519dc688ade3d4273.jpg: 640x640 1 6, 20.2ms
image 15/70 /content/datasets/ASLDetection-1/test/images/hand1_6_top_seg_3_cropp
ed_jpeg.rf.6828a3a691f92fcecef4d1fdf8ea66d5.jpg: 640x640 1 6, 20.2ms
image 16/70 /content/datasets/ASLDetection-1/test/images/hand1_7_bot_seg_1_cropp
ed_jpeg.rf.ffc3684ebaa3c77597027d1086c840fa.jpg: 640x640 1 7, 20.2ms
image 17/70 /content/datasets/ASLDetection-1/test/images/hand1_7_bot_seg_3_cropp
ed_jpeg.rf.8ebceb59464bb562f4a72afc6d767692.jpg: 640x640 1 7, 20.2ms
image 18/70 /content/datasets/ASLDetection-1/test/images/hand1_7_bot_seg_5_cropp
ed_jpeg.rf.44493801301963b42f0dfa0afc135679.jpg: 640x640 1 7, 20.6ms
image 19/70 /content/datasets/ASLDetection-1/test/images/hand1_7_dif_seg_5_cropp
ed_jpeg.rf.e14fbfe5341e5f3713a74e45bfd7760e.jpg: 640x640 1 7, 19.0ms
image 20/70 /content/datasets/ASLDetection-1/test/images/hand1_7_right_seg_4_cro
pped_jpeg.rf.fd33f73f32b98e8f25a8a4a6697dff65.jpg: 640x640 1 7, 19.8ms
image 21/70 /content/datasets/ASLDetection-1/test/images/hand1_8_right_seg_4_cro
pped_jpeg.rf.ee8767891c8cb1a9375f01dcff727a2c.jpg: 640x640 1 8, 19.5ms
image 22/70 /content/datasets/ASLDetection-1/test/images/hand1_8_top_seg_3_cropp
ed_jpeg.rf.4847ff4fbaae656aebae1e719a2f3f74.jpg: 640x640 1 8, 18.7ms
image 23/70 /content/datasets/ASLDetection-1/test/images/hand1_9_left_seg_5_crop
ped_jpeg.rf.e63444e9567bce9d3d11859e924cebba.jpg: 640x640 1 9, 18.2ms
image 24/70 /content/datasets/ASLDetection-1/test/images/hand2_0_dif_seg_1_cropp
ed_jpeg.rf.5c25981199f029d97c2bcd19c2734fa4.jpg: 640x640 1 0, 19.8ms
image 25/70 /content/datasets/ASLDetection-1/test/images/hand2_0_left_seg_4_crop
```

```
ped_jpeg.rf.a597fd8125410abc12d588b831173433.jpg: 640x640 1 0, 20.0ms
image 26/70 /content/datasets/ASLDetection-1/test/images/hand2_1_right_seg_5_cro
pped_jpeg.rf.3ca0aff2e5a027fef4f21d3f0a082694.jpg: 640x640 1 1, 18.9ms
image 27/70 /content/datasets/ASLDetection-1/test/images/hand2_1_top_seg_2_cropp
ed_jpeg.rf.e434750144e13ff642618d679f3da90a.jpg: 640x640 1 1, 18.4ms
image 28/70 /content/datasets/ASLDetection-1/test/images/hand2_2_left_seg_3_crop
ped_jpeg.rf.cdcb5536abc3022ec490bbf6a2a699f7.jpg: 640x640 1 2, 19.8ms
image 29/70 /content/datasets/ASLDetection-1/test/images/hand2_2_right_seg_4_cro
pped_jpeg.rf.54e1cacfc4d8fd17f469aa7cf6b40896.jpg: 640x640 1 2, 19.5ms
image 30/70 /content/datasets/ASLDetection-1/test/images/hand2_2_top_seg_2_cropp
ed_jpeg.rf.56df77bbc87c70c5c5bca3d3de603efc.jpg: 640x640 1 2, 18.4ms
image 31/70 /content/datasets/ASLDetection-1/test/images/hand2_2_top_seg_5_cropp
ed_jpeg.rf.aa37018fad1efeded46a41716a3bb4e1.jpg: 640x640 1 2, 18.2ms
image 32/70 /content/datasets/ASLDetection-1/test/images/hand2_3_bot_seg_1_cropp
ed_jpeg.rf.5e588c3fd53169132754d61bd5238272.jpg: 640x640 1 3, 18.2ms
image 33/70 /content/datasets/ASLDetection-1/test/images/hand2_3_left_seg_3_crop
ped_jpeg.rf.41b540f3ab74f0b84e7daff3e2db14a2.jpg: 640x640 1 3, 18.2ms
image 34/70 /content/datasets/ASLDetection-1/test/images/hand2_3_top_seg_3_cropp
ed_jpeg.rf.d9ef0451ee63954dcbb57e838ce5f347.jpg: 640x640 1 3, 18.9ms
image 35/70 /content/datasets/ASLDetection-1/test/images/hand2_4_bot_seg_1_cropp
ed_jpeg.rf.35dc90a9d517227874a6986e71bab599.jpg: 640x640 1 4, 19.5ms
image 36/70 /content/datasets/ASLDetection-1/test/images/hand2_4_dif_seg_1_cropp
ed_jpeg.rf.c3ceeb54b4e5cc66cddc60ae7b042892.jpg: 640x640 1 5, 19.2ms
image 37/70 /content/datasets/ASLDetection-1/test/images/hand2_4_left_seg_3_crop
ped_jpeg.rf.a7561f688214cee626df089ce20c2d00.jpg: 640x640 1 4, 19.7ms
image 38/70 /content/datasets/ASLDetection-1/test/images/hand2_5_bot_seg_4_cropp
ed_jpeg.rf.787d1eabb22cf505a07ed701e9cf537d.jpg: 640x640 1 5, 19.2ms
image 39/70 /content/datasets/ASLDetection-1/test/images/hand2_5_bot_seg_5_cropp
ed_jpeg.rf.53281348a1e923f3b7f5e11568fb93d4.jpg: 640x640 1 5, 18.4ms
image 40/70 /content/datasets/ASLDetection-1/test/images/hand2_5_dif_seg_4_cropp
ed_jpeg.rf.ad2e1637e5d94a01f1c074a7269359ae.jpg: 640x640 1 4, 19.2ms
image 41/70 /content/datasets/ASLDetection-1/test/images/hand2_5_left_seg_3_crop
ped_jpeg.rf.7489af4afd07d0c343f6f3ee2872e140.jpg: 640x640 1 5, 20.0ms
image 42/70 /content/datasets/ASLDetection-1/test/images/hand2_5_right_seg_5_cro
pped_jpeg.rf.a3712a5bf70e3c07abfd3833689d6a9e.jpg: 640x640 1 5, 19.2ms
image 43/70 /content/datasets/ASLDetection-1/test/images/hand2_6_bot_seg_4_cropp
ed_jpeg.rf.77e2059ee766975edbc414e6d6fab39d.jpg: 640x640 1 6, 18.3ms
image 44/70 /content/datasets/ASLDetection-1/test/images/hand2_6_dif_seg_4_cropp
ed_jpeg.rf.01e7e481008e90388f2441bb4c6f10f1.jpg: 640x640 1 6, 19.8ms
image 45/70 /content/datasets/ASLDetection-1/test/images/hand2_6_left_seg_1_crop
ped_jpeg.rf.4c1633b6b6390ebd106ca8680b833930.jpg: 640x640 1 6, 19.8ms
image 46/70 /content/datasets/ASLDetection-1/test/images/hand2_6_right_seg_5_cro
pped_jpeg.rf.28d77c13d955a00c4f6ce7e77cb3ffc3.jpg: 640x640 1 6, 19.0ms
image 47/70 /content/datasets/ASLDetection-1/test/images/hand2_7_bot_seg_5_cropp
ed_jpeg.rf.927232f7c1645d94f09e45fb0213d251.jpg: 640x640 1 7, 18.6ms
image 48/70 /content/datasets/ASLDetection-1/test/images/hand2_8_dif_seg_1_cropp
ed_jpeg.rf.c747a74fbb31e8410bff3dab8c601663.jpg: 640x640 1 8, 19.8ms
image 49/70 /content/datasets/ASLDetection-1/test/images/hand2_8_dif_seg_2_cropp
```

```
ed_jpeg.rf.1ee4934d5c2798b107e601fc84f9ab32.jpg: 640x640 1 8, 19.6ms
image 50/70 /content/datasets/ASLDetection-1/test/images/hand2_8_right_seg_3_cro
pped_jpeg.rf.68b763ed9423ebd69617e65ef3cf751b.jpg: 640x640 1 8, 18.4ms
image 51/70 /content/datasets/ASLDetection-1/test/images/hand2_9_dif_seg_1_cropp
ed_jpeg.rf.dd216239a1cdbea92072241694451872.jpg: 640x640 1 9, 18.1ms
image 52/70 /content/datasets/ASLDetection-1/test/images/hand2_9_left_seg_3_crop
ped_jpeg.rf.cfb36d88baf4cec07f54e34826a74eec.jpg: 640x640 1 9, 19.8ms
image 53/70 /content/datasets/ASLDetection-1/test/images/hand2_9_top_seg_4_cropp
ed_jpeg.rf.be1807453afd253abb56d98ede94fafb.jpg: 640x640 1 9, 19.6ms
image 54/70 /content/datasets/ASLDetection-1/test/images/hand3_0_dif_seg_1_cropp
ed_jpeg.rf.9b0da928071f83960952be237c523311.jpg: 640x640 1 0, 18.6ms
image 55/70 /content/datasets/ASLDetection-1/test/images/hand3_0_dif_seg_5_cropp
ed_jpeg.rf.696637ce27ae145599f5f4c832c34406.jpg: 640x640 1 0, 18.5ms
image 56/70 /content/datasets/ASLDetection-1/test/images/hand3_2_dif_seg_4_cropp
ed_jpeg.rf.43d3dc26eaa4b805caed1aee1b141fec.jpg: 640x640 1 2, 19.8ms
image 57/70 /content/datasets/ASLDetection-1/test/images/hand3_7_dif_seg_4_cropp
ed_jpeg.rf.aca76a7127837cd9310f73245671ed4d.jpg: 640x640 1 7, 19.6ms
image 58/70 /content/datasets/ASLDetection-1/test/images/hand4_1_bot_seg_1_cropp
ed_jpeg.rf.32017eff7f8fbbc97780a3d2fc1a8ae9.jpg: 640x640 1 1, 18.5ms
image 59/70 /content/datasets/ASLDetection-1/test/images/hand4_1_bot_seg_4_cropp
ed_jpeg.rf.4f66d6d203e7614f86883d2bb5bb08d8.jpg: 640x640 1 1, 19.3ms
image 60/70 /content/datasets/ASLDetection-1/test/images/hand4_4_bot_seg_2_cropp
ed_jpeg.rf.302dcafccc96bbed70ad8f96d15f0a3a.jpg: 640x640 1 4, 19.7ms
image 61/70 /content/datasets/ASLDetection-1/test/images/hand4_4_bot_seg_3_cropp
ed_jpeg.rf.d8b4da98be13c45d78a765b535c973fa.jpg: 640x640 1 4, 18.9ms
image 62/70 /content/datasets/ASLDetection-1/test/images/hand4_8_bot_seg_2_cropp
ed_jpeg.rf.5c58c5ab9bb3ee934d2bb65b41721d65.jpg: 640x640 1 8, 18.3ms
image 63/70 /content/datasets/ASLDetection-1/test/images/hand4_9_bot_seg_1_cropp
ed_jpeg.rf.7204e40c1132826058ea5698bb52879a.jpg: 640x640 1 9, 19.5ms
image 64/70 /content/datasets/ASLDetection-1/test/images/hand5_2_dif_seg_4_cropp
ed_jpeg.rf.5bd5874d5b9433cdf0ea9ae30cbbfbfb.jpg: 640x640 1 2, 19.6ms
image 65/70 /content/datasets/ASLDetection-1/test/images/hand5_3_bot_seg_3_cropp
ed_jpeg.rf.57c606dead7d5990bc558dada037bc1c.jpg: 640x640 1 3, 18.8ms
image 66/70 /content/datasets/ASLDetection-1/test/images/hand5_3_dif_seg_4_cropp
ed_jpeg.rf.2971d4887713febdcbc84c20999b90c9.jpg: 640x640 1 3, 18.3ms
image 67/70 /content/datasets/ASLDetection-1/test/images/hand5_4_bot_seg_3_cropp
ed_jpeg.rf.669066b9138bbb1305f259c971a46121.jpg: 640x640 1 4, 19.9ms
image 68/70 /content/datasets/ASLDetection-1/test/images/hand5_8_bot_seg_5_cropp
ed_jpeg.rf.09c982ed81c3c2ed8905345b48c1c51d.jpg: 640x640 1 8, 19.6ms
image 69/70 /content/datasets/ASLDetection-1/test/images/hand5_9_dif_seg_2_cropp
ed_jpeg.rf.d2edd5ee73041ff3cf65e287b5e8a0cd.jpg: 640x640 1 9, 18.5ms
image 70/70 /content/datasets/ASLDetection-1/test/images/hand5_9_dif_seg_4_cropp
ed_jpeg.rf.21696ad34a495ab3c69aef46f7e36220.jpg: 640x640 1 9, 18.3ms
Speed: 1.6ms preprocess, 21.1ms inference, 3.2ms postprocess per image at shape
(1, 3, 640, 640)
Results saved to runs/detect/predict
  Learn more at https://docs.ultralytics.com/modes/predict
```

```
[ ]: Image("/content/runs/detect/predict/hand1_0_bot_seg_1_cropped_jpeg.rf.
     ↪5442952bcbd49bde784d3e52a6597b57.jpg")
```

[ ]:



##Test on random videos

```
[ ]: !gdown --id 1W2wOLrLTrlBotNe1IVF-LiOLdV6Iuo3D -O video.mp4
```

```
/usr/local/lib/python3.11/dist-packages/gdown/__main__.py:140: FutureWarning:
Option `--id` was deprecated in version 4.3.1 and will be removed in 5.0. You
don't need to pass it anymore to use a file ID.
  warnings.warn(
Downloading…
From: https://drive.google.com/uc?id=1W2wOLrLTrlBotNe1IVF-LiOLdV6Iuo3D
```

```
To: /content/video.mp4
100% 3.28M/3.28M [00:00<00:00, 158MB/s]
```

[ ]:
```
%cd /content
!yolo task=detect mode=predict model=/content/runs/detect/train/weights/best.pt␣
↪conf=0.25 source='/content/video.mp4'
```

```
/content
Ultralytics 8.3.99  Python-3.11.11 torch-2.6.0+cu124 CUDA:0 (Tesla T4,
15095MiB)
Model summary (fused): 92 layers, 25,845,550 parameters, 0 gradients, 78.7
GFLOPs

video 1/1 (frame 1/607) /content/video.mp4: 640x384 1 8, 53.3ms
video 1/1 (frame 2/607) /content/video.mp4: 640x384 1 1, 1 8, 25.1ms
video 1/1 (frame 3/607) /content/video.mp4: 640x384 1 8, 25.1ms
video 1/1 (frame 4/607) /content/video.mp4: 640x384 1 1, 1 8, 25.0ms
video 1/1 (frame 5/607) /content/video.mp4: 640x384 1 8, 25.0ms
video 1/1 (frame 6/607) /content/video.mp4: 640x384 (no detections), 21.7ms
video 1/1 (frame 7/607) /content/video.mp4: 640x384 1 8, 19.9ms
video 1/1 (frame 8/607) /content/video.mp4: 640x384 (no detections), 19.8ms
video 1/1 (frame 9/607) /content/video.mp4: 640x384 (no detections), 19.8ms
video 1/1 (frame 10/607) /content/video.mp4: 640x384 (no detections), 19.9ms
video 1/1 (frame 11/607) /content/video.mp4: 640x384 (no detections), 19.9ms
video 1/1 (frame 12/607) /content/video.mp4: 640x384 (no detections), 19.9ms
video 1/1 (frame 13/607) /content/video.mp4: 640x384 (no detections), 17.9ms
video 1/1 (frame 14/607) /content/video.mp4: 640x384 (no detections), 12.4ms
video 1/1 (frame 15/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 16/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 17/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 18/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 19/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 20/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 21/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 22/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 23/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 24/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 25/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 26/607) /content/video.mp4: 640x384 (no detections), 12.1ms
video 1/1 (frame 27/607) /content/video.mp4: 640x384 (no detections), 11.8ms
video 1/1 (frame 28/607) /content/video.mp4: 640x384 (no detections), 11.8ms
video 1/1 (frame 29/607) /content/video.mp4: 640x384 (no detections), 11.8ms
video 1/1 (frame 30/607) /content/video.mp4: 640x384 (no detections), 11.8ms
video 1/1 (frame 31/607) /content/video.mp4: 640x384 (no detections), 11.8ms
video 1/1 (frame 32/607) /content/video.mp4: 640x384 (no detections), 11.9ms
video 1/1 (frame 33/607) /content/video.mp4: 640x384 (no detections), 11.9ms
video 1/1 (frame 34/607) /content/video.mp4: 640x384 (no detections), 11.9ms
video 1/1 (frame 35/607) /content/video.mp4: 640x384 (no detections), 11.9ms
```

```
video 1/1 (frame 36/607) /content/video.mp4: 640x384 (no detections), 11.9ms
video 1/1 (frame 37/607) /content/video.mp4: 640x384 (no detections), 11.6ms
video 1/1 (frame 38/607) /content/video.mp4: 640x384 (no detections), 11.3ms
video 1/1 (frame 39/607) /content/video.mp4: 640x384 (no detections), 11.2ms
video 1/1 (frame 40/607) /content/video.mp4: 640x384 (no detections), 11.2ms
video 1/1 (frame 41/607) /content/video.mp4: 640x384 (no detections), 11.1ms
video 1/1 (frame 42/607) /content/video.mp4: 640x384 (no detections), 11.1ms
video 1/1 (frame 43/607) /content/video.mp4: 640x384 (no detections), 11.1ms
video 1/1 (frame 44/607) /content/video.mp4: 640x384 (no detections), 11.1ms
video 1/1 (frame 45/607) /content/video.mp4: 640x384 (no detections), 11.4ms
video 1/1 (frame 46/607) /content/video.mp4: 640x384 (no detections), 11.6ms
video 1/1 (frame 47/607) /content/video.mp4: 640x384 (no detections), 11.6ms
video 1/1 (frame 48/607) /content/video.mp4: 640x384 (no detections), 11.7ms
video 1/1 (frame 49/607) /content/video.mp4: 640x384 (no detections), 11.9ms
video 1/1 (frame 50/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 51/607) /content/video.mp4: 640x384 (no detections), 12.1ms
video 1/1 (frame 52/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 53/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 54/607) /content/video.mp4: 640x384 (no detections), 12.2ms
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video 1/1 (frame 56/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 57/607) /content/video.mp4: 640x384 (no detections), 12.1ms
video 1/1 (frame 58/607) /content/video.mp4: 640x384 1 8, 12.1ms
video 1/1 (frame 59/607) /content/video.mp4: 640x384 1 8, 12.1ms
video 1/1 (frame 60/607) /content/video.mp4: 640x384 (no detections), 12.1ms
video 1/1 (frame 61/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 62/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 63/607) /content/video.mp4: 640x384 (no detections), 12.1ms
video 1/1 (frame 64/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 65/607) /content/video.mp4: 640x384 1 6, 12.1ms
video 1/1 (frame 66/607) /content/video.mp4: 640x384 1 6, 1 8, 12.1ms
video 1/1 (frame 67/607) /content/video.mp4: 640x384 1 6, 1 8, 12.1ms
video 1/1 (frame 68/607) /content/video.mp4: 640x384 1 2, 1 6, 12.0ms
video 1/1 (frame 69/607) /content/video.mp4: 640x384 1 2, 1 6, 1 8, 11.9ms
video 1/1 (frame 70/607) /content/video.mp4: 640x384 1 6, 1 8, 11.9ms
video 1/1 (frame 71/607) /content/video.mp4: 640x384 1 8, 11.7ms
video 1/1 (frame 72/607) /content/video.mp4: 640x384 1 8, 11.6ms
video 1/1 (frame 73/607) /content/video.mp4: 640x384 1 8, 11.5ms
video 1/1 (frame 74/607) /content/video.mp4: 640x384 1 8, 11.5ms
video 1/1 (frame 75/607) /content/video.mp4: 640x384 1 8, 11.5ms
video 1/1 (frame 76/607) /content/video.mp4: 640x384 1 6, 1 8, 11.5ms
video 1/1 (frame 77/607) /content/video.mp4: 640x384 1 6, 1 8, 11.3ms
video 1/1 (frame 78/607) /content/video.mp4: 640x384 1 6, 1 8, 11.2ms
video 1/1 (frame 79/607) /content/video.mp4: 640x384 1 8, 11.1ms
video 1/1 (frame 80/607) /content/video.mp4: 640x384 1 8, 11.1ms
video 1/1 (frame 81/607) /content/video.mp4: 640x384 1 2, 1 8, 11.1ms
video 1/1 (frame 82/607) /content/video.mp4: 640x384 1 8, 11.1ms
video 1/1 (frame 83/607) /content/video.mp4: 640x384 1 8, 11.0ms
```

```
video 1/1 (frame 84/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 85/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 86/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 87/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 88/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 89/607) /content/video.mp4: 640x384 1 2, 1 8, 11.0ms
video 1/1 (frame 90/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 91/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 92/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 93/607) /content/video.mp4: 640x384 1 8, 11.0ms
video 1/1 (frame 94/607) /content/video.mp4: 640x384 1 8, 11.1ms
video 1/1 (frame 95/607) /content/video.mp4: 640x384 1 8, 11.4ms
video 1/1 (frame 96/607) /content/video.mp4: 640x384 1 8, 11.6ms
video 1/1 (frame 97/607) /content/video.mp4: 640x384 1 0, 11.6ms
video 1/1 (frame 98/607) /content/video.mp4: 640x384 1 6, 1 8, 11.5ms
video 1/1 (frame 99/607) /content/video.mp4: 640x384 1 8, 11.5ms
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video 1/1 (frame 101/607) /content/video.mp4: 640x384 1 8, 11.5ms
video 1/1 (frame 102/607) /content/video.mp4: 640x384 1 8, 11.5ms
video 1/1 (frame 103/607) /content/video.mp4: 640x384 1 8, 11.4ms
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video 1/1 (frame 107/607) /content/video.mp4: 640x384 1 8, 11.6ms
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video 1/1 (frame 109/607) /content/video.mp4: 640x384 1 8, 11.5ms
video 1/1 (frame 110/607) /content/video.mp4: 640x384 1 8, 11.6ms
video 1/1 (frame 111/607) /content/video.mp4: 640x384 1 8, 11.5ms
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video 1/1 (frame 116/607) /content/video.mp4: 640x384 1 0, 11.7ms
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video 1/1 (frame 118/607) /content/video.mp4: 640x384 1 0, 1 6, 11.7ms
video 1/1 (frame 119/607) /content/video.mp4: 640x384 1 0, 1 6, 11.5ms
video 1/1 (frame 120/607) /content/video.mp4: 640x384 1 6, 11.4ms
video 1/1 (frame 121/607) /content/video.mp4: 640x384 1 7, 11.6ms
video 1/1 (frame 122/607) /content/video.mp4: 640x384 1 7, 11.7ms
video 1/1 (frame 123/607) /content/video.mp4: 640x384 1 7, 11.9ms
video 1/1 (frame 124/607) /content/video.mp4: 640x384 1 7, 11.9ms
video 1/1 (frame 125/607) /content/video.mp4: 640x384 1 7, 11.8ms
video 1/1 (frame 126/607) /content/video.mp4: 640x384 1 7, 11.6ms
video 1/1 (frame 127/607) /content/video.mp4: 640x384 1 7, 1 8, 11.5ms
video 1/1 (frame 128/607) /content/video.mp4: 640x384 1 7, 1 8, 11.4ms
video 1/1 (frame 129/607) /content/video.mp4: 640x384 1 7, 1 8, 11.2ms
video 1/1 (frame 130/607) /content/video.mp4: 640x384 1 7, 1 8, 11.1ms
video 1/1 (frame 131/607) /content/video.mp4: 640x384 1 7, 1 8, 11.1ms
```

```
video 1/1 (frame 132/607) /content/video.mp4: 640x384 1 7, 1 8, 11.1ms
video 1/1 (frame 133/607) /content/video.mp4: 640x384 1 7, 1 8, 11.1ms
video 1/1 (frame 134/607) /content/video.mp4: 640x384 1 8, 11.0ms
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video 1/1 (frame 136/607) /content/video.mp4: 640x384 1 0, 11.0ms
video 1/1 (frame 137/607) /content/video.mp4: 640x384 1 0, 11.0ms
video 1/1 (frame 138/607) /content/video.mp4: 640x384 1 0, 11.0ms
video 1/1 (frame 139/607) /content/video.mp4: 640x384 (no detections), 11.0ms
video 1/1 (frame 140/607) /content/video.mp4: 640x384 (no detections), 11.0ms
video 1/1 (frame 141/607) /content/video.mp4: 640x384 1 7, 11.1ms
video 1/1 (frame 142/607) /content/video.mp4: 640x384 1 7, 1 8, 11.3ms
video 1/1 (frame 143/607) /content/video.mp4: 640x384 1 7, 1 8, 11.3ms
video 1/1 (frame 144/607) /content/video.mp4: 640x384 1 8, 11.2ms
video 1/1 (frame 145/607) /content/video.mp4: 640x384 1 8, 11.2ms
video 1/1 (frame 146/607) /content/video.mp4: 640x384 1 8, 11.1ms
video 1/1 (frame 147/607) /content/video.mp4: 640x384 (no detections), 11.1ms
video 1/1 (frame 148/607) /content/video.mp4: 640x384 (no detections), 11.1ms
video 1/1 (frame 149/607) /content/video.mp4: 640x384 (no detections), 11.5ms
video 1/1 (frame 150/607) /content/video.mp4: 640x384 1 0, 11.9ms
video 1/1 (frame 151/607) /content/video.mp4: 640x384 1 0, 12.2ms
video 1/1 (frame 152/607) /content/video.mp4: 640x384 1 0, 12.1ms
video 1/1 (frame 153/607) /content/video.mp4: 640x384 1 0, 11.9ms
video 1/1 (frame 154/607) /content/video.mp4: 640x384 1 0, 11.9ms
video 1/1 (frame 155/607) /content/video.mp4: 640x384 (no detections), 11.9ms
video 1/1 (frame 156/607) /content/video.mp4: 640x384 (no detections), 11.7ms
video 1/1 (frame 157/607) /content/video.mp4: 640x384 (no detections), 11.7ms
video 1/1 (frame 158/607) /content/video.mp4: 640x384 (no detections), 11.7ms
video 1/1 (frame 159/607) /content/video.mp4: 640x384 (no detections), 11.7ms
video 1/1 (frame 160/607) /content/video.mp4: 640x384 (no detections), 11.7ms
video 1/1 (frame 161/607) /content/video.mp4: 640x384 (no detections), 11.9ms
video 1/1 (frame 162/607) /content/video.mp4: 640x384 (no detections), 12.0ms
video 1/1 (frame 163/607) /content/video.mp4: 640x384 (no detections), 12.1ms
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video 1/1 (frame 166/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 167/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 168/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 169/607) /content/video.mp4: 640x384 (no detections), 12.2ms
video 1/1 (frame 170/607) /content/video.mp4: 640x384 (no detections), 12.1ms
video 1/1 (frame 171/607) /content/video.mp4: 640x384 (no detections), 11.9ms
video 1/1 (frame 172/607) /content/video.mp4: 640x384 (no detections), 11.7ms
video 1/1 (frame 173/607) /content/video.mp4: 640x384 (no detections), 11.5ms
video 1/1 (frame 174/607) /content/video.mp4: 640x384 (no detections), 11.3ms
video 1/1 (frame 175/607) /content/video.mp4: 640x384 (no detections), 11.2ms
video 1/1 (frame 176/607) /content/video.mp4: 640x384 (no detections), 11.1ms
video 1/1 (frame 177/607) /content/video.mp4: 640x384 1 0, 11.1ms
video 1/1 (frame 178/607) /content/video.mp4: 640x384 1 0, 11.1ms
video 1/1 (frame 179/607) /content/video.mp4: 640x384 (no detections), 11.1ms
```

```
video 1/1 (frame 180/607) /content/video.mp4: 640x384 1 0, 11.1ms
video 1/1 (frame 181/607) /content/video.mp4: 640x384 (no detections), 11.1ms
video 1/1 (frame 182/607) /content/video.mp4: 640x384 1 0, 11.1ms
video 1/1 (frame 183/607) /content/video.mp4: 640x384 1 0, 11.6ms
video 1/1 (frame 184/607) /content/video.mp4: 640x384 1 0, 11.7ms
video 1/1 (frame 185/607) /content/video.mp4: 640x384 (no detections), 11.6ms
video 1/1 (frame 186/607) /content/video.mp4: 640x384 1 8, 11.5ms
video 1/1 (frame 187/607) /content/video.mp4: 640x384 1 8, 11.5ms
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video 1/1 (frame 460/607) /content/video.mp4: 640x384 1 7, 11.5ms
video 1/1 (frame 461/607) /content/video.mp4: 640x384 1 8, 11.5ms
video 1/1 (frame 462/607) /content/video.mp4: 640x384 1 8, 11.6ms
video 1/1 (frame 463/607) /content/video.mp4: 640x384 1 0, 11.6ms
video 1/1 (frame 464/607) /content/video.mp4: 640x384 1 0, 1 8, 11.5ms
video 1/1 (frame 465/607) /content/video.mp4: 640x384 1 8, 11.4ms
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video 1/1 (frame 467/607) /content/video.mp4: 640x384 1 8, 11.2ms
```

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video 1/1 (frame 468/607) /content/video.mp4: 640x384 1 8, 11.1ms
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video 1/1 (frame 471/607) /content/video.mp4: 640x384 1 8, 11.1ms
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```
video 1/1 (frame 516/607) /content/video.mp4: 640x384 1 7, 12.4ms
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video 1/1 (frame 523/607) /content/video.mp4: 640x384 1 7, 12.0ms
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video 1/1 (frame 562/607) /content/video.mp4: 640x384 1 0, 1 8, 11.4ms
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video 1/1 (frame 564/607) /content/video.mp4: 640x384 1 0, 1 8, 11.1ms
video 1/1 (frame 565/607) /content/video.mp4: 640x384 1 0, 1 8, 11.1ms
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video 1/1 (frame 567/607) /content/video.mp4: 640x384 (no detections), 11.2ms
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video 1/1 (frame 607/607) /content/video.mp4: 640x384 (no detections), 12.6ms
Speed: 1.7ms preprocess, 11.8ms inference, 1.2ms postprocess per image at shape
(1, 3, 640, 384)
Results saved to runs/detect/predict2
  Learn more at https://docs.ultralytics.com/modes/predict
```

##Display Video

[ ]:
```
from IPython.display import HTML
from base64 import b64encode
import os
# input video path
save_path = '/content/runs/detect/predict2/video.avi'

# compressed video path
compressed_path = "/content/compressed_video.mp4"

os.system(f"ffmpeg -i {save_path} -vcodec libx264 {compressed_path}")

# display the compressed video
mp4 = open(compressed_path,'rb').read()
data_url = "data:video/mp4;base64," + b64encode(mp4).decode()
HTML("""
<video width=400 controls>
  <source src="%s" type="video/mp4">
</video>
""" % data_url)
```

[ ]:
```
<IPython.core.display.HTML object>
```

##Export Model in TFlite format

[ ]:
```
!yolo task=detect mode=export model=yolov8m.pt format=tflite
```

```
Ultralytics 8.3.99  Python-3.11.11 torch-2.6.0+cu124 CPU (Intel Xeon 2.30GHz)
YOLOv8m summary (fused): 92 layers, 25,886,080 parameters, 0 gradients, 78.9
GFLOPs

PyTorch: starting from 'yolov8m.pt' with input shape (1, 3, 640,
640) BCHW and output shape(s) (1, 84, 8400) (49.7 MB)
WARNING: All log messages before absl::InitializeLog() is called are written to
STDERR
E0000 00:00:1743360869.823242   21374 cuda_dnn.cc:8310] Unable to register cuDNN
factory: Attempting to register factory for plugin cuDNN when one has already
been registered
E0000 00:00:1743360869.828217   21374 cuda_blas.cc:1418] Unable to register
cuBLAS factory: Attempting to register factory for plugin cuBLAS when one has
already been registered
requirements: Ultralytics requirements ['sng4onnx>=1.0.1',
'onnx_graphsurgeon>=0.3.26', 'ai-edge-litert>=1.2.0', 'onnx>=1.12.0',
'onnx2tf>=1.26.3', 'onnxslim>=0.1.31', 'tflite_support', 'onnxruntime'] not
found, attempting AutoUpdate…
```

```
ERROR: pip's dependency resolver does not currently take into account all
the packages that are installed. This behaviour is the source of the following
dependency conflicts.
grpcio-status 1.71.0 requires protobuf<6.0dev,>=5.26.1, but you have protobuf
3.20.3 which is incompatible.
tensorflow-metadata 1.16.1 requires protobuf<6.0.0dev,>=4.25.2; python_version
>= "3.11", but you have protobuf 3.20.3 which is incompatible.
Looking in indexes: https://pypi.org/simple, https://pypi.ngc.nvidia.com
Collecting sng4onnx>=1.0.1
  Downloading sng4onnx-1.0.4-py3-none-any.whl.metadata (4.6 kB)
Collecting onnx_graphsurgeon>=0.3.26
  Downloading onnx_graphsurgeon-0.5.7-py2.py3-none-any.whl.metadata (8.2 kB)
Collecting ai-edge-litert>=1.2.0
  Downloading
ai_edge_litert-1.2.0-cp311-cp311-manylinux_2_17_x86_64.whl.metadata (1.6 kB)
Collecting onnx>=1.12.0
  Downloading
onnx-1.17.0-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata
(16 kB)
Collecting onnx2tf>=1.26.3
  Downloading onnx2tf-1.27.1-py3-none-any.whl.metadata (147 kB)
                           147.7/147.7 kB 3.7 MB/s eta
0:00:00
Collecting onnxslim>=0.1.31
  Downloading onnxslim-0.1.49-py3-none-any.whl.metadata (4.8 kB)
Collecting tflite_support
  Downloading tflite_support-0.4.4-cp311-cp311-manylinux2014_x86_64.whl.metadata
(2.4 kB)
Collecting onnxruntime
  Downloading onnxruntime-1.21.0-cp311-cp311-manylinux_2_27_x86_64.manylinux_2_2
8_x86_64.whl.metadata (4.5 kB)
Requirement already satisfied: numpy in /usr/local/lib/python3.11/dist-packages
(from onnx_graphsurgeon>=0.3.26) (2.0.2)
Collecting onnx>=1.12.0
  Downloading
onnx-1.16.1-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata
(16 kB)
Requirement already satisfied: flatbuffers in /usr/local/lib/python3.11/dist-
packages (from ai-edge-litert>=1.2.0) (25.2.10)
Requirement already satisfied: protobuf>=3.20.2 in
/usr/local/lib/python3.11/dist-packages (from onnx>=1.12.0) (5.29.4)
Requirement already satisfied: sympy in /usr/local/lib/python3.11/dist-packages
(from onnxslim>=0.1.31) (1.13.1)
Requirement already satisfied: packaging in /usr/local/lib/python3.11/dist-
```

```
packages (from onnxslim>=0.1.31) (24.2)
Requirement already satisfied: absl-py>=0.7.0 in /usr/local/lib/python3.11/dist-
packages (from tflite_support) (1.4.0)
Collecting protobuf>=3.20.2 (from onnx>=1.12.0)
  Downloading protobuf-3.20.3-py2.py3-none-any.whl.metadata (720 bytes)
Collecting sounddevice>=0.4.4 (from tflite_support)
  Downloading sounddevice-0.5.1-py3-none-any.whl.metadata (1.4 kB)
Collecting pybind11>=2.6.0 (from tflite_support)
  Downloading pybind11-2.13.6-py3-none-any.whl.metadata (9.5 kB)
Collecting coloredlogs (from onnxruntime)
  Downloading coloredlogs-15.0.1-py2.py3-none-any.whl.metadata (12 kB)
Requirement already satisfied: CFFI>=1.0 in /usr/local/lib/python3.11/dist-
packages (from sounddevice>=0.4.4->tflite_support) (1.17.1)
Collecting humanfriendly>=9.1 (from coloredlogs->onnxruntime)
  Downloading humanfriendly-10.0-py2.py3-none-any.whl.metadata (9.2 kB)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in
/usr/local/lib/python3.11/dist-packages (from sympy->onnxslim>=0.1.31) (1.3.0)
Requirement already satisfied: pycparser in /usr/local/lib/python3.11/dist-
packages (from CFFI>=1.0->sounddevice>=0.4.4->tflite_support) (2.22)
Downloading sng4onnx-1.0.4-py3-none-any.whl (5.9 kB)
Downloading onnx_graphsurgeon-0.5.7-py2.py3-none-any.whl (57 kB)
                         57.9/57.9 kB 220.0 MB/s eta 0:00:00
Downloading ai_edge_litert-1.2.0-cp311-cp311-manylinux_2_17_x86_64.whl (3.5 MB)
                         3.5/3.5 MB 63.9 MB/s eta 0:00:00
Downloading
onnx-1.16.1-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (15.9 MB)
                         15.9/15.9 MB 166.6 MB/s eta 0:00:00
Downloading onnx2tf-1.27.1-py3-none-any.whl (446 kB)
                         446.4/446.4 kB 356.6 MB/s eta
0:00:00
Downloading onnxslim-0.1.49-py3-none-any.whl (144 kB)
                         144.1/144.1 kB 318.8 MB/s eta
0:00:00
Downloading tflite_support-0.4.4-cp311-cp311-manylinux2014_x86_64.whl (60.8 MB)
                         60.8/60.8 MB 258.1 MB/s eta 0:00:00
Downloading
onnxruntime-1.21.0-cp311-cp311-manylinux_2_27_x86_64.manylinux_2_28_x86_64.whl
(16.0 MB)
                         16.0/16.0 MB 205.5 MB/s eta 0:00:00
Downloading protobuf-3.20.3-py2.py3-none-any.whl (162 kB)
                         162.1/162.1 kB 331.9 MB/s eta
0:00:00
Downloading pybind11-2.13.6-py3-none-any.whl (243 kB)
                         243.3/243.3 kB 342.5 MB/s eta
0:00:00
Downloading sounddevice-0.5.1-py3-none-any.whl (32 kB)
Downloading coloredlogs-15.0.1-py2.py3-none-any.whl (46 kB)
                         46.0/46.0 kB 253.9 MB/s eta 0:00:00
```

```
Downloading humanfriendly-10.0-py2.py3-none-any.whl (86 kB)
                         86.8/86.8 kB 293.4 MB/s eta 0:00:00
Installing collected packages: sng4onnx, pybind11, protobuf, onnx2tf,
humanfriendly, ai-edge-litert, sounddevice, onnx, coloredlogs, tflite_support,
onnxslim, onnxruntime, onnx_graphsurgeon
  Attempting uninstall: protobuf
    Found existing installation: protobuf 5.29.4
    Uninstalling protobuf-5.29.4:
      Successfully uninstalled protobuf-5.29.4
Successfully installed ai-edge-litert-1.2.0 coloredlogs-15.0.1
humanfriendly-10.0 onnx-1.16.1 onnx2tf-1.27.1 onnx_graphsurgeon-0.5.7
onnxruntime-1.21.0 onnxslim-0.1.49 protobuf-3.20.3 pybind11-2.13.6
sng4onnx-1.0.4 sounddevice-0.5.1 tflite_support-0.4.4

requirements: AutoUpdate success  17.3s, installed 8 packages:
['sng4onnx>=1.0.1', 'onnx_graphsurgeon>=0.3.26', 'ai-edge-litert>=1.2.0',
'onnx>=1.12.0', 'onnx2tf>=1.26.3', 'onnxslim>=0.1.31', 'tflite_support',
'onnxruntime']
requirements:  Restart runtime or rerun command for updates

to take effect


TensorFlow SavedModel: starting export with tensorflow 2.18.0…
Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/calib
ration_image_sample_data_20x128x128x3_float32.npy.zip to
'calibration_image_sample_data_20x128x128x3_float32.npy.zip'…
100% 1.11M/1.11M [00:00<00:00, 18.6MB/s]
Unzipping calibration_image_sample_data_20x128x128x3_float32.npy.zip to
/content/calibration_image_sample_data_20x128x128x3_float32.npy…: 100% 1/1
[00:00<00:00, 51.82file/s]

ONNX: starting export with onnx 1.16.1 opset 19…
ONNX: slimming with onnxslim 0.1.49…
ONNX: export success  3.1s, saved as 'yolov8m.onnx' (99.1 MB)
TensorFlow SavedModel: starting TFLite export with onnx2tf
1.27.1…
I0000 00:00:1743361027.348676   21374 devices.cc:67] Number of eligible GPUs
(core count >= 8, compute capability >= 0.0): 0
WARNING: All log messages before absl::InitializeLog() is called are written to
STDERR
I0000 00:00:1743361027.348835   21374 single_machine.cc:361] Starting new
session
W0000 00:00:1743361029.970164   21374 tf_tfl_flatbuffer_helpers.cc:365] Ignored
output_format.
W0000 00:00:1743361029.970202   21374 tf_tfl_flatbuffer_helpers.cc:368] Ignored
drop_control_dependency.
I0000 00:00:1743361033.243507   21374 devices.cc:67] Number of eligible GPUs
```

```
(core count >= 8, compute capability >= 0.0): 0
I0000 00:00:1743361033.243635   21374 single_machine.cc:361] Starting new
session
W0000 00:00:1743361035.956655   21374 tf_tfl_flatbuffer_helpers.cc:365] Ignored
output_format.
W0000 00:00:1743361035.956690   21374 tf_tfl_flatbuffer_helpers.cc:368] Ignored
drop_control_dependency.
TensorFlow SavedModel: export success  170.8s, saved as
'yolov8m_saved_model' (248.4 MB)

TensorFlow Lite: starting export with tensorflow 2.18.0…
TensorFlow Lite: export success  0.0s, saved as
'yolov8m_saved_model/yolov8m_float32.tflite' (99.0 MB)

Export complete (173.3s)
Results saved to /content
Predict:         yolo predict task=detect
model=yolov8m_saved_model/yolov8m_float32.tflite imgsz=640
Validate:        yolo val task=detect
model=yolov8m_saved_model/yolov8m_float32.tflite imgsz=640 data=coco.yaml
Visualize:       https://netron.app
 Learn more at https://docs.ultralytics.com/modes/export
```

##Download TFLite file

[ ]:
```
!zip -r /content/yolov8m_saved_model.zip /content/yolov8m_saved_model
```

```
  adding: content/yolov8m_saved_model/ (stored 0%)
  adding: content/yolov8m_saved_model/yolov8m_float16.tflite (deflated 8%)
  adding: content/yolov8m_saved_model/assets/ (stored 0%)
  adding: content/yolov8m_saved_model/saved_model.pb (deflated 8%)
  adding: content/yolov8m_saved_model/metadata.yaml (deflated 45%)
  adding: content/yolov8m_saved_model/fingerprint.pb (stored 0%)
  adding: content/yolov8m_saved_model/variables/ (stored 0%)
  adding: content/yolov8m_saved_model/variables/variables.index (deflated 33%)
  adding: content/yolov8m_saved_model/variables/variables.data-00000-of-00001
(deflated 86%)
  adding: content/yolov8m_saved_model/yolov8m_float32.tflite (deflated 17%)
```

[ ]:
```
from google.colab import files
files.download('/content/yolov8m_saved_model.zip')
#I download whole folder for just incase cuz idw ro rerun
#for flutter, it just use only /content/yolov8m_saved_model/yolov8m_float32.
 ↪tflite
#you can just directly download only a file
```

```
<IPython.core.display.Javascript object>
```

```
<IPython.core.display.Javascript object>
```