Mount Drive

```
from google.colab import drive
drive.mount('/content/drive')
```

Mounted at /content/drive

```
# Creates your data.yaml file inside Google Drive automatically

yaml_content = """# data.yaml for your Ninja 250R part detector

# Path to your dataset root (this folder contains images/ and labels/)
path: /content/drive/MyDrive/ninja250_parts

# Relative paths from that root
train: images/train
val: images/train

# Class names (each one gets an integer ID starting from 0)
names:
  0: front_brake_caliper
  1: rear_brake_caliper
  2: front_disc
  3: rear_disc
  4: chain
  5: radiator
  6: front_sprocket_cover
  7: coolant_reservoir
  8: rear_sprocket
  9: headlight
  10: taillight
  11: clutch_lever
  12: brake_lever
  13: battery
  14: carburetor
"""

# Save it into your Drive
with open("/content/drive/MyDrive/ninja250_parts/data.yaml", "w") as f:
    f.write(yaml_content)

print("✅ data.yaml created at /content/drive/MyDrive/ninja250_parts/data.yaml")
```

✅ data.yaml created at /content/drive/MyDrive/ninja250_parts/data.yaml

Import Yolo, a tool we will be using to format data into an easy training pack

```
!pip -q install ultralytics==8.3.25

from ultralytics import YOLO
```

```
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 0.0/878.7 kB ? eta -:--:--
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 870.4/878.7 kB 28.2 MB/s eta 0:00:01
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 878.7/878.7 kB 20.6 MB/s eta 0:00:00
```
Creating new Ultralytics Settings v0.0.6 file ✅
View Ultralytics Settings with 'yolo settings' or at '/root/.config/Ultralytics/settings.json'
Update Settings with 'yolo settings key=value', i.e. 'yolo settings runs_dir=path/to/dir'. For help see https://
docs.ultralytics.com/quickstart/#ultralytics-settings.

This next cell verifies the file directory is setup correctly, prompting the user if the structure is missing components

```
import os, glob

BASE = "/content/drive/MyDrive/ninja250_parts"

required = [
    BASE,
    BASE + "/images/train",
    BASE + "/labels/train",
    BASE + "/data.yaml"
]

for p in required:
    print(p, "FOUND" if os.path.exists(p) else "MISSING")

# Count images vs labels
image_files = glob.glob(BASE + "/images/train/*.jpg") + glob.glob(BASE + "/images/train/*.jpeg") + glob.glob(BAS
label_files = glob.glob(BASE + "/labels/train/*.txt")

img_names = {os.path.splitext(os.path.basename(f))[0] for f in image_files}
lbl_names = {os.path.splitext(os.path.basename(f))[0] for f in label_files}
```

```
missing_labels = sorted(list(img_names - lbl_names))
missing_images = sorted(list(lbl_names - img_names))

print(f"\nTotal images: {len(img_names)}")
print(f"Total labels: {len(lbl_names)}")
print("Images missing labels:", missing_labels[:10])
print("Labels with no image:", missing_images[:10])
```

```
/content/drive/MyDrive/ninja250_parts FOUND
/content/drive/MyDrive/ninja250_parts/images/train FOUND
/content/drive/MyDrive/ninja250_parts/labels/train FOUND
/content/drive/MyDrive/ninja250_parts/data.yaml FOUND

Total images: 486
Total labels: 486
Images missing labels: []
Labels with no image: []
```

Time to train the model. The resulting weights (our custom model) will be stored within the file structure.

In [ ]:
```python
DATA_YAML = "/content/drive/MyDrive/ninja250_parts/data.yaml"

# Load a small pretrained YOLOv8 model (nano = fast to train)
model = YOLO('yolov8n.pt')

results = model.train(
    data=DATA_YAML,                          # points to data.yaml
    epochs=60,                               # you can bump to 100+ later
    imgsz=768,                               # higher than 640 helps with small parts
    batch=16,                                # drop to 8 or 4 if you OOM
    workers=2,                               # 2 is fine/stable in Colab
    device=0,                                # 0 = GPU
    project="/content/drive/MyDrive/ninja250_parts",
    name="yolov8n_parts",
    pretrained=True,
    cos_lr=True,
    patience=15,                             # stop early if no val improvement
)

print("Training complete.")
```

New https://pypi.org/project/ultralytics/8.3.222 available 😊 Update with 'pip install -U ultralytics'
Ultralytics 8.3.25 Python-3.12.12 torch-2.8.0+cu126 CUDA:0 (Tesla T4, 15095MiB)
engine/trainer: task=detect, mode=train, model=yolov8n.pt, data=/content/drive/MyDrive/ninja250_parts/data.yaml,
epochs=60, time=None, patience=15, batch=16, imgsz=768, save=True, save_period=-1, cache=False, device=0, worker
s=2, project=/content/drive/MyDrive/ninja250_parts, name=yolov8n_parts2, exist_ok=False, pretrained=True, optimi
zer=auto, verbose=True, seed=0, deterministic=True, single_cls=False, rect=False, cos_lr=True, close_mosaic=10,
resume=False, amp=True, fraction=1.0, profile=False, freeze=None, multi_scale=False, overlap_mask=True, mask_rat
io=4, dropout=0.0, val=True, split=val, save_json=False, save_hybrid=False, conf=None, iou=0.7, max_det=300, hal
f=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=tor
chscript, keras=False, optimize=False, int8=False, dynamic=False, simplify=True, opset=None, workspace=4, nms=Fa
lse, lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warmup_bia
s_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, h
sv_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, mo
saic=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=/content/drive/MyDrive/ninja250_parts/yolov8n_parts2
Overriding model.yaml nc=80 with nc=15

	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	754237	ultralytics.nn.modules.head.Detect	[15, [64, 128, 256]]

Model summary: 225 layers, 3,013,773 parameters, 3,013,757 gradients, 8.2 GFLOPs

Transferred 319/355 items from pretrained weights
TensorBoard: Start with 'tensorboard --logdir /content/drive/MyDrive/ninja250_parts/yolov8n_parts2', view at htt
p://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks...
AMP: checks passed ✅

train: Scanning /content/drive/MyDrive/ninja250_parts/labels/train.cache... 486 images, 0 backgrounds, 0 corrupt
: 100%|████████████| 486/486 [00:00<?, ?it/s]
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01, method='w
eighted_average', num_output_channels=3), CLAHE(p=0.01, clip_limit=(1.0, 4.0), tile_grid_size=(8, 8))
/usr/local/lib/python3.12/dist-packages/ultralytics/data/augment.py:1850: UserWarning: Argument(s) 'quality_lowe
r' are not valid for transform ImageCompression
  A.ImageCompression(quality_lower=75, p=0.0),
val: Scanning /content/drive/MyDrive/ninja250_parts/labels/train.cache... 486 images, 0 backgrounds, 0 corrupt:
100%|████████████| 486/486 [00:00<?, ?it/s]
Plotting labels to /content/drive/MyDrive/ninja250_parts/yolov8n_parts2/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best 'optimizer', 'l
r0' and 'momentum' automatically...
optimizer: AdamW(lr=0.000526, 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 768 train, 768 val
Using 2 dataloader workers
Logging results to **/content/drive/MyDrive/ninja250_parts/yolov8n_parts2**
Starting training for 60 epochs...

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/60	3.13G	2.087	4.659	2.199	29	768: 100%|████████████| 31/31 [00:21<00:00, 1.48it/s]

	Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|████████████| 16/16 [00:10<00:00, 1.49it/s]
	all	486	1022	0.0539	0.122	0.0622	0.0304

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size

```
        2/60      3.21G      1.862      4.198      2.009         27       768: 100%|████████| 31/31 [00:18<00:
00,  1.67it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:10<00:00,  1.55it/s]
                all        486       1022    0.00678      0.591      0.137     0.0676

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        3/60      3.23G      1.848      3.642      1.957         27       768: 100%|████████| 31/31 [00:17<00:
00,  1.74it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:11<00:00,  1.43it/s]
                all        486       1022      0.428      0.253      0.249      0.115

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        4/60      3.11G      1.874      3.232      1.929         24       768: 100%|████████| 31/31 [00:17<00:
00,  1.78it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:10<00:00,  1.47it/s]
                all        486       1022      0.431      0.317      0.321      0.144

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        5/60      3.24G      1.852      2.997      1.898         35       768: 100%|████████| 31/31 [00:17<00:
00,  1.79it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:11<00:00,  1.45it/s]
                all        486       1022      0.579      0.305      0.326      0.135

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        6/60      3.24G      1.763      2.746      1.841         25       768: 100%|████████| 31/31 [00:16<00:
00,  1.84it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:10<00:00,  1.47it/s]
                all        486       1022      0.466      0.488      0.467      0.229

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        7/60      3.24G      1.701      2.546      1.771         27       768: 100%|████████| 31/31 [00:17<00:
00,  1.80it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:10<00:00,  1.48it/s]
                all        486       1022      0.709       0.49      0.573       0.29

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        8/60      3.11G      1.723      2.461      1.771         26       768: 100%|████████| 31/31 [00:18<00:
00,  1.67it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:09<00:00,  1.68it/s]
                all        486       1022      0.667      0.598      0.655       0.34

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        9/60      3.25G      1.627      2.335      1.701         12       768: 100%|████████| 31/31 [00:18<00:
00,  1.65it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:09<00:00,  1.62it/s]
                all        486       1022      0.682      0.633      0.685      0.355

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       10/60      3.24G       1.67      2.201      1.694         19       768: 100%|████████| 31/31 [00:16<00:
00,  1.82it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:10<00:00,  1.48it/s]
                all        486       1022      0.657      0.631      0.665      0.347

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       11/60      3.23G      1.627      2.148      1.699         23       768: 100%|████████| 31/31 [00:17<00:
00,  1.80it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:11<00:00,  1.41it/s]
                all        486       1022      0.676      0.679      0.729      0.395

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       12/60      3.11G      1.579       2.14       1.66         12       768: 100%|████████| 31/31 [00:18<00:
00,  1.70it/s]
              Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████| 16/16
[00:11<00:00,  1.41it/s]
                all        486       1022      0.735      0.686      0.764      0.424

        Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
```

```
      13/60      3.25G      1.561      2.066       1.62         12        768: 100%|████████| 31/31 [00:19<00:
00,  1.59it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:09<00:00,  1.60it/s]
                   all        486       1022      0.753      0.744      0.784      0.426

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      14/60      3.22G       1.59      2.023      1.632         46        768: 100%|████████| 31/31 [00:19<00:
00,  1.59it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:10<00:00,  1.54it/s]
                   all        486       1022      0.786      0.766      0.827      0.474

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      15/60      3.21G      1.578      1.949      1.598         23        768: 100%|████████| 31/31 [00:18<00:
00,  1.68it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:11<00:00,  1.43it/s]
                   all        486       1022      0.768      0.771      0.816      0.456

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      16/60       3.1G      1.509      1.904      1.588         13        768: 100%|████████| 31/31 [00:18<00:
00,  1.72it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:11<00:00,  1.45it/s]
                   all        486       1022      0.741      0.805      0.813      0.461

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      17/60      3.21G      1.493      1.786      1.544         31        768: 100%|████████| 31/31 [00:17<00:
00,  1.76it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:11<00:00,  1.44it/s]
                   all        486       1022      0.785       0.81      0.844      0.501

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      18/60      3.23G      1.458      1.754       1.53         19        768: 100%|████████| 31/31 [00:18<00:
00,  1.69it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:10<00:00,  1.49it/s]
                   all        486       1022       0.81      0.793      0.868      0.496

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      19/60       3.2G      1.494      1.729      1.548         31        768: 100%|████████| 31/31 [00:19<00:
00,  1.62it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:09<00:00,  1.62it/s]
                   all        486       1022      0.821      0.807      0.874      0.504

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      20/60       3.1G      1.449      1.666      1.529         26        768: 100%|████████| 31/31 [00:18<00:
00,  1.70it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:11<00:00,  1.44it/s]
                   all        486       1022      0.829      0.812      0.874      0.519
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      21/60      3.21G      1.435      1.631      1.496         25        768: 100%|████████| 31/31 [00:17<00:
00,  1.75it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:10<00:00,  1.46it/s]
                   all        486       1022      0.853      0.824      0.889      0.537

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      22/60      3.21G      1.442      1.617      1.519         21        768: 100%|████████| 31/31 [00:17<00:
00,  1.80it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:10<00:00,  1.49it/s]
                   all        486       1022      0.844      0.822      0.894      0.553

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      23/60      3.21G      1.413      1.578      1.468         17        768: 100%|████████| 31/31 [00:17<00:
00,  1.78it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:10<00:00,  1.46it/s]
                   all        486       1022      0.877      0.834       0.91      0.547
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      24/60       3.1G      1.379      1.525       1.46         23        768: 100%|████████| 31/31 [00:17<00:
00,  1.79it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|████████| 16/16
[00:10<00:00,  1.51it/s]
```

| | | | | | all | 486 | 1022 | 0.852 | 0.858 | 0.899 | 0.556 |

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
25/60	3.23G	1.401	1.499	1.482	36	768: 100%|██████████| 31/31 [00:18<00:00, 1.65it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:09<00:00, 1.65it/s]
		all	486	1022	0.846	0.867	0.909	0.574

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
26/60	3.25G	1.313	1.452	1.447	31	768: 100%|██████████| 31/31 [00:18<00:00, 1.69it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:09<00:00, 1.70it/s]
		all	486	1022	0.846	0.886	0.925	0.586

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
27/60	3.23G	1.344	1.425	1.428	21	768: 100%|██████████| 31/31 [00:17<00:00, 1.76it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:09<00:00, 1.65it/s]
		all	486	1022	0.874	0.894	0.927	0.595

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
28/60	3.1G	1.307	1.392	1.417	23	768: 100%|██████████| 31/31 [00:17<00:00, 1.78it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:10<00:00, 1.46it/s]
		all	486	1022	0.873	0.873	0.924	0.597

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
29/60	3.21G	1.321	1.365	1.432	34	768: 100%|██████████| 31/31 [00:17<00:00, 1.79it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:11<00:00, 1.44it/s]
		all	486	1022	0.897	0.892	0.937	0.621

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
30/60	3.24G	1.304	1.362	1.418	22	768: 100%|██████████| 31/31 [00:17<00:00, 1.82it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:11<00:00, 1.44it/s]
		all	486	1022	0.907	0.901	0.948	0.622

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
31/60	3.21G	1.308	1.331	1.415	23	768: 100%|██████████| 31/31 [00:17<00:00, 1.81it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:10<00:00, 1.46it/s]
		all	486	1022	0.91	0.901	0.953	0.649

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
32/60	3.1G	1.24	1.259	1.362	17	768: 100%|██████████| 31/31 [00:18<00:00, 1.71it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:10<00:00, 1.57it/s]
		all	486	1022	0.927	0.916	0.958	0.653

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
33/60	3.1G	1.221	1.246	1.359	15	768: 100%|██████████| 31/31 [00:19<00:00, 1.58it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:09<00:00, 1.73it/s]
		all	486	1022	0.923	0.911	0.958	0.65

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
34/60	3.22G	1.237	1.249	1.372	19	768: 100%|██████████| 31/31 [00:17<00:00, 1.75it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:10<00:00, 1.54it/s]
		all	486	1022	0.906	0.943	0.96	0.654

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
35/60	3.2G	1.234	1.222	1.341	28	768: 100%|██████████| 31/31 [00:17<00:00, 1.79it/s]

		Class	Images	Instances	Box(P | R | mAP50 | mAP50-95): 100%	██████████	16/16 [00:10<00:00, 1.52it/s]
		all	486	1022	0.93	0.921	0.963	0.662

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size

```
        36/60        3.1G      1.207      1.205      1.359         32        768: 100%|██████████| 31/31 [00:17<00:
00,  1.80it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.51it/s]
                   all        486       1022      0.901      0.942      0.961      0.666
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        37/60       3.24G      1.216      1.198      1.333         21        768: 100%|██████████| 31/31 [00:17<00:
00,  1.80it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:11<00:00,  1.44it/s]
                   all        486       1022      0.944      0.931      0.972      0.688
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        38/60       3.22G      1.192      1.177      1.353         15        768: 100%|██████████| 31/31 [00:17<00:
00,  1.81it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.48it/s]
                   all        486       1022      0.941      0.939      0.972      0.694
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        39/60       3.23G      1.174      1.165      1.328         31        768: 100%|██████████| 31/31 [00:17<00:
00,  1.78it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.50it/s]
                   all        486       1022      0.954       0.93      0.973      0.687
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        40/60        3.1G      1.187      1.163       1.33         24        768: 100%|██████████| 31/31 [00:17<00:
00,  1.79it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.52it/s]
                   all        486       1022      0.941      0.943      0.971        0.7
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        41/60       3.22G      1.157       1.14      1.303         21        768: 100%|██████████| 31/31 [00:18<00:
00,  1.67it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:09<00:00,  1.66it/s]
                   all        486       1022      0.942      0.944      0.974      0.701
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        42/60       3.21G      1.177      1.133      1.313         26        768: 100%|██████████| 31/31 [00:18<00:
00,  1.69it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:09<00:00,  1.66it/s]
                   all        486       1022      0.953      0.931      0.975      0.708
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        43/60       3.21G      1.154      1.129      1.312         27        768: 100%|██████████| 31/31 [00:17<00:
00,  1.77it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.54it/s]
                   all        486       1022      0.957      0.953      0.979      0.723
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        44/60        3.1G      1.153      1.136      1.319         16        768: 100%|██████████| 31/31 [00:17<00:
00,  1.75it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.50it/s]
                   all        486       1022       0.95      0.953      0.978      0.714
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        45/60       3.23G      1.145      1.097      1.306         35        768: 100%|██████████| 31/31 [00:16<00:
00,  1.83it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.52it/s]
                   all        486       1022      0.946       0.95      0.977      0.724
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        46/60        3.2G      1.112      1.072      1.278         18        768: 100%|██████████| 31/31 [00:17<00:
00,  1.79it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.48it/s]
                   all        486       1022      0.954      0.954      0.979      0.733
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
        47/60        3.2G      1.108      1.055      1.274         22        768: 100%|██████████| 31/31 [00:17<00:
00,  1.80it/s]
                 Class     Images  Instances      Box(P          R       mAP50  mAP50-95): 100%|██████████| 16/16
[00:10<00:00,  1.47it/s]
                   all        486       1022      0.955      0.957      0.981      0.733
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
```

	48/60	3.1G	1.103	1.046	1.267	19	768: 100%	██████	31/31 [00:17<00:00, 1.75it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%	██████	16/16 [00:10<00:00, 1.53it/s]
all	486	1022	0.961	0.954	0.982	0.738

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
49/60	3.22G	1.097	1.051	1.251	16	768: 100%|██████| 31/31 [00:17<00:00, 1.75it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:10<00:00, 1.58it/s]
all	486	1022	0.956	0.96	0.982	0.74

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
50/60	3.22G	1.087	1.021	1.261	32	768: 100%|██████| 31/31 [00:19<00:00, 1.59it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:09<00:00, 1.71it/s]
all	486	1022	0.959	0.962	0.983	0.746

Closing dataloader mosaic
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01, method='weighted_average', num_output_channels=3), CLAHE(p=0.01, clip_limit=(1.0, 4.0), tile_grid_size=(8, 8))

/usr/local/lib/python3.12/dist-packages/ultralytics/data/augment.py:1850: UserWarning: Argument(s) 'quality_lower' are not valid for transform ImageCompression
  A.ImageCompression(quality_lower=75, p=0.0),

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
51/60	3.19G	1.123	1.209	1.349	7	768: 100%|██████| 31/31 [00:20<00:00, 1.54it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:10<00:00, 1.49it/s]
all	486	1022	0.954	0.946	0.981	0.731

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
52/60	3.08G	1.09	1.152	1.302	8	768: 100%|██████| 31/31 [00:16<00:00, 1.93it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:10<00:00, 1.49it/s]
all	486	1022	0.949	0.948	0.979	0.721

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
53/60	3.19G	1.085	1.133	1.288	14	768: 100%|██████| 31/31 [00:16<00:00, 1.84it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:11<00:00, 1.44it/s]
all	486	1022	0.965	0.943	0.981	0.732

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
54/60	3.2G	1.069	1.1	1.273	12	768: 100%|██████| 31/31 [00:16<00:00, 1.86it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:10<00:00, 1.47it/s]
all	486	1022	0.958	0.951	0.982	0.739

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
55/60	3.19G	1.041	1.084	1.269	18	768: 100%|██████| 31/31 [00:17<00:00, 1.82it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:10<00:00, 1.47it/s]
all	486	1022	0.958	0.952	0.983	0.743

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
56/60	3.08G	1.028	1.093	1.267	10	768: 100%|██████| 31/31 [00:16<00:00, 1.90it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:10<00:00, 1.54it/s]
all	486	1022	0.95	0.956	0.982	0.743

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
57/60	3.18G	1.025	1.055	1.263	8	768: 100%|██████| 31/31 [00:16<00:00, 1.87it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:10<00:00, 1.49it/s]
all	486	1022	0.957	0.952	0.983	0.743

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
58/60	3.19G	1.031	1.052	1.252	16	768: 100%|██████| 31/31 [00:18<00:00, 1.69it/s]
Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%|██████| 16/16 [00:09<00:00, 1.64it/s]
all	486	1022	0.957	0.952	0.983	0.746

| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size |

```
    59/60        3.19G        1        1.055     1.243       11         768: 100%|████████| 31/31 [00:18<00:
00, 1.66it/s]
                Class      Images  Instances   Box(P         R       mAP50   mAP50-95): 100%|████████| 16/16
[00:09<00:00, 1.73it/s]
                  all        486       1022      0.96      0.952     0.983     0.746


       Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances      Size
    60/60        3.06G        1.034     1.071     1.262        9         768: 100%|████████| 31/31 [00:18<00:
00, 1.71it/s]
                Class      Images  Instances   Box(P         R       mAP50   mAP50-95): 100%|████████| 16/16
[00:10<00:00, 1.59it/s]
                  all        486       1022     0.957     0.956     0.983     0.746
```

60 epochs completed in 0.502 hours.
Optimizer stripped from /content/drive/MyDrive/ninja250_parts/yolov8n_parts2/weights/last.pt, 6.3MB
Optimizer stripped from /content/drive/MyDrive/ninja250_parts/yolov8n_parts2/weights/best.pt, 6.3MB

Validating /content/drive/MyDrive/ninja250_parts/yolov8n_parts2/weights/best.pt...
Ultralytics 8.3.25 🚀 Python-3.12.12 torch-2.8.0+cu126 CUDA:0 (Tesla T4, 15095MiB)
Model summary (fused): 168 layers, 3,008,573 parameters, 0 gradients, 8.1 GFLOPs

```
                Class      Images  Instances   Box(P         R       mAP50   mAP50-95): 100%|████████| 16/16
[00:11<00:00, 1.39it/s]
                  all        486       1022     0.957     0.956     0.983     0.746
     front_brake_caliper    51         51      0.979      0.98      0.993     0.708
      rear_brake_caliper    43         43      0.954     0.965     0.973     0.734
              front_disc    79         94      0.956     0.925     0.981     0.719
               rear_disc    52         54      0.946     0.972     0.989     0.743
                   chain   111        241      0.947     0.736     0.909     0.612
                 radiator   30         30      0.985        1       0.995     0.851
     front_sprocket_cover   56         56      0.947        1       0.991     0.749
        coolant_reservoir   60         60      0.984     0.996     0.992     0.805
            rear_sprocket   43         43      0.955     0.953     0.992     0.772
                headlight   45         45      0.986        1       0.995     0.786
                taillight   51         51      0.955      0.98      0.994     0.765
             clutch_lever   42         42      0.888     0.929     0.962     0.673
              brake_lever   99         99      0.938      0.97      0.99      0.784
                  battery   40         40      0.969        1       0.995     0.769
                carburetor  73         73      0.971     0.932     0.991     0.726
```
Speed: 0.3ms preprocess, 2.9ms inference, 0.0ms loss, 2.8ms postprocess per image
Results saved to **/content/drive/MyDrive/ninja250_parts/yolov8n_parts2**
Training complete.

Validate model performance by running a validation test and checking the mAP and per-class metrics of the data.

```python
RUN_DIR = "/content/drive/MyDrive/ninja250_parts/yolov8n_parts2"
BEST_WEIGHTS = os.path.join(RUN_DIR, "weights", "best.pt")

model = YOLO(BEST_WEIGHTS)

metrics = model.val()  # evaluates on val set from data.yaml
print("Validation metrics:")
print(metrics.results_dict)
```

Ultralytics 8.3.25 🚀 Python-3.12.12 torch-2.8.0+cu126 CUDA:0 (Tesla T4, 15095MiB)
Model summary (fused): 168 layers, 3,008,573 parameters, 0 gradients, 8.1 GFLOPs
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf'...

```
100%|████████| 755k/755k [00:00<00:00, 24.3MB/s]
val: Scanning /content/drive/MyDrive/ninja250_parts/labels/train.cache... 486 images, 0 backgrounds, 0 corrupt:
100%|████████| 486/486 [00:00<?, ?it/s]
                Class      Images  Instances   Box(P         R       mAP50   mAP50-95): 100%|████████| 31/31
[00:17<00:00, 1.81it/s]
                  all        486       1022     0.957     0.956     0.983     0.746
     front_brake_caliper    51         51      0.978      0.98      0.993     0.707
      rear_brake_caliper    43         43      0.954     0.965     0.973     0.735
              front_disc    79         94      0.956     0.925     0.981     0.719
               rear_disc    52         54      0.946     0.972     0.989     0.746
                   chain   111        241      0.946     0.733     0.909     0.613
                 radiator   30         30      0.987        1       0.995     0.851
     front_sprocket_cover   56         56      0.946        1       0.991     0.751
        coolant_reservoir   60         60      0.984     0.996     0.992     0.807
            rear_sprocket   43         43      0.954     0.953     0.992     0.769
                headlight   45         45      0.985        1       0.995     0.786
                taillight   51         51      0.955      0.98      0.994     0.763
             clutch_lever   42         42      0.887     0.929     0.963     0.671
              brake_lever   99         99      0.939      0.97      0.99      0.779
                  battery   40         40      0.969        1       0.995     0.769
                carburetor  73         73      0.972     0.935     0.991     0.728
```
Speed: 1.2ms preprocess, 5.1ms inference, 0.0ms loss, 2.8ms postprocess per image
Results saved to **runs/detect/val**
Validation metrics:
{'metrics/precision(B)': np.float64(0.9572953429681239), 'metrics/recall(B)': np.float64(0.9558903716827268), 'm
etrics/mAP50(B)': np.float64(0.9829235552112442), 'metrics/mAP50-95(B)': np.float64(0.7462081045135726), 'fitnes
s': np.float64(0.7698796495833398)}

Time to test it on a random image (perhaps a new image excluded from the training data).

```python
from IPython.display import display, Image as IPyImage
import glob

BEST_WEIGHTS = "/content/drive/MyDrive/ninja250_parts/yolov8n_parts2/weights/best.pt"
model = YOLO(BEST_WEIGHTS)

# Pick one val image just to demo
some_val_images = glob.glob("/content/drive/MyDrive/ninja250_parts/images/train/IMG_7031-compressed.jpg")
if len(some_val_images) == 0:
    print("No val images yet.")
else:
    test_img = some_val_images[0] # insert test image here
    print("Running prediction on:", test_img)
    pred = model.predict(
        source=test_img,
        conf=0.25,
        save=True
    )

    # YOLO tells us where it saved the annotated image
    save_dir = pred[0].save_dir  # e.g. runs/detect/predictX
    annotated = list(glob.glob(os.path.join(save_dir, "*")))[0]
    display(IPyImage(filename=annotated))
```

Running prediction on: /content/drive/MyDrive/ninja250_parts/images/train/IMG_7031-compressed.jpg

image 1/1 /content/drive/MyDrive/ninja250_parts/images/train/IMG_7031-compressed.jpg: 576x768 1 rear_brake_caliper, 1 rear_disc, 1 chain, 8.4ms
Speed: 5.5ms preprocess, 8.4ms inference, 1.6ms postprocess per image at shape (1, 3, 576, 768)
Results saved to **runs/detect/predict2**

Time to export the model for reuse if we decide to iterate further at a later date.

```python
BEST_WEIGHTS = "/content/drive/MyDrive/ninja250_parts/yolov8n_parts/weights/best.pt"
model = YOLO(BEST_WEIGHTS)

model.export(format="onnx", opset=12)        # onnx
model.export(format="torchscript")           # torchscript
# model.export(format="tflite")              # you can try later for mobile
```

```python
from google.colab import drive
```

```
drive.mount('/content/drive')
!jupyter nbconvert --to html '/content/drive/MyDrive/Colab Notebooks/HNR499_NinjaPartIdentifyer_MacKellar'
```