

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

Collecting ultralytics

Downloading ultralytics-8.0.189-py3-none-any.whl (615 kB)

615.6/615.6 kB 8.6 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: numpy>=1.22.2 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (1.23.5)
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) (1.11.2)
Requirement already satisfied: torch>=1.8.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.0.1+cu118)
Requirement already satisfied: torchvision>=0.9.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (0.15.2+cu118)
Requirement already satisfied: tqdm>=4.64.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (4.66.1)
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) (0.12.2)
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)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.1.0)
Requirement already satisfied:ycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (4.42.1)
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: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (23.1)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (3.1.1)
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) (2023.3.post1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (3.2.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (3.4)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (2.0.4)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (2023.7.22)
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.12.2)
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (4.5.0)
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) (3.1)
Requirement already satisfied: Jinja2 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.1.2)
Requirement already satisfied: triton==2.0.0 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (2.0.0)
Requirement already satisfied: cmake in /usr/local/lib/python3.10/dist-packages (from triton==2.0.0->torch>=1.8.0->ultralytics) (3.27.4.1)
Requirement already satisfied: lit in /usr/local/lib/python3.10/dist-packages (from triton==2.0.0->torch>=1.8.0->ultralytics) (16.0.6)
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) (2.1.3)
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: ultralytics
Successfully installed ultralytics-8.0.189

```
In [3]: import os
import shutil
import random

!pip install tqdm --upgrade
from tqdm.notebook import tqdm
```

Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packages (4.66.1)

```
In [4]: from IPython import display
display.clear_output()

import ultralytics
ultralytics.checks()
```

Ultralytics YOLOv8.0.189 Python-3.10.12 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)
Setup complete (2 CPUs, 12.7 GB RAM, 26.3/78.2 GB disk)

```
In [5]: from ultralytics import YOLO

from IPython.display import display, Image
```

```
In [15]: import os
HOME = '/content/drive/MyDrive'
print(HOME)

/content/drive/MyDrive
```

```
In [17]: %cd {HOME}
!yolo task=detect mode=train model=yolov8s.pt data=/content/drive/MyDrive/datasets/train-3/data.yaml epochs=25 imgsz=640 plots=True save=True
```


```

/content/drive/MyDrive
UltraLytics YOLOv8.0.189 Python-3.10.12 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)
engine/trainer: task=detect, mode=train, model=yolov8s.pt, data=/content/drive/MyDrive/datasets/train-3/data.yaml, epochs=25, patience=50, batch=16, imgs=640, save=True, save_period=1, cache=False, device=None, workers=8, project=None, name=None, 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, overlap_mask=True, mask_ratio=0.0, 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, show=False, save_txt=False, save_conf=False, save_crop=False, show_labels=True, show_conf=True, vid_stride=1, stream_buffer=False, line_width=None, visualize=False, augment=False, agnostic_nms=False, classes=None, retina_masks=False, boxes=True, 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=0.1, 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, mosaic=1.0, mixup=0.0, copy_paste=0.0, cfg=None, tracker=botsort.yaml, save_dir=runs/detect/train3
Overriding model.yaml nc=80 with nc=75

```

	from	n	params	module	arguments
0	-1	1	928	ultralytics.nn.modules.conv.Conv	[3, 32, 3, 2]
1	-1	1	18560	ultralytics.nn.modules.conv.Conv	[32, 64, 3, 2]
2	-1	1	29056	ultralytics.nn.modules.block.C2f	[64, 64, 1, True]
3	-1	1	73984	ultralytics.nn.modules.conv.Conv	[64, 128, 3, 2]
4	-1	2	197632	ultralytics.nn.modules.block.C2f	[128, 128, 2, True]
5	-1	1	295424	ultralytics.nn.modules.conv.Conv	[128, 256, 3, 2]
6	-1	2	788480	ultralytics.nn.modules.block.C2f	[256, 256, 2, True]
7	-1	1	1180672	ultralytics.nn.modules.conv.Conv	[256, 512, 3, 2]
8	-1	1	1838080	ultralytics.nn.modules.block.C2f	[512, 512, 1, True]
9	-1	1	656896	ultralytics.nn.modules.block.SPPF	[512, 512, 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	591360	ultralytics.nn.modules.block.C2f	[768, 256, 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	148224	ultralytics.nn.modules.block.C2f	[384, 128, 1]
16	-1	1	147712	ultralytics.nn.modules.conv.Conv	[128, 128, 3, 2]
17	[-1, 12]	1	0	ultralytics.nn.modules.conv.Concat	[1]
18	-1	1	493056	ultralytics.nn.modules.block.C2f	[384, 256, 1]
19	-1	1	590336	ultralytics.nn.modules.conv.Conv	[256, 256, 3, 2]
20	[-1, 9]	1	0	ultralytics.nn.modules.conv.Concat	[1]
21	-1	1	1969152	ultralytics.nn.modules.block.C2f	[768, 512, 1]
22	[15, 18, 21]	1	2145073	ultralytics.nn.modules.head.Detect	[75, [128, 256, 512]]

Model summary: 225 layers, 11164625 parameters, 11164609 gradients

Transferred 349/355 items from pretrained weights
TensorBoard: Start with 'tensorboard --logdir runs/detect/train3', view at http://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
AMP: checks passed 
train: Scanning /content/drive/MyDrive/datasets/train-3/train/labels.cache... 6116 images, 0 backgrounds, 0 corrupt: 100% 6116/6116 [00:00<?, ?it/s]
albumations: 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/drive/MyDrive/datasets/New folder (3)/test/labels... 1943 images, 0 backgrounds, 0 corrupt: 100% 1943/1943 [20:56<00:00, 1.55it/s]
val: New cache created: /content/drive/MyDrive/datasets/New folder (3)/test/labels.cache
Plotting labels to runs/detect/train3/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=0.000127, momentum=0.9) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train3
Starting training for 25 epochs...

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/25	4.25G	1.288	6.634	1.056	6	640: 100% 383/383 [02:45<00:00, 2.31it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 61/61 [00:28<00:00, 2.11it/s]
	all	1943	2434	0.515	0.0842	0.0512 0.0412
2/25	4.33G	1.148	3.048	0.9887	11	640: 100% 383/383 [02:43<00:00, 2.35it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 61/61 [00:28<00:00, 2.14it/s]
	all	1943	2434	0.524	0.122	0.0813 0.0653
3/25	4.32G	1.113	2.31	0.9803	1	640: 100% 383/383 [02:43<00:00, 2.34it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 61/61 [00:30<00:00, 1.98it/s]
	all	1943	2434	0.385	0.139	0.105 0.0862
4/25	4.33G	1.089	1.979	0.9727	8	640: 100% 383/383 [02:44<00:00, 2.33it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 61/61 [00:27<00:00, 2.24it/s]
	all	1943	2434	0.289	0.142	0.121 0.101
5/25	4.32G	1.04	1.762	0.9562	10	640: 100% 383/383 [02:43<00:00, 2.35it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 61/61 [00:27<00:00, 2.21it/s]
	all	1943	2434	0.316	0.149	0.125 0.103
6/25	4.33G	1.043	1.628	0.9587	6	640: 100% 383/383 [02:41<00:00, 2.36it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 61/61 [00:27<00:00, 2.20it/s]
	all	1943	2434	0.212	0.159	0.14 0.12
7/25	4.32G	1.003	1.491	0.9468	9	640: 100% 383/383 [02:44<00:00, 2.33it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 61/61 [00:26<00:00, 2.29it/s]
	all	1943	2434	0.35	0.143	0.143 0.12
8/25	4.35G	1.002	1.408	0.9436	11	640: 100% 383/383 [02:40<00:00, 2.39it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 61/61 [00:27<00:00, 2.21it/s]
	all	1943	2434	0.304	0.16	0.151 0.127
9/25	4.35G	0.9567	1.291	0.9357	14	640: 100% 383/383 [02:42<00:00, 2.35it/s]

	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.19it/s]
	all	1943	2434	0.295	0.152	0.152	0.128		
Epoch 10/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.34G	0.9539	1.242	0.935	9	640:	100%	383/383	[02:43<00:00, 2.34it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.22it/s]
	all	1943	2434	0.376	0.146	0.154	0.13		
Epoch 11/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.94	1.169	0.928	10	640:	100%	383/383	[02:40<00:00, 2.38it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:26<00:00, 2.27it/s]
	all	1943	2434	0.288	0.152	0.147	0.124		
Epoch 12/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.9292	1.144	0.9259	3	640:	100%	383/383	[02:41<00:00, 2.38it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.22it/s]
	all	1943	2434	0.334	0.137	0.152	0.129		
Epoch 13/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.9126	1.083	0.9193	6	640:	100%	383/383	[02:43<00:00, 2.35it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:29<00:00, 2.10it/s]
	all	1943	2434	0.365	0.14	0.152	0.128		
Epoch 14/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.901	1.049	0.9218	4	640:	100%	383/383	[02:38<00:00, 2.41it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:29<00:00, 2.06it/s]
	all	1943	2434	0.357	0.153	0.161	0.137		
Epoch 15/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.9044	1.019	0.9157	5	640:	100%	383/383	[02:43<00:00, 2.34it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.19it/s]
	all	1943	2434	0.258	0.154	0.154	0.132		

Closing dataloader mosaic
albumentations: 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 16/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.8666	0.9418	0.9266	6	640:	100%	383/383	[02:35<00:00, 2.47it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.23it/s]
	all	1943	2434	0.308	0.156	0.156	0.132		
Epoch 17/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.32G	0.85	0.8806	0.9197	5	640:	100%	383/383	[02:32<00:00, 2.51it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.19it/s]
	all	1943	2434	0.315	0.168	0.163	0.139		
Epoch 18/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.34G	0.8293	0.8332	0.9086	7	640:	100%	383/383	[02:33<00:00, 2.49it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.19it/s]
	all	1943	2434	0.342	0.148	0.157	0.134		
Epoch 19/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.8208	0.8176	0.906	4	640:	100%	383/383	[02:32<00:00, 2.52it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.23it/s]
	all	1943	2434	0.34	0.151	0.156	0.134		
Epoch 20/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.34G	0.8145	0.7894	0.9039	4	640:	100%	383/383	[02:34<00:00, 2.48it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:28<00:00, 2.14it/s]
	all	1943	2434	0.38	0.136	0.158	0.134		
Epoch 21/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.8054	0.7665	0.9017	4	640:	100%	383/383	[02:32<00:00, 2.51it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.19it/s]
	all	1943	2434	0.314	0.157	0.154	0.131		
Epoch 22/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.7904	0.7407	0.8986	4	640:	100%	383/383	[02:35<00:00, 2.46it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.22it/s]
	all	1943	2434	0.337	0.145	0.156	0.133		
Epoch 23/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.32G	0.777	0.7251	0.8957	4	640:	100%	383/383	[02:35<00:00, 2.46it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:26<00:00, 2.29it/s]
	all	1943	2434	0.341	0.15	0.155	0.132		
Epoch 24/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.7796	0.7129	0.8955	4	640:	100%	383/383	[02:34<00:00, 2.49it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.23it/s]
	all	1943	2434	0.34	0.151	0.155	0.133		
Epoch 25/25	GPU_mem	box_loss	cls_loss	df1_loss	Instances	Size			
	4.33G	0.7671	0.6968	0.8948	6	640:	100%	383/383	[02:34<00:00, 2.47it/s]
	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:27<00:00, 2.22it/s]
	all	1943	2434	0.338	0.152	0.152	0.13		

25 epochs completed in 1.312 hours.
 Optimizer stripped from runs/detect/train3/weights/last.pt, 22.6MB
 Optimizer stripped from runs/detect/train3/weights/best.pt, 22.6MB

Validating runs/detect/train3/weights/best.pt...
 Ultralytics YOLOv8.0.189 Python-3.10.12 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)

Model summary (fused): 168 layers, 11154609 parameters, 0 gradients

	Class	Images	Instances	Box(P)	R	mAP50	mAP50-95): 100%	61/61	[00:30<00:00, 2.03it/s]
	all	1943	2434	0.315	0.168	0.163	0.139		
	APR-09	1943	39	0.712	0.692	0.684	0.566		
	APR-10	1943	16	0.809	1	0.978	0.825		
	APR-11	1943	21	0.92	1	0.985	0.813		
	APR-12	1943	44	0.834	0.773	0.793	0.642		
	APR-14	1943	15	0.547	0.646	0.64	0.544		

DWS-01	1943	79	0.822	0.987	0.965	0.856
DWS-02	1943	73	0.819	0.945	0.962	0.846
DWS-03	1943	43	0.646	1	0.964	0.859
DWS-04	1943	51	0.743	0.963	0.944	0.823
DWS-09	1943	28	0	0	0.0462	0.0371
DWS-10	1943	8	0.165	0.75	0.127	0.105
DWS-11	1943	20	0	0	0	0
DWS-12	1943	9	0.143	0.333	0.124	0.11
DWS-13	1943	11	0.43	0.823	0.444	0.393
DWS-14	1943	93	0	0	0.143	0.129
DWS-15	1943	9	0	0	0.0598	0.0507
DWS-16	1943	58	1	0	0.0167	0.0143
DWS-17	1943	33	0	0	0.00647	0.00588
DWS-18	1943	10	0	0	0.0115	0.00964
DWS-19	1943	58	0	0	0.00406	0.00296
DWS-20	1943	165	0	0	0.00302	0.00181
DWS-21	1943	69	0	0	0	0
DWS-25	1943	16	0	0	0.0169	0.0105
DWS-26	1943	20	0	0	0	0
DWS-27	1943	23	1	0	0.624	0.54
DWS-28	1943	12	1	0	0	0
DWS-29	1943	88	1	0	0	0
DWS-32	1943	11	0	0	7.37e-05	7.37e-05
DWS-33	1943	6	0	0	0	0
DWS-35	1943	137	0	0	0	0
DWS-36	1943	7	1	0	0	0
DWS-40	1943	12	0	0	0	0
DWS-41	1943	28	0	0	0	0
DWS-42	1943	239	1	0	0	0
DWS-44	1943	47	1	0	0.0168	0.0135
DWS-46	1943	13	0	0	0	0
MNS-01	1943	9	0	0	0	0
MNS-02	1943	21	1	0	0	0
MNS-03	1943	21	1	0	0	0
MNS-04	1943	13	1	0	0	0
MNS-05	1943	27	1	0	0	0
MNS-06	1943	28	0	0	0.00213	0.0012
MNS-07	1943	13	0	0	0.0265	0.0234
MNS-09	1943	60	0	0	0	0
OSD-01	1943	33	0	0	8.49e-05	3.26e-05
OSD-02	1943	31	0	0	0	0
OSD-03	1943	12	0	0	0	0
OSD-04	1943	35	0	0	0	0
OSD-06	1943	11	0	0	0.000175	0.00014
OSD-07	1943	75	0	0	0	0
OSD-16	1943	45	0	0	0	0
OSD-17	1943	29	0	0	0	0
OSD-26	1943	26	0	0	0	0
PHS-01	1943	31	0	0	0	0
PHS-02	1943	8	0	0	0.00312	0.00287
PHS-03	1943	46	0	0	0	0
PHS-04	1943	179	0	0	0	0
PHS-09	1943	32	0	0	0	0
PHS-23	1943	38	0	0	0.000115	2.31e-05

Speed: 0.4ms preprocess, 4.4ms inference, 0.0ms loss, 2.1ms postprocess per image

Results saved to **runs/detect/train3**

🔗 Learn more at <https://docs.ultralytics.com/modes/train>

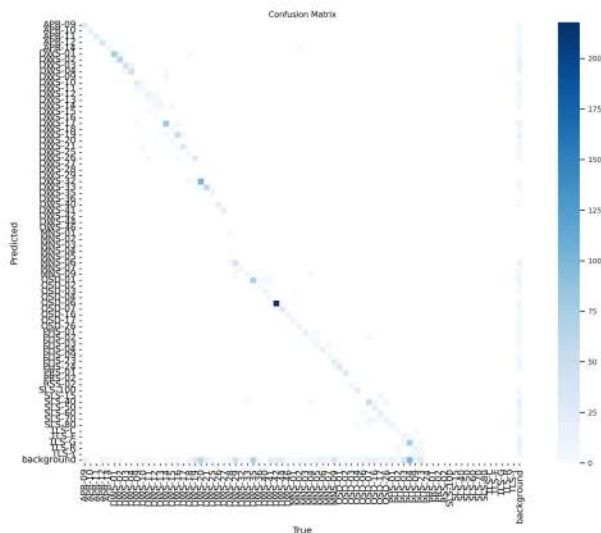
In [18]: !ls {HOME}/runs/detect/train3/

```
args.yaml
confusion_matrix_normalized.png
confusion_matrix.png
events.out.tfevents.1695957040.4edcc17405c9.29727.0
F1_curve.png
labels_correlogram.jpg
labels.jpg
P_curve.png
PR_curve.png
R_curve.png
results.csv
results.png
train_batch0.jpg
train_batch1.jpg
train_batch2.jpg
train_batch5745.jpg
train_batch5746.jpg
train_batch5747.jpg
val_batch0_labels.jpg
val_batch0_pred.jpg
val_batch1_labels.jpg
val_batch1_pred.jpg
val_batch2_labels.jpg
val_batch2_pred.jpg
weights
```

In [19]: %cd {HOME}
Image(filename=f'{HOME}/runs/detect/train3/confusion_matrix.png', width=600)

/content/drive/MyDrive

Out[19]:

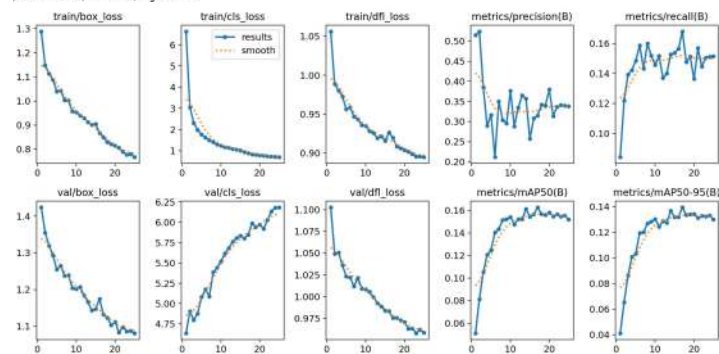


In [20]:

```
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train3/results.png', width=600)
```

Out[20]:

/content/drive/MyDrive



In [21]:

```
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train3/val_batch0_pred.jpg', width=600)
```

Out[21]:



In [22]:

```
%cd {HOME}

!yolo task=detect mode=val model={HOME}/runs/detect/train3/weights/best.pt data=/content/drive/MyDrive/datasets/train-3/data.yaml
```



```

/content/drive/MyDrive
Ultralytics YOLOv8.0.189 Python-3.10.12 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 168 layers, 11154609 parameters, 0 gradients
val: Scanning /content/drive/MyDrive/datasets/New folder (3)/test/labels.cache... 1943 images, 0 backgrounds, 0 corrupt: 100% 1943/1943 [00:00<?, ?it/s]

```

Class	Images	Instances	Box(P)	R	mAP50	mAP50-95)
a11	1943	2434	0.315	0.168	0.162	0.139
APR-09	1943	39	0.714	0.692	0.684	0.559
APR-10	1943	16	0.813	1	0.978	0.825
APR-11	1943	21	0.921	1	0.985	0.807
APR-12	1943	44	0.834	0.773	0.793	0.638
APR-14	1943	15	0.545	0.639	0.64	0.552
DWS-01	1943	79	0.823	0.987	0.965	0.862
DWS-02	1943	73	0.822	0.945	0.962	0.844
DWS-03	1943	43	0.647	1	0.964	0.852
DWS-04	1943	51	0.741	0.954	0.944	0.821
DWS-09	1943	28	0	0	0.0459	0.037
DWS-10	1943	8	0.166	0.75	0.127	0.105
DWS-11	1943	20	0	0	0	0
DWS-12	1943	9	0.143	0.333	0.124	0.112
DWS-13	1943	11	0.428	0.816	0.426	0.384
DWS-14	1943	93	0	0	0.142	0.128
DWS-15	1943	9	0	0	0.0598	0.0507
DWS-16	1943	58	1	0	0.0168	0.0144
DWS-17	1943	33	0	0	0.00645	0.0058
DWS-18	1943	10	0	0	0.0115	0.0093
DWS-19	1943	58	0	0	0.00406	0.00296
DWS-20	1943	165	0	0	0.00302	0.00181
DWS-21	1943	69	0	0	0	0
DWS-25	1943	16	0	0	0.0169	0.0105
DWS-26	1943	20	0	0	0	0
DWS-27	1943	23	1	0	0.624	0.54
DWS-28	1943	12	1	0	0	0
DWS-29	1943	88	1	0	0	0
DWS-32	1943	11	0	0	7.37e-05	7.37e-05
DWS-33	1943	6	0	0	0	0
DWS-35	1943	137	0	0	0	0
DWS-36	1943	7	1	0	0	0
DWS-40	1943	12	0	0	0	0
DWS-41	1943	28	0	0	0	0
DWS-42	1943	239	1	0	0	0
DWS-44	1943	47	1	0	0.0168	0.0135
DWS-46	1943	13	0	0	0	0
MNS-01	1943	9	0	0	0	0
MNS-02	1943	21	1	0	0	0
MNS-03	1943	21	1	0	0	0
MNS-04	1943	13	1	0	0	0
MNS-05	1943	27	1	0	0	0
MNS-06	1943	28	0	0	0.00213	0.00119
MNS-07	1943	13	0	0	0.0263	0.0228
MNS-09	1943	60	0	0	0	0
OSD-01	1943	33	0	0	8.45e-05	3.26e-05
OSD-02	1943	31	0	0	0	0
OSD-03	1943	12	0	0	0	0
OSD-04	1943	35	0	0	0	0
OSD-06	1943	11	0	0	0.000174	0.00014
OSD-07	1943	75	0	0	0	0
OSD-16	1943	45	0	0	0	0
OSD-17	1943	29	0	0	0	0
OSD-26	1943	26	0	0	0	0
PHS-01	1943	31	0	0	0	0
PHS-02	1943	8	0	0	0.00315	0.0029
PHS-03	1943	46	0	0	0	0
PHS-04	1943	179	0	0	0	0
PHS-09	1943	32	0	0	0	0
PHS-23	1943	38	0	0	0.000115	2.31e-05

Speed: 0.5ms preprocess, 9.0ms inference, 0.0ms loss, 1.6ms postprocess per image
 Results saved to runs/detect/val
 Learn more at <https://docs.ultralytics.com/modes/val>

```

In [23]: %cd {HOME}
          !yolo task=detect mode=predict model={HOME}/runs/detect/train3/weights/best.pt conf=0.25 source=/content/drive/MyDrive/datasets/train-3/valid/images save=

```

```

/content/drive/MyDrive
Ultralytics YOLOv8.0.189 Python-3.10.12 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 168 layers, 11154609 parameters, 0 gradients

image 1/13 /content/drive/MyDrive/datasets/train-3/valid/images/1779_jpg.rf.bd8fb73e8f6730b53a7df2b18bb53975.jpg: 640x640 1 OSD-06, 16.6ms
image 2/13 /content/drive/MyDrive/datasets/train-3/valid/images/1780_jpg.rf.aa8084d646aec5ab343018cebc5a3ed0.jpg: 640x640 1 DWS-32, 16.5ms
image 3/13 /content/drive/MyDrive/datasets/train-3/valid/images/1791_jpg.rf.212bf70a1194dd03138204d3750eced9.jpg: 640x640 1 OSD-06, 16.5ms
image 4/13 /content/drive/MyDrive/datasets/train-3/valid/images/1794c_jpg.rf.c4f9452c432bfadfc7b5fc7408452658.jpg: 640x640 1 DWS-01, 16.5ms
image 5/13 /content/drive/MyDrive/datasets/train-3/valid/images/1795_jpg.rf.751ad923fecfd729bf560059666ab4da.jpg: 640x640 1 OSD-06, 16.5ms
image 6/13 /content/drive/MyDrive/datasets/train-3/valid/images/1801c_jpg.rf.07c4afc2fa7744eefe30348cfe8764b9.jpg: 640x640 1 SLS-60, 16.5ms
image 7/13 /content/drive/MyDrive/datasets/train-3/valid/images/1802_jpg.rf.fdebc6d0ba625b0a4a498e8012676636.jpg: 640x640 1 DWS-33, 16.9ms
image 8/13 /content/drive/MyDrive/datasets/train-3/valid/images/1802c_jpg.rf.70356c5f45ad47b817ac43c665a853cf.jpg: 640x640 1 DWS-33, 16.5ms
image 9/13 /content/drive/MyDrive/datasets/train-3/valid/images/1802d_jpg.rf.7c2ab24a568104fef151570b9b6966ae.jpg: 640x640 1 DWS-33, 16.5ms
image 10/13 /content/drive/MyDrive/datasets/train-3/valid/images/1804_jpg.rf.c44463d71d16f428a9ecfbb2a342a6b7.jpg: 640x640 1 DWS-32, 16.5ms
image 11/13 /content/drive/MyDrive/datasets/train-3/valid/images/1805_jpg.rf.f8dc3c8468827b99f4091d26382e7b8.jpg: 640x640 1 OSD-01, 16.5ms
image 12/13 /content/drive/MyDrive/datasets/train-3/valid/images/1806c_jpg.rf.d81d73ea8ee57ea98d0f1aabc5f7650e.jpg: 640x640 1 DWS-25, 16.5ms
image 13/13 /content/drive/MyDrive/datasets/train-3/valid/images/1812a_jpg.rf.a67cc2ef96aec0bca65e3b886c61b566.jpg: 640x640 1 DWS-33, 16.5ms
Speed: 1.8ms preprocess, 16.5ms inference, 11.3ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/predict
Learn more at https://docs.ultralytics.com/modes/predict

```

```

In [24]: import glob
          from IPython.display import Image, display

          for image_path in glob.glob(f'{HOME}/runs/detect/predict/*.jpg')[1:12]:
              display(Image(filename=image_path, width=600))
              print("\n")

```













```
In [26]: %cd {HOME}
!yolo task=detect mode=predict model={HOME}/runs/detect/train3/weights/best.pt conf=0.25 source=/content/drive/MyDrive/datasets/train-3/test/images save=Tr

/content/drive/MyDrive
Ultralytics YOLOv8.0.189 Python-3.10.12 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 168 layers, 11154609 parameters, 0 gradients

image 1/13 /content/drive/MyDrive/datasets/train-3/test/images/1463b.jpg.rf.a7d3949df0d394c9e997422c08c79625.jpg: 640x640 1 OSD-06, 16.5ms
image 2/13 /content/drive/MyDrive/datasets/train-3/test/images/1464a.jpg.rf.8d7caff2fea0f915b719e29d44932246.jpg: 640x640 1 DWS-19, 16.5ms
image 3/13 /content/drive/MyDrive/datasets/train-3/test/images/1464a.jpg.rf.289f9c8b2d06aa097b43027412bd0c20.jpg: 640x640 1 DWS-19, 16.5ms
image 4/13 /content/drive/MyDrive/datasets/train-3/test/images/1465.jpg.rf.87a23bb8a29c3b2afbfc7dc7590b00fc.jpg: 640x640 1 DWS-01, 16.6ms
image 5/13 /content/drive/MyDrive/datasets/train-3/test/images/1465a.jpg.rf.2c2386c5439a077848b21411b7b31a7d.jpg: 640x640 1 DWS-01, 16.6ms
image 6/13 /content/drive/MyDrive/datasets/train-3/test/images/1466a.jpg.rf.688a1cbeba8afe04991629aa62df4593.jpg: 640x640 1 OSD-06, 16.6ms
image 7/13 /content/drive/MyDrive/datasets/train-3/test/images/1467c.jpg.rf.4b2baf1597184b159c0bfddc22817678.jpg: 640x640 1 DWS-19, 1 DWS-32, 16.6ms
image 8/13 /content/drive/MyDrive/datasets/train-3/test/images/1468b.jpg.rf.f1e479e15a6e5baa011b5a225b7b2a2b.jpg: 640x640 1 OSD-06, 16.6ms
image 9/13 /content/drive/MyDrive/datasets/train-3/test/images/1469c.jpg.rf.80cd4ed85572d353ba3a34337ee37f41.jpg: 640x640 1 OSD-06, 16.6ms
image 10/13 /content/drive/MyDrive/datasets/train-3/test/images/1470d.jpg.rf.981be5f874fa15c17196c21a67e632a9.jpg: 640x640 1 DWS-17, 16.6ms
image 11/13 /content/drive/MyDrive/datasets/train-3/test/images/1471.jpg.rf.f0579696b6db1ce0d582772e76706f73.jpg: 640x640 1 DWS-02, 16.6ms
image 12/13 /content/drive/MyDrive/datasets/train-3/test/images/1475.jpg.rf.36625832826c54e6a5b5fec08c993a41.jpg: 640x640 1 OSD-06, 16.6ms
image 13/13 /content/drive/MyDrive/datasets/train-3/test/images/1475c.jpg.rf.d08f60286d7930bfabd2178c0aa7e468.jpg: 640x640 1 OSD-06, 16.6ms
Speed: 1.8ms preprocess, 16.6ms inference, 11.1ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/predict2
🔗 Learn more at https://docs.ultralytics.com/modes/predict
```

```
In [27]: import glob
from IPython.display import Image, display

for image_path in glob.glob(f'{HOME}/runs/detect/predict2/*.jpg')[:12]:
    display(Image(filename=image_path, width=600))
    print("\n")
```











