

```
!pip install --upgrade opencv-python
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: opencv-python in /usr/local/lib/python3.10/dist-packages (4.7.0.72)
Requirement already satisfied: numpy>=1.21.2 in /usr/local/lib/python3.10/dist-packages (from opencv-python) (1.22.4)
```

```
!pip show opencv-python
```

```
Name: opencv-python
Version: 4.7.0.72
Summary: Wrapper package for OpenCV python bindings.
Home-page: https://github.com/opencv/opencv-python
Author:
Author-email:
License: Apache 2.0
Location: /usr/local/lib/python3.10/dist-packages
Requires: numpy, numpy, numpy, numpy
Required-by: dopamine-rl, imgaug
```

```
!pip install ultralytics
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting ultralytics
  Downloading ultralytics-8.0.109-py3-none-any.whl (591 kB)
    591.4/591.4 kB 25.2 MB/s eta 0:00:00
Requirement already satisfied: matplotlib>=3.2.2 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) (4.7.0.72)
Requirement already satisfied: Pillow>=7.1.2 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (8.4.0)
Requirement already satisfied: PyYAML>=5.3.1 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (6.0)
Requirement already satisfied: requests>=2.23.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.27.1)
Requirement already satisfied: scipy>=1.4.1 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (1.10.1)
Requirement already satisfied: torch>=1.7.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.0.1+cu118)
Requirement already satisfied: torchvision>=0.8.1 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) (4.65.0)
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)
Collecting sentry-sdk (from ultralytics)
  Downloading sentry_sdk-1.24.0-py2.py3-none-any.whl (206 kB)
    206.5/206.5 kB 23.3 MB/s eta 0:00:00
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.2.2->ultralytics) (1.0.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.2.2->ultralytics) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.2.2->ultralytics) (4.22.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.2.2->ultralytics) (1.0.1)
Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.2.2->ultralytics) (1.22.4)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.2.2->ultralytics) (23.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.2.2->ultralytics) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.2.2->ultralytics) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.1.4->ultralytics) (2022.7.1)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (1.26.13)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (2022.9.24)
Requirement already satisfied: charset-normalizer<=2.0.0 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (2.0.0)
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: filelock in /usr/local/lib/python3.10/dist-packages (from torch>=1.7.0->ultralytics) (3.12.0)
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.10/dist-packages (from torch>=1.7.0->ultralytics) (4.5.0)
Requirement already satisfied: sympy in /usr/local/lib/python3.10/dist-packages (from torch>=1.7.0->ultralytics) (1.11.1)
Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-packages (from torch>=1.7.0->ultralytics) (3.1)
Requirement already satisfied: Jinja2 in /usr/local/lib/python3.10/dist-packages (from torch>=1.7.0->ultralytics) (3.1.2)
Requirement already satisfied: triton==2.0.0 in /usr/local/lib/python3.10/dist-packages (from torch>=1.7.0->ultralytics) (2.0.0)
Requirement already satisfied: cmake in /usr/local/lib/python3.10/dist-packages (from triton==2.0.0->torch>=1.7.0->ultralytics) (3.25.0)
Requirement already satisfied: lit in /usr/local/lib/python3.10/dist-packages (from triton==2.0.0->torch>=1.7.0->ultralytics) (16.0.6)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib>=3.2.2->ultralytics) (1.16.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/dist-packages (from Jinja2->torch>=1.7.0->ultralytics) (2.1.2)
Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.10/dist-packages (from sympy->torch>=1.7.0->ultralytics) (1.3.0)
Installing collected packages: sentry-sdk, ultralytics
Successfully installed sentry-sdk-1.24.0 ultralytics-8.0.109
```

```
from ultralytics import YOLO # imports the YOLO class from the ultralytics package
import os # imports the os module, which provides functions for interacting with the operating system, such as manipulating file paths
from IPython.display import display, Image # These classes are used for displaying images and other content within IPython
from IPython import display # The display module provides functions for controlling the display of output within IPython
display.clear_output() # clear_output() function from the display module to clear the output displayed
!yolo checks # ultralytics package and is used to perform checks or diagnostics related to the YOLO algorithm.
```

```
Ultralytics YOLOv8.0.109 Python-3.10.11 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)
Setup complete (2 CPUs, 12.7 GB RAM, 23.3/78.2 GB disk)
```

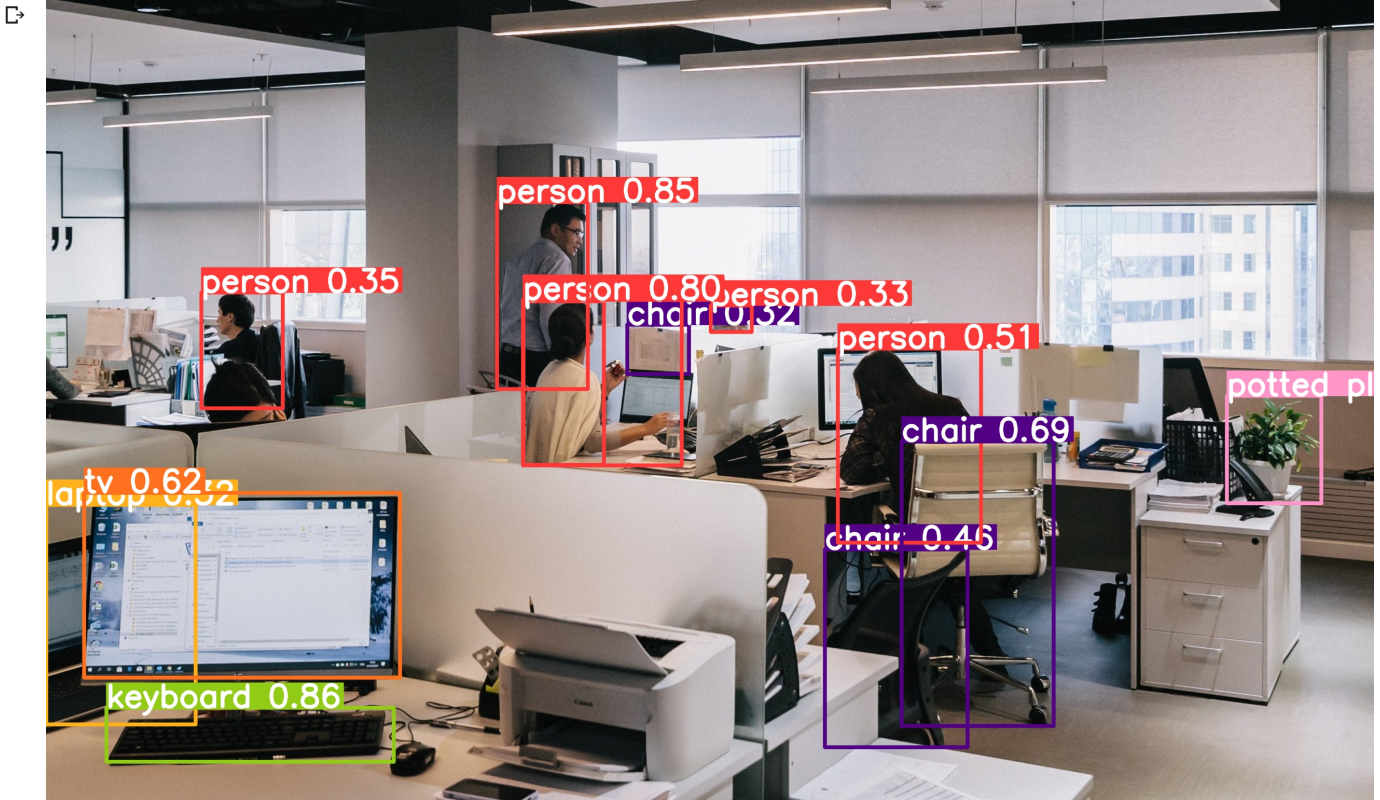
```
!yolo task = detect mode=predict model=yolov8n.pt conf=0.30 source='/content/damir-kopezhnov-nC6CyrVBtkU-unsplash-scaled.jpg'
```

```
Ultralytics YOLOv8.0.109 Python-3.10.11 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3151904 parameters, 0 gradients
```

```
image 1/1 /content/damir-kopezhnov-nC6CyrVBtkU-unsplash-scaled.jpg: 416x640 6 persons, 3 chairs, 1 potted plant, 1 tv, 1 laptop, 1
```

Speed: 13.7ms preprocess, 61.3ms inference, 21.3ms postprocess per image at shape (1, 3, 640, 640)
Results saved to **runs/detect/predict**

Image(filename='/content/runs/detect/predict/damir-kopezhanov-nC6CyrVBtkU-unsplash-scaled.jpg',height=600)



```
!pip install roboflow
```

```
from roboflow import Roboflow
rf = Roboflow(api_key="KuHpGId9jwwUFEVDe059")
project = rf.workspace("final-project-7gql2").project("vehicle-detection-i66s2")
dataset = project.version(16).download("yolov8")
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: roboflow in /usr/local/lib/python3.10/dist-packages (1.0.9)
Requirement already satisfied: certifi==2022.12.7 in /usr/local/lib/python3.10/dist-packages (from roboflow) (2022.12.7)
Requirement already satisfied: chardet==4.0.0 in /usr/local/lib/python3.10/dist-packages (from roboflow) (4.0.0)
Requirement already satisfied: cycler==0.10.0 in /usr/local/lib/python3.10/dist-packages (from roboflow) (0.10.0)
Requirement already satisfied: idna==2.10 in /usr/local/lib/python3.10/dist-packages (from roboflow) (2.10)
Requirement already satisfied: kiwisolver==1.3.1 in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.4.4)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (from roboflow) (3.7.1)
Requirement already satisfied: numpy>=1.18.5 in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.22.4)
Requirement already satisfied: opencv-python>=4.1.2 in /usr/local/lib/python3.10/dist-packages (from roboflow) (4.7.0.72)
Requirement already satisfied: Pillow>=7.1.2 in /usr/local/lib/python3.10/dist-packages (from roboflow) (8.4.0)
Requirement already satisfied: pyparsing==2.4.7 in /usr/local/lib/python3.10/dist-packages (from roboflow) (2.4.7)
Requirement already satisfied: python-dateutil in /usr/local/lib/python3.10/dist-packages (from roboflow) (2.8.2)
Requirement already satisfied: python-dotenv in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.0.0)
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-packages (from roboflow) (2.27.1)
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.16.0)
Requirement already satisfied: urllib3>=1.26.6 in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.26.15)
Requirement already satisfied: wget in /usr/local/lib/python3.10/dist-packages (from roboflow) (3.2)
Requirement already satisfied: tqdm>=4.41.0 in /usr/local/lib/python3.10/dist-packages (from roboflow) (4.65.0)
Requirement already satisfied: PyYAML>=5.3.1 in /usr/local/lib/python3.10/dist-packages (from roboflow) (6.0)
Requirement already satisfied: requests-toolbelt in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.0.0)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow) (1.0.7)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow) (4.39.3)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow) (23.1)
Requirement already satisfied: charset-normalizer==2.0.0 in /usr/local/lib/python3.10/dist-packages (from requests->roboflow) (2.0.0)
loading Roboflow workspace...
loading Roboflow project...
Dependency ultralytics<=8.0.20 is required but found version=8.0.109, to fix: `pip install ultralytics<=8.0.20`
Downloading Dataset Version Zip in vehicle-detection-16 to yolov8: 100% [107971058 / 107971058] bytes
Extracting Dataset Version Zip to vehicle-detection-16 in yolov8:: 100% [3782/3782 [00:01<00:00, 2581.45it/s]
```

```
!yolo task=detect mode=train model=yolov8m.pt data={dataset.location}/data.yaml epochs=30 imgsz=640
```

```
Downloading https://github.com/ultralytics/assets/releases/download/v0.0.0/yolov8m.pt to yolov8m.pt...
100% 49.7M/49.7M [00:00<00:00, 54.3MB/s]
```

```
Ultralytics YOLOv8.0.109 Python-3.10.11 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)
yolo/engine/trainer: task=detect, mode=train, model=yolov8m.pt, data=/content/vehicle-detection-16/data.yaml, epochs=30, patience=10
Downloading https://ultralytics.com/assets/Arial.ttf to /root/.config/Ultralytics/Arial.ttf...
100% 755k/755k [00:00<00:00, 42.2MB/s]
Overriding model.yaml nc=80 with nc=2
```

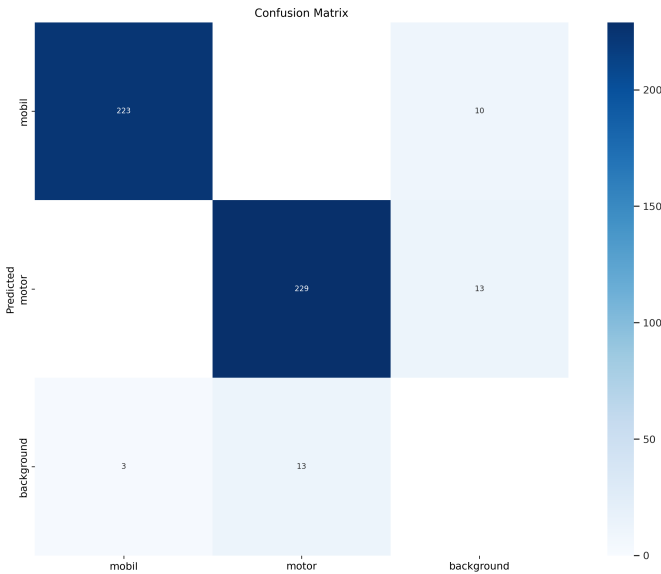
	from	n	params	module	arguments	
0		-1	1	1392	ultralytics.nn.modules.conv.Conv	[3, 48, 3, 2]
1		-1	1	41664	ultralytics.nn.modules.conv.Conv	[48, 96, 3, 2]
2		-1	2	111360	ultralytics.nn.modules.block.C2f	[96, 96, 2, True]
3		-1	1	166272	ultralytics.nn.modules.conv.Conv	[96, 192, 3, 2]
4		-1	4	813312	ultralytics.nn.modules.block.C2f	[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	3776854	ultralytics.nn.modules.head.Detect	[2, [192, 384, 576]]

Model summary: 295 layers, 25857478 parameters, 25857462 gradients

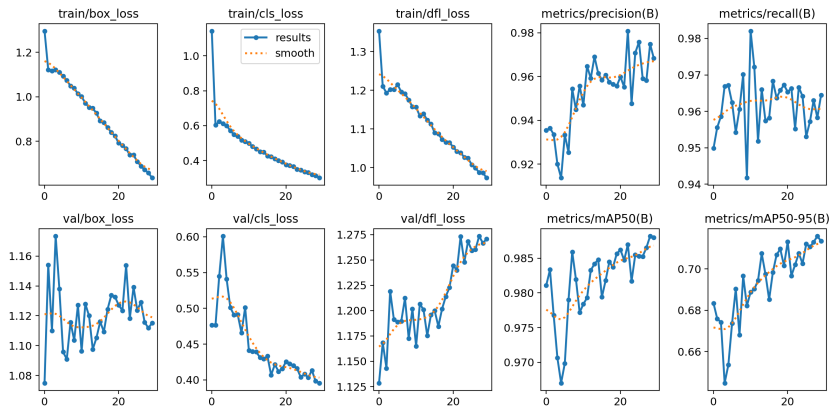
```
Transferred 469/475 items from pretrained weights
TensorBoard: Start with 'tensorboard --logdir runs/detect/train', view at http://localhost:6006/
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
AMP: checks passed
optimizer: SGD(lr=0.01) with parameter groups 77 weight(decay=0.0), 84 weight(decay=0.0005), 83 bias
train: Scanning /content/vehicle-detection-16/train/labels... 1793 images, 0 backgrounds, 0 corrupt: 100% 1793/1793 [00:00<00:00
train: New cache created: /content/vehicle-detection-16/train/labels.cache
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
val: Scanning /content/vehicle-detection-16/valid/labels... 84 images, 0 backgrounds, 0 corrupt: 100% 84/84 [00:00<00:00, 777.75
val: New cache created: /content/vehicle-detection-16/valid/labels.cache
Plotting labels to runs/detect/train/labels.jpg...
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train
Starting training for 30 epochs...
```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/30	6.84G	1.296	1.142	1.353	15	640: 100% 113/113 [01:00<00:00, 1.85it/s]
	Class	Images	Instances	Box(P	R	mAP50 mAP50-95): 100% 3/3 [00:03<00:00, 1.20s/it]
	all	84	468	0.935	0.95	0.981 0.683
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size

```
Image(filename='/content/runs/detect/train/confusion_matrix.png',width=600)
```



```
Image(filename='/content/runs/detect/train/results.png',width=900)
```



```
!yolo task=detect mode=val model=/content/runs/detect/train/weights/best.pt data={dataset.location}/data.yaml
```

Ultralytics YOLOv8.0.109 Python-3.10.11 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)

Model summary (fused): 218 layers, 25840918 parameters, 0 gradients

val: Scanning /content/vehicle-detection-16/valid/labels.cache... 84 images, 0 backgrounds, 0 corrupt: 100% 84/84 [00:00<?, ?it/s]

Class	Images	Instances	Box(P)	R	mAP50	mAP50-95)
all	84	468	0.975	0.958	0.988	0.717
mobil	84	226	0.973	0.987	0.993	0.814
motor	84	242	0.977	0.93	0.983	0.62

Speed: 3.6ms preprocess, 26.9ms inference, 0.0ms loss, 8.2ms postprocess per image

Results saved to **runs/detect/val2**

```
!yolo task=detect mode=predict model=/content/runs/detect/train/weights/best.pt conf=0.25 source={dataset.location}/test/images
```

Ultralytics YOLOv8.0.109 Python-3.10.11 torch-2.0.1+cu118 CUDA:0 (Tesla T4, 15102MiB)

Model summary (fused): 218 layers, 25840918 parameters, 0 gradients

image 1/8 /content/vehicle-detection-16/test/images/Screenshot-1411-_png.rf.20dcbea296aa093885d6ac07ea4f1028.jpg: 640x640 2 mobils,

image 2/8 /content/vehicle-detection-16/test/images/Screenshot-1422-_png.rf.bad5d10de5d820cc40b034ae0c8280df.jpg: 640x640 5 mobils,

image 3/8 /content/vehicle-detection-16/test/images/Screenshot-1453-_png.rf.ea38a9094b1852d6ca4cebf518113869.jpg: 640x640 3 mobils,

image 4/8 /content/vehicle-detection-16/test/images/Screenshot-231-_png.rf.e67dc6264fd3cc8cbafab5a86be89b5d.jpg: 640x640 6 mobils,

image 5/8 /content/vehicle-detection-16/test/images/Screenshot-261-_png.rf.37b99a692c29366f2abb8e38db0aa534.jpg: 640x640 6 mobils,

image 6/8 /content/vehicle-detection-16/test/images/WhatsApp-Image-2023-05-19-at-16-19-44_jpg.rf.fa43391db74f42a70aece365ad0fbf7e.j

image 7/8 /content/vehicle-detection-16/test/images/a1e3e429a1286c8a0e3a5a015daf5da82f96c4f1_jpg.rf.474370fdde9db60eabff288256448b0

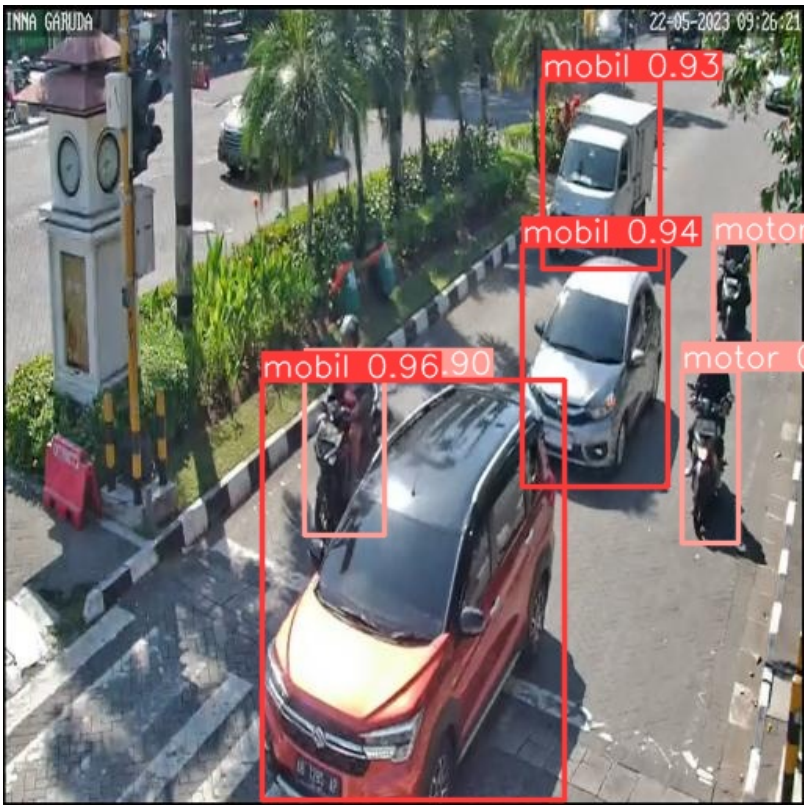
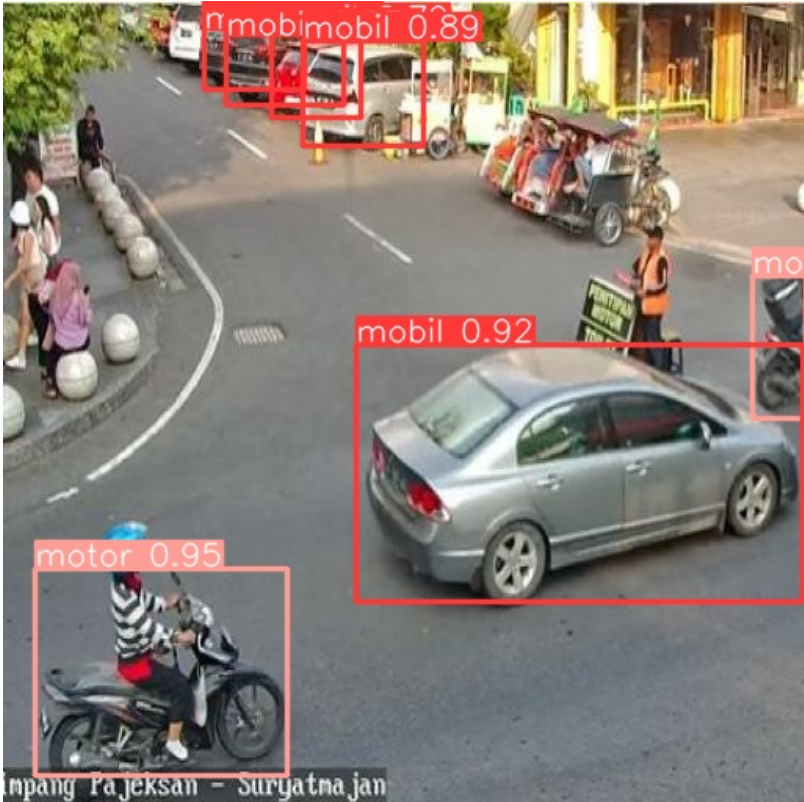
image 8/8 /content/vehicle-detection-16/test/images/b17fbc3c67662efc7ea1754a083a1fa3c09109dc_jpg.rf.b9c76e12cb4c1cb5be921de0ae21254

Speed: 2.8ms preprocess, 28.7ms inference, 1.6ms postprocess per image at shape (1, 3, 640, 640)

Results saved to **runs/detect/predict3**

```
import glob
from IPython.display import Image, display

for image_path in glob.glob(f'/content/runs/detect/predict3/*.jpg')[:3]:
    display(Image(filename=image_path,height=600))
    print("\n")
```



✓ 0s completed at 11:05 PM

