🚗 Car Parts Segmentation using YOLOv8 🚗

📌 Project Overview

This project focuses on **segmenting different car parts** from images using **YOLOv8-seg**. The model is trained to detect and precisely outline car components, enabling applications in **automotive diagnostics, repair, and manufacturing**.

🛠️ Key Features

- **Car Part Detection & Segmentation**: Accurately detects and segments various car parts.
- **YOLOv8-seg Model**: Utilizes **Ultralytics YOLOv8** for high-speed and precise segmentation.
- **Custom Dataset**: Trained on a dataset of labeled car part images.
- **Efficient Training & Deployment**: Optimized training with fine-tuning and real-world deployment potential.

🌍 Real-World Use Cases

1️⃣ Automotive Repair & Maintenance

- Identifies **damaged car parts** for quick diagnosis.
- Helps mechanics **automate repair assessments**.

2️⃣ Autonomous Vehicles

- Enables **self-driving cars** to recognize parts of other vehicles.
- Assists in **real-time hazard detection** on the road.

3️⃣ Car Manufacturing & Quality Control

- Automates **defect detection** during assembly.
- Ensures correct **part alignment** before final production.

4️⃣ Insurance & Damage Assessment

- Automates **accident damage analysis** for insurance claims.
- Reduces manual inspection time and cost.

📂 Project Workflow

1. **Dataset Preparation**: Collect and label images of car parts.
2. **Model Training**: Train YOLOv8-seg using labeled data.
3. **Evaluation & Optimization**: Assess accuracy and fine-tune the model.
4. **Deployment**: Use the trained model for real-world applications.

```
# Install the ultralytics package from PyPI
!pip install ultralytics
```

Show hidden output

```
!pip install roboflow

from roboflow import Roboflow
rf = Roboflow(api_key="8eJjPpZKGfOIgwcvcVo0")
project = rf.workspace("alpaco5-f3woi").project("part-autolabeld")
version = project.version(5)
dataset = version.download("yolov8")
```

Show hidden output

```
project = rf.workspace("johns").project("car-parts-segmentation-7akj9")
version = project.version(1)
```

```
loading Roboflow workspace...
loading Roboflow project...
---------------------------------------------------------------------------
RuntimeError                              Traceback (most recent call last)
<ipython-input-23-e202f0f2cc42> in <cell line: 0>()
      1 project = rf.workspace("johns").project("car-parts-segmentation-7akj9")
----> 2 version = project.version(1)

/usr/local/lib/python3.11/dist-packages/roboflow/core/project.py in version(self, version_number, local)
    349                 return vers
    350
--> 351         raise RuntimeError(f"Version number {version_number} is not found.")
    352
    353     def check_valid_image(self, image_path: str) -> bool:

RuntimeError: Version number 1 is not found.
```

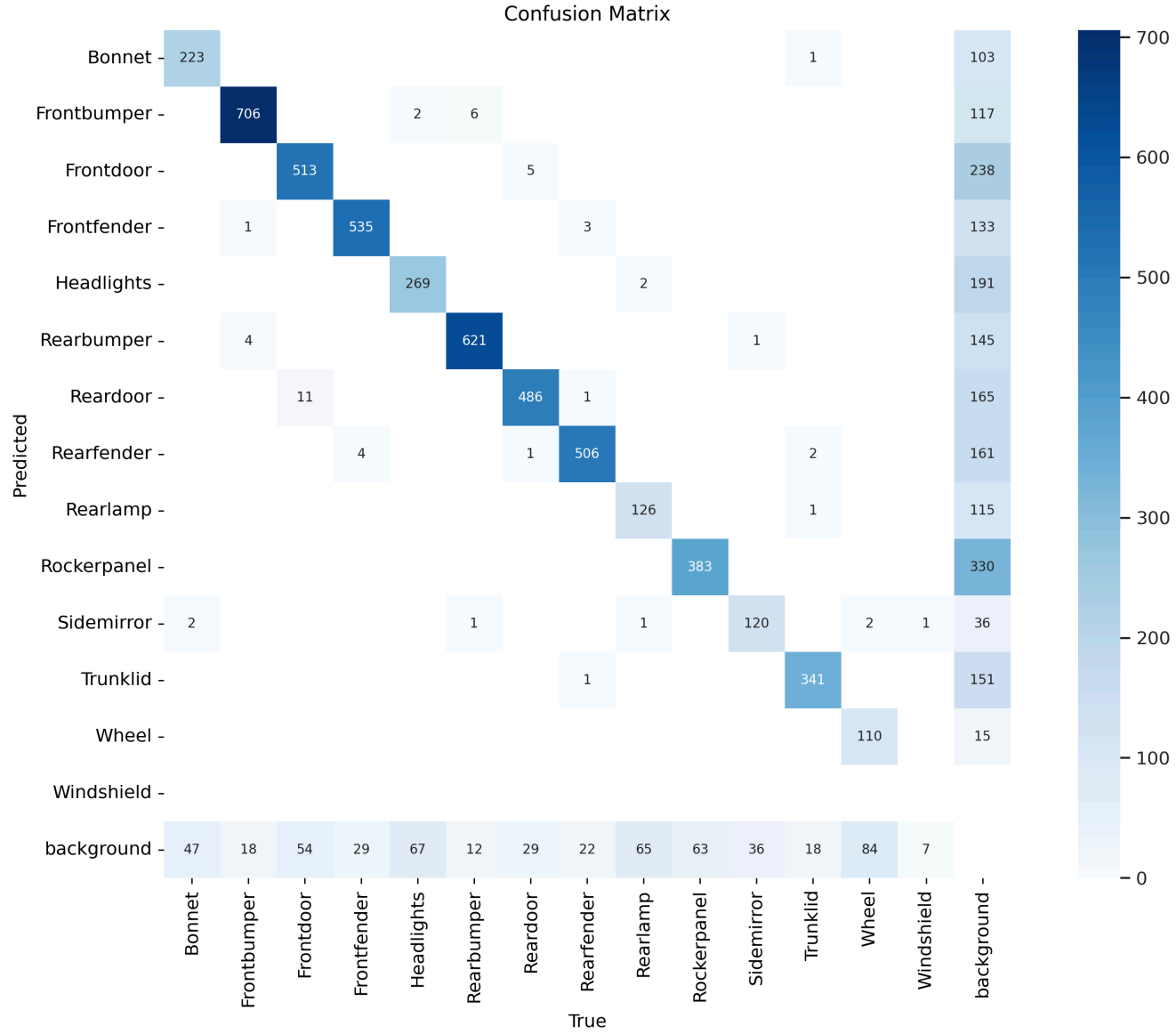
```
!yolo task=segment mode=train model=yolov8n-seg.pt data="/content/part-autolabeld-5/data.yaml" epochs=5 imgsz=320 batch=4 a
```

```
Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolov8n-seg.pt to 'yolov8n-seg.pt'...
100% 6.74M/6.74M [00:00<00:00, 283MB/s]
Ultralytics 8.3.78 🚀 Python-3.11.11 torch-2.5.1+cu124 CUDA:0 (Tesla T4, 15095MiB)
engine/trainer: task=segment, mode=train, model=yolov8n-seg.pt, data=/content/part-autolabeld-5/data.yaml, epochs=5,
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf'...
100% 755k/755k [00:00<00:00, 99.3MB/s]
WARNING: All log messages before absl::InitializeLog() is called are written to STDERR
E0000 00:00:1740389011.535740    1157 cuda_dnn.cc:8310] Unable to register cuDNN factory: Attempting to register fac
E0000 00:00:1740389011.608353    1157 cuda_blas.cc:1418] Unable to register cuBLAS factory: Attempting to register f
Overriding model.yaml nc=80 with nc=14

                   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]
```

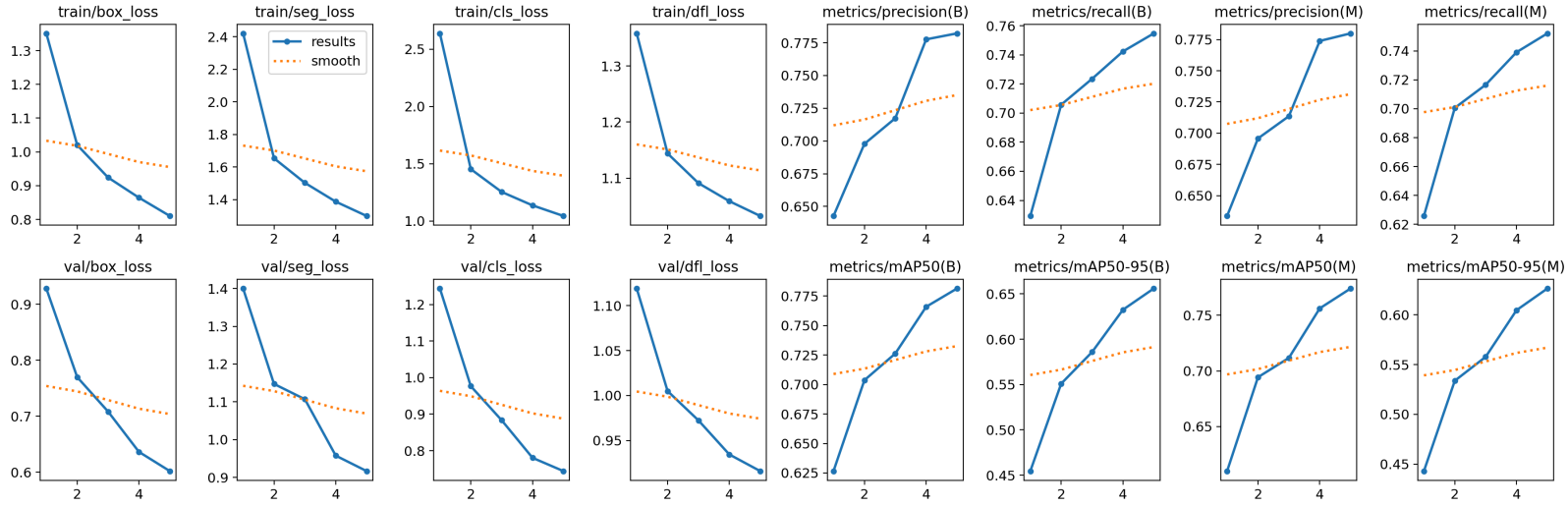
```
  9                  -1  1    164608  ultralytics.nn.modules.block.SPPF            [256, 256, 5]
 10                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 11             [-1, 6]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 12                  -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   1006810  ultralytics.nn.modules.head.Segment          [14, 32, 64, [64, 128, 256]]
YOLOv8n-seg summary: 151 layers, 3,266,346 parameters, 3,266,330 gradients, 12.1 GFLOPs

Transferred 381/417 items from pretrained weights
TensorBoard: Start with 'tensorboard --logdir runs/segment/train', view at http://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks...
Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolo11n.pt to 'yolo11n.pt'...
100% 5.35M/5.35M [00:00<00:00, 97.8MB/s]
AMP: checks passed ✅
train: Scanning /content/part-autolabeld-5/train/labels... 6603 images, 1 backgrounds, 0 corrupt: 100% 6603/6603 [00
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0122413_as-3243139_jpg.rf.27cba18d3b5cb377f6fe0e2f4c2f3f46
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0189576_sc-157769_jpg.rf.58e76ac524dfb9ab3fb4ac1a9cf547e9.
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0259102_sc-150122_jpg.rf.fe44c3dc6124e79b4038f85eaf180781.
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0306794_sc-1016074_jpg.rf.eebae45adec8e55ce4598aeee72ee1e0
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0330446_sc-226428_jpg.rf.ed12673188cf4bd1a004e658cab9bf65.
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0466044_sc-199874_jpg.rf.3f7c9f6e7b6d5f10e451a0a0283565a0.
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0523868_as-0041759_jpg.rf.f0d6d24c3a542f1485dc526c452bbf4f
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0540109_as-0047882_jpg.rf.ce12c21f9b43c6f813bee5dd9de56caa
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0550889_sc-206394_jpg.rf.61ff94fbf1d470fdff3e4a5a1cef972f.
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0590096_as-0081526_jpg.rf.8f7c348ad0e0f34f45b96c8475e532cf
train: WARNING ⚠️ /content/part-autolabeld-5/train/images/0596695_as-0075152_jpg.rf.ab4c5bcf6339e051ca4aacbb6a76e4ac
train: New cache created: /content/part-autolabeld-5/train/labels.cache
```

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

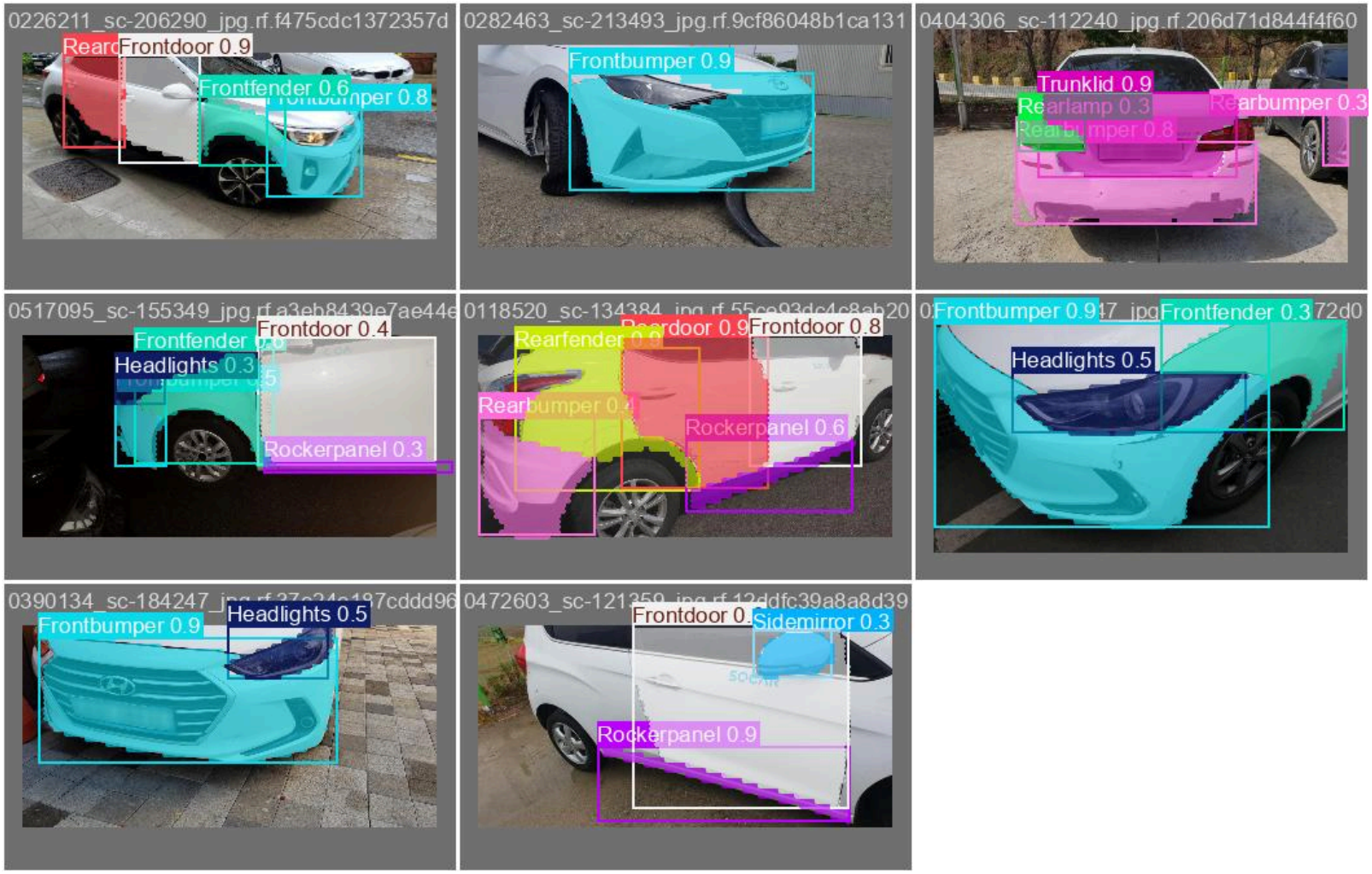
```
Image(filename="runs/segment/train/confusion_matrix.png", width=800)
```




```
Image(filename="/content/runs/segment/train/results.png",width=800)
```



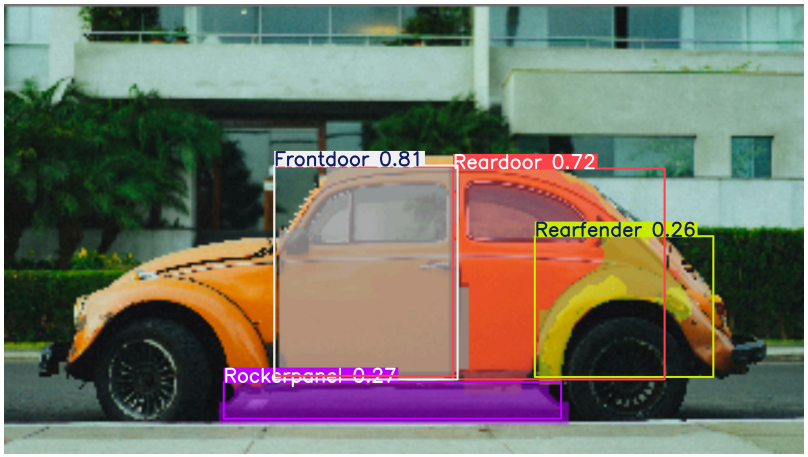

```
Image(filename=f'/content/runs/segment/train/val_batch0_pred.jpg', width=800)
```




```
!yolo task=segment mode=predict model=/content/runs/segment/train/weights/best.pt conf=0.25 source="/content/dan-gold-N7RiD
```

```
Ultralytics 8.3.78 🚀 Python-3.11.11 torch-2.5.1+cu124 CUDA:0 (Tesla T4, 15095MiB)
YOLOv8n-seg summary (fused): 85 layers, 3,260,794 parameters, 0 gradients, 12.0 GFLOPs

image 1/1 /content/dan-gold-N7RiDzfF2iw-unsplash.jpg: 192x320 1 Frontdoor, 2 Reardoors, 1 Rearfender, 1 Rockerpanel, 61
Speed: 2.1ms preprocess, 61.9ms inference, 217.2ms postprocess per image at shape (1, 3, 192, 320)
Results saved to runs/segment/predict
💡 Learn more at https://docs.ultralytics.com/modes/predict
```

```
Image(filename="/content/runs/segment/predict/dan-gold-N7RiDzfF2iw-unsplash.jpg",width=400)
```




```
!yolo task=segment mode=predict model=/content/runs/segment/train/weights/best.pt conf=0.25 source="/content/Volkswagen_Gol
```

```
Ultralytics 8.3.78 🚀 Python-3.11.11 torch-2.5.1+cu124 CUDA:0 (Tesla T4, 15095MiB)
YOLOv8n-seg summary (fused): 85 layers, 3,260,794 parameters, 0 gradients, 12.0 GFLOPs

image 1/1 /content/Volkswagen_Golf_VIII_IMG_4023.jpg: 192x320 1 Frontdoor, 1 Rearbumper, 1 Reardoor, 1 Rearfender, 1 Ro
Speed: 1.8ms preprocess, 68.4ms inference, 257.0ms postprocess per image at shape (1, 3, 192, 320)
Results saved to runs/segment/predict2
💡 Learn more at https://docs.ultralytics.com/modes/predict
```

```
Image(filename="/content/runs/segment/predict2/Volkswagen_Golf_VIII_IMG_4023.jpg",width=600)
```

Start coding or generate with AI.

```
---------------------------------------------------------------------------
RuntimeError                              Traceback (most recent call last)
<ipython-input-22-7209b8528cdb> in <cell line: 0>()
----> 1 project.version(dataset.version).deploy(model_type="yolov8-seg", model_path=f"/content/runs/segment/train")

/usr/local/lib/python3.11/dist-packages/roboflow/core/project.py in version(self, version_number, local)
    349                 return vers
    350
--> 351         raise RuntimeError(f"Version number {version_number} is not found.")
```