

train

March 28, 2024

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

Collecting ultralytics

Downloading ultralytics-8.1.35-py3-none-any.whl (723 kB)

723.1/723.1

kB 8.9 MB/s eta 0:00:00

Requirement already satisfied: matplotlib>=3.3.0 in
/usr/local/lib/python3.10/dist-packages (from ultralytics) (3.7.1)

Requirement already satisfied: opencv-python>=4.6.0 in
/usr/local/lib/python3.10/dist-packages (from ultralytics) (4.8.0.76)

Requirement already satisfied: pillow>=7.1.2 in /usr/local/lib/python3.10/dist-
packages (from ultralytics) (9.4.0)

Requirement already satisfied: pyyaml>=5.3.1 in /usr/local/lib/python3.10/dist-
packages (from ultralytics) (6.0.1)

Requirement already satisfied: requests>=2.23.0 in
/usr/local/lib/python3.10/dist-packages (from ultralytics) (2.31.0)

Requirement already satisfied: scipy>=1.4.1 in /usr/local/lib/python3.10/dist-
packages (from ultralytics) (1.11.4)

Requirement already satisfied: torch>=1.8.0 in /usr/local/lib/python3.10/dist-
packages (from ultralytics) (2.2.1+cu121)

Requirement already satisfied: torchvision>=0.9.0 in
/usr/local/lib/python3.10/dist-packages (from ultralytics) (0.17.1+cu121)

Requirement already satisfied: tqdm>=4.64.0 in /usr/local/lib/python3.10/dist-
packages (from ultralytics) (4.66.2)

Requirement already satisfied: psutil in /usr/local/lib/python3.10/dist-packages
(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: pandas>=1.1.4 in /usr/local/lib/python3.10/dist-
packages (from ultralytics) (1.5.3)

Requirement already satisfied: seaborn>=0.11.0 in
/usr/local/lib/python3.10/dist-packages (from ultralytics) (0.13.1)

Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics)

(1.2.0)

Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (0.12.1)

Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (4.50.0)

Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.4.5)

Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.25.2)

Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (24.0)

Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (3.1.2)

Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (2.8.2)

Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.1.4->ultralytics) (2023.4)

Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (3.3.2)

Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-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) (2024.2.2)

Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.13.3)

Requirement already satisfied: typing-extensions>=4.8.0 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (4.10.0)

Requirement already satisfied: sympy in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (1.12)

Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.2.1)

Requirement already satisfied: jinja2 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.1.3)

Requirement already satisfied: fsspec in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (2023.6.0)

Collecting nvidia-cuda-nvrtc-cu12==12.1.105 (from torch>=1.8.0->ultralytics)

 Downloading nvidia_cuda_nvrtc_cu12-12.1.105-py3-none-manylinux1_x86_64.whl

(23.7 MB)

23.7/23.7 MB

40.6 MB/s eta 0:00:00

Collecting nvidia-cuda-runtime-cu12==12.1.105 (from torch>=1.8.0->ultralytics)

Downloading nvidia_cuda_runtime_cu12-12.1.105-py3-none-manylinux1_x86_64.whl (823 kB)

823.6/823.6

kB 37.7 MB/s eta 0:00:00

Collecting nvidia-cuda-cupti-cu12==12.1.105 (from torch>=1.8.0->ultralytics)

Downloading nvidia_cuda_cupti_cu12-12.1.105-py3-none-manylinux1_x86_64.whl (14.1 MB)

14.1/14.1 MB

53.4 MB/s eta 0:00:00

Collecting nvidia-cudnn-cu12==8.9.2.26 (from torch>=1.8.0->ultralytics)

Downloading nvidia_cudnn_cu12-8.9.2.26-py3-none-manylinux1_x86_64.whl (731.7 MB)

731.7/731.7

MB 2.0 MB/s eta 0:00:00

Collecting nvidia-cublas-cu12==12.1.3.1 (from torch>=1.8.0->ultralytics)

Downloading nvidia_cublas_cu12-12.1.3.1-py3-none-manylinux1_x86_64.whl (410.6 MB)

410.6/410.6

MB 1.3 MB/s eta 0:00:00

Collecting nvidia-cufft-cu12==11.0.2.54 (from torch>=1.8.0->ultralytics)

Downloading nvidia_cufft_cu12-11.0.2.54-py3-none-manylinux1_x86_64.whl (121.6 MB)

121.6/121.6

MB 8.3 MB/s eta 0:00:00

Collecting nvidia-curand-cu12==10.3.2.106 (from torch>=1.8.0->ultralytics)

Downloading nvidia_curand_cu12-10.3.2.106-py3-none-manylinux1_x86_64.whl (56.5 MB)

56.5/56.5 MB

10.5 MB/s eta 0:00:00

Collecting nvidia-cusolver-cu12==11.4.5.107 (from torch>=1.8.0->ultralytics)

Downloading nvidia_cusolver_cu12-11.4.5.107-py3-none-manylinux1_x86_64.whl (124.2 MB)

124.2/124.2

MB 7.4 MB/s eta 0:00:00

Collecting nvidia-cuspars-cu12==12.1.0.106 (from torch>=1.8.0->ultralytics)

Downloading nvidia_cuspars-cu12-12.1.0.106-py3-none-manylinux1_x86_64.whl (196.0 MB)

196.0/196.0

MB 6.2 MB/s eta 0:00:00

Collecting nvidia-nccl-cu12==2.19.3 (from torch>=1.8.0->ultralytics)

Downloading nvidia_nccl_cu12-2.19.3-py3-none-manylinux1_x86_64.whl (166.0 MB)

166.0/166.0

MB 7.5 MB/s eta 0:00:00

Collecting nvidia-nvtx-cu12==12.1.105 (from torch>=1.8.0->ultralytics)

Downloading nvidia_nvtx_cu12-12.1.105-py3-none-manylinux1_x86_64.whl (99 kB)

99.1/99.1 kB

15.1 MB/s eta 0:00:00

Requirement already satisfied: triton==2.2.0 in

/usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (2.2.0)

Collecting nvidia-nvjitlink-cu12 (from nvidia-cusolver-

cu12==11.4.5.107->torch>=1.8.0->ultralytics)

Downloading nvidia_nvjitlink_cu12-12.4.99-py3-none-manylinux2014_x86_64.whl (21.1 MB)

21.1/21.1 MB

72.1 MB/s eta 0:00:00

Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (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) (2.1.5)

Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.10/dist-packages (from sympy->torch>=1.8.0->ultralytics) (1.3.0)

Installing collected packages: nvidia-nvtx-cu12, nvidia-nvjitlink-cu12, nvidia-nccl-cu12, nvidia-curand-cu12, nvidia-cufft-cu12, nvidia-cuda-runtime-cu12, nvidia-cuda-nvrtc-cu12, nvidia-cuda-cupti-cu12, nvidia-cublas-cu12, nvidia-cuspars-cu12, nvidia-cudnn-cu12, nvidia-cusolver-cu12, thop, ultralytics

Successfully installed nvidia-cublas-cu12-12.1.3.1 nvidia-cuda-cupti-cu12-12.1.105 nvidia-cuda-nvrtc-cu12-12.1.105 nvidia-cuda-runtime-cu12-12.1.105 nvidia-cudnn-cu12-8.9.2.26 nvidia-cufft-cu12-11.0.2.54 nvidia-curand-cu12-10.3.2.106 nvidia-cusolver-cu12-11.4.5.107 nvidia-cuspars-cu12-12.1.0.106 nvidia-nccl-cu12-2.19.3 nvidia-nvjitlink-cu12-12.4.99 nvidia-nvtx-cu12-12.1.105 thop-0.1.1.post2209072238 ultralytics-8.1.35

```
[2]: from ultralytics import YOLO
```

```
model = YOLO('yolov8n.pt')
```

```
[13]: results = model.train(  
      data='/content/data.yaml',  
      imgsz=(1048, 586),
```

```

    epochs=15,
    batch=8,
    name='detect'
)

```

Ultralytics YOLOv8.1.35 Python-3.10.12 torch-2.2.1+cu121 CPU (Intel Xeon 2.20GHz)

```

engine/trainer: task=detect, mode=train, model=yolov8n.pt,
data=/content/data.yaml, epochs=15, time=None, patience=100, batch=8,
imgsz=(1048, 586), save=True, save_period=-1, cache=False, device=None,
workers=0, project=None, name=detect, 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=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=0.0, box=7.5, cls=0.5, dfl=1.5, pose=12.0, kobj=1.0,
label_smoothing=0.0, 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=0.0, mixup=0.0, copy_paste=0.0, auto_augment=randaugument,
erasing=0.4, crop_fraction=1.0, cfg=None, tracker=botsort.yaml,
save_dir=runs/detect/detect

```

	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]]
Model summary: 225 layers, 3011043 parameters, 3011027 gradients, 8.2 GFLOPs

```

Transferred 355/355 items from pretrained weights

TensorBoard: Start with 'tensorboard --logdir runs/detect/detect',
view at <http://localhost:6006/>

Freezing layer 'model.22.dfl.conv.weight'

WARNING updating to 'imgsz=1048'. 'train' and 'val' imgsz must be an integer,
while 'predict' and 'export' imgsz may be a [h, w] list or an integer, i.e.
'yolo export imgsz=640,480' or 'yolo export imgsz=640'

WARNING imgsz=[1048] must be multiple of max stride 32, updating to [1056]

train: Scanning /content/dataset/train/labels.cache... 56 images, 0
backgrounds, 0 corrupt: 100%| | 56/56 [00:00<?, ?it/s]

augmentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01,
blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01, clip_limit=(1, 4.0),
tile_grid_size=(8, 8))

val: Scanning /content/dataset/val/labels.cache... 14 images, 0
backgrounds, 0 corrupt: 100%| | 14/14 [00:00<?, ?it/s]

Plotting labels to runs/detect/detect/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(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)

TensorBoard: model graph visualization added

Image sizes 1056 train, 1056 val

Using 0 dataloader workers

Logging results to runs/detect/detect

Starting training for 15 epochs...

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
1/15	OG	1.398	1.143	1.182	119	1056:
100%	7/7	[02:11<00:00, 18.78s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95): 100%	1/1	[00:06<00:00, 6.58s/it]				
	all	14	204	0.901	0.853	0.949
0.524						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
2/15	OG	1.362	1.157	1.196	119	1056:
100%	7/7	[02:09<00:00, 18.48s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95): 100%	1/1	[00:05<00:00, 5.82s/it]				
	all	14	204	0.876	0.833	0.931
0.522						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
3/15	OG	1.35	1.105	1.187	148	1056:
100%	7/7	[01:58<00:00, 16.91s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95): 100%	1/1	[00:05<00:00, 5.86s/it]				
	all	14	204	0.893	0.843	0.935
0.541						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
4/15	OG	1.423	1.168	1.214	119	1056:
100%	7/7	[02:01<00:00, 17.41s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95):	100%	1/1	[00:05<00:00, 5.61s/it]			
	all	14	204	0.905	0.863	0.958
0.542						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
5/15	OG	1.343	1.131	1.158	102	1056:
100%	7/7	[02:03<00:00, 17.62s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95):	100%	1/1	[00:07<00:00, 7.03s/it]			
	all	14	204	0.855	0.867	0.944
0.526						

Closing dataloader mosaic

[alumentations](#): Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01, clip_limit=(1, 4.0), tile_grid_size=(8, 8))

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
6/15	OG	1.339	1.076	1.168	119	1056:
100%	7/7	[02:07<00:00, 18.17s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95):	100%	1/1	[00:06<00:00, 6.64s/it]			
	all	14	204	0.895	0.837	0.948
0.547						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
7/15	OG	1.324	1.086	1.154	92	1056:
100%	7/7	[02:03<00:00, 17.68s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95):	100%	1/1	[00:06<00:00, 6.45s/it]			
	all	14	204	0.899	0.887	0.956
0.544						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
8/15	OG	1.347	1.1	1.157	117	1056:
100%	7/7	[02:05<00:00, 17.99s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95): 100%	1/1	[00:05<00:00, 5.60s/it]				
	all	14	204	0.882	0.877	0.938
0.514						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
9/15	OG	1.322	1.019	1.161	119	1056:
100%	7/7	[02:08<00:00, 18.39s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95): 100%	1/1	[00:05<00:00, 5.60s/it]				
	all	14	204	0.968	0.819	0.953
0.54						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
10/15	OG	1.311	1.024	1.153	160	1056:
100%	7/7	[02:09<00:00, 18.51s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95): 100%	1/1	[00:05<00:00, 5.59s/it]				
	all	14	204	0.951	0.85	0.937
0.535						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
11/15	OG	1.353	1.059	1.154	159	1056:
100%	7/7	[02:03<00:00, 17.65s/it]				
	Class	Images	Instances	Box(P	R	mAP50
mAP50-95): 100%	1/1	[00:05<00:00, 5.47s/it]				
	all	14	204	0.962	0.833	0.944
0.533						

Epoch	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size
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```

12/15      OG      1.278      0.9942      1.147      98      1056:
100%|      | 7/7 [02:01<00:00, 17.37s/it]
          Class      Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|      | 1/1 [00:06<00:00,  6.62s/it]
          all          14          204      0.957      0.848      0.96
0.54

```

```

Epoch      GPU_mem      box_loss      cls_loss      dfl_loss  Instances      Size
13/15      OG          1.28      0.9857      1.152      91      1056:
100%|      | 7/7 [02:02<00:00, 17.52s/it]
          Class      Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|      | 1/1 [00:06<00:00,  6.13s/it]
          all          14          204      0.923      0.877      0.956
0.551

```

```

Epoch      GPU_mem      box_loss      cls_loss      dfl_loss  Instances      Size
14/15      OG          1.288      0.967      1.127      114      1056:
100%|      | 7/7 [02:03<00:00, 17.61s/it]
          Class      Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|      | 1/1 [00:05<00:00,  5.50s/it]
          all          14          204      0.923      0.877      0.956
0.551

```

```

Epoch      GPU_mem      box_loss      cls_loss      dfl_loss  Instances      Size
15/15      OG          1.283      0.9796      1.141      124      1056:
100%|      | 7/7 [02:03<00:00, 17.62s/it]
          Class      Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|      | 1/1 [00:05<00:00,  5.65s/it]
          all          14          204      0.919      0.893      0.965
0.552

```

15 epochs completed in 0.550 hours.

Optimizer stripped from runs/detect/detect/weights/last.pt, 6.3MB

Optimizer stripped from runs/detect/detect/weights/best.pt, 6.3MB

Validating runs/detect/detect/weights/best.pt...

Ultralytics YOLOv8.1.35 Python-3.10.12 torch-2.2.1+cu121 CPU (Intel Xeon 2.20GHz)

Model summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GFLOPs

	Class	Images	Instances	Box(P	R	mAP50
mAP50-95): 100%		1/1	[00:05<00:00,	5.56s/it]		
	all	14	204	0.919	0.892	0.966

0.552

Speed: 3.5ms preprocess, 349.8ms inference, 0.0ms loss, 26.0ms postprocess per image

Results saved to runs/detect/detect