```
ROOT_DIR = '/home/vishal/ObjectDetection/Ocean-2/Dataset'
```

```
print(ROOT_DIR)
```

```
/home/vishal/ObjectDetection/Ocean-2/Dataset
```

```
!pip install ultralytics
```

```
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 6.2/6.2 MB 11.0 MB/s eta 0:00:0031m11.3 MB/s eta 0:00:01
Downloading triton-3.1.0-cp312-cp312-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (209.6 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 209.6/209.6 MB 8.5 MB/s eta 0:00:00m eta 0:00:01[36m0:00:01m
Downloading torchvision-0.20.1-cp312-cp312-manylinux1_x86_64.whl (7.2 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 7.2/7.2 MB 2.9 MB/s eta 0:00:00 MB/s eta 0:00:01:01
Downloading ultralytics_thop-2.0.12-py3-none-any.whl (26 kB)
Downloading py_cpuinfo-9.0.0-py3-none-any.whl (22 kB)
Downloading filelock-3.16.1-py3-none-any.whl (16 kB)
Downloading fsspec-2024.10.0-py3-none-any.whl (179 kB)
Downloading mpmath-1.3.0-py3-none-any.whl (536 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 536.2/536.2 kB 3.4 MB/s eta 0:00:00
Installing collected packages: py-cpuinfo, mpmath, sympy, nvidia-nvtx-cu12, nvidia-nvjitlink-cu12, nvidia-nccl-cu12, nvidia-curand-cu1
  Attempting uninstall: nvidia-nvjitlink-cu12
    Found existing installation: nvidia-nvjitlink-cu12 12.3.101
    Uninstalling nvidia-nvjitlink-cu12-12.3.101:
      Successfully uninstalled nvidia-nvjitlink-cu12-12.3.101
  Attempting uninstall: nvidia-nccl-cu12
    Found existing installation: nvidia-nccl-cu12 2.19.3
    Uninstalling nvidia-nccl-cu12-2.19.3:
      Successfully uninstalled nvidia-nccl-cu12-2.19.3
  Attempting uninstall: nvidia-curand-cu12
    Found existing installation: nvidia-curand-cu12 10.3.4.107
    Uninstalling nvidia-curand-cu12-10.3.4.107:
      Successfully uninstalled nvidia-curand-cu12-10.3.4.107
  Attempting uninstall: nvidia-cufft-cu12
    Found existing installation: nvidia-cufft-cu12 11.0.12.1
    Uninstalling nvidia-cufft-cu12-11.0.12.1:
      Successfully uninstalled nvidia-cufft-cu12-11.0.12.1
  Attempting uninstall: nvidia-cuda-runtime-cu12
    Found existing installation: nvidia-cuda-runtime-cu12 12.3.101
    Uninstalling nvidia-cuda-runtime-cu12-12.3.101:
      Successfully uninstalled nvidia-cuda-runtime-cu12-12.3.101
  Attempting uninstall: nvidia-cuda-nvrtc-cu12
    Found existing installation: nvidia-cuda-nvrtc-cu12 12.3.107
    Uninstalling nvidia-cuda-nvrtc-cu12-12.3.107:
      Successfully uninstalled nvidia-cuda-nvrtc-cu12-12.3.107
  Attempting uninstall: nvidia-cuda-cupti-cu12
    Found existing installation: nvidia-cuda-cupti-cu12 12.3.101
    Uninstalling nvidia-cuda-cupti-cu12-12.3.101:
      Successfully uninstalled nvidia-cuda-cupti-cu12-12.3.101
  Attempting uninstall: nvidia-cublas-cu12
    Found existing installation: nvidia-cublas-cu12 12.3.4.1
    Uninstalling nvidia-cublas-cu12-12.3.4.1:
      Successfully uninstalled nvidia-cublas-cu12-12.3.4.1
  Attempting uninstall: nvidia-cusparse-cu12
    Found existing installation: nvidia-cusparse-cu12 12.2.0.103
    Uninstalling nvidia-cusparse-cu12-12.2.0.103:
      Successfully uninstalled nvidia-cusparse-cu12-12.2.0.103
  Attempting uninstall: nvidia-cudnn-cu12
    Found existing installation: nvidia-cudnn-cu12 8.9.7.29
    Uninstalling nvidia-cudnn-cu12-8.9.7.29:
      Successfully uninstalled nvidia-cudnn-cu12-8.9.7.29
  Attempting uninstall: nvidia-cusolver-cu12
    Found existing installation: nvidia-cusolver-cu12 11.5.4.101
    Uninstalling nvidia-cusolver-cu12-11.5.4.101:
      Successfully uninstalled nvidia-cusolver-cu12-11.5.4.101
Successfully installed filelock-3.16.1 fsspec-2024.10.0 mpmath-1.3.0 nvidia-cublas-cu12-12.4.5.8 nvidia-cuda-cupti-cu12-12.4.127 nvidi
```

```
# import os

# from ultralytics import YOLO
```

```
Creating new Ultralytics Settings v0.0.6 file ✅
View Ultralytics Settings with 'yolo settings' or at '/home/vishal/.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/qui
```

```
import os
import random
import pandas as pd
```

```
from PIL import Image
import cv2
from ultralytics import YOLO
from IPython.display import Video
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
sns.set(style='darkgrid')
import pathlib
import glob
from tqdm.notebook import trange, tqdm
import warnings
warnings.filterwarnings('ignore')
```

```
trainimage1 = cv2.imread(ROOT_DIR + "/train/images/1-1_jpg.rf.3c35c15f5361d33821647bfd181b0af7.jpg")
h, w, c = image1.shape
print(f"The image has dimensions {w}x{h} and {c} channels.")
```

```
The image has dimensions 416x416 and 3 channels.
```

```
trainimage2 = cv2.imread(ROOT_DIR +"/train/images/uwg_g-1098__flipv_jpg.rf.788c619ed30e1be98b8ca6e74a87b92d.jpg")
h, w, c = image2.shape
print(f"The image has dimensions {w}x{h} and {c} channels.")
```

```
The image has dimensions 416x416 and 3 channels.
```

```
trainimage3 = cv2.imread(ROOT_DIR +"/train/images/gloves_in_the_ocean78_jpg.rf.a5ba0b4fe93f94613c7c92dd9a0d37a1.jpg")
h, w, c = image2.shape
print(f"The image has dimensions {w}x{h} and {c} channels.")
```

```
The image has dimensions 416x416 and 3 channels.
```

```
model = YOLO("yolov8n.yaml")
```

```
result_predict = model.predict(source = trainimage1)
```

```
0: 640x640 (no detections), 4.2ms
Speed: 1.8ms preprocess, 4.2ms inference, 0.4ms postprocess per image at shape (1, 3, 640, 640)
```

```
result_predict = model.predict(source = trainimage2)
```

```
0: 640x640 (no detections), 11.2ms
Speed: 4.6ms preprocess, 11.2ms inference, 0.8ms postprocess per image at shape (1, 3, 640, 640)
```

```
result_predict = model.predict(source = trainimage3)
```

```
0: 640x640 (no detections), 12.2ms
Speed: 4.6ms preprocess, 12.2ms inference, 0.7ms postprocess per image at shape (1, 3, 640, 640)
```

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

```
results = Final_model.train(data="/kaggle/input/underwater-plastic-pollution-detection/underwater_plastics/data.yaml",epochs=100, imgsz = 64
                            lr0=0.01, dropout= 0.15, device = 0)
```

```
results = model.train(data=os.path.join(ROOT_DIR, "Dataset.yaml"), epochs=100)
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    98/100      2.33G      1.141       1.02      1.597         42
                 Class     Images  Instances      Box(P          R      mA
                   all       1001       1891      0.588      0.503      0.547      0.351

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    99/100      2.21G      1.145      1.031      1.596         15
                 Class     Images  Instances      Box(P          R      mA
                   all       1001       1891      0.602        0.5      0.544      0.349

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
   100/100      2.32G       1.14      1.019      1.599         45
                 Class     Images  Instances      Box(P          R      mA
                   all       1001       1891      0.599      0.488      0.543      0.349

100 epochs completed in 1.037 hours.
Optimizer stripped from runs/detect/train2/weights/last.pt, 6.3MB
Optimizer stripped from runs/detect/train2/weights/best.pt, 6.3MB

Validating runs/detect/train2/weights/best.pt...
WARNING ⚠️ validating an untrained model YAML will result in 0 mAP.
Ultralytics 8.3.34 🚀 Python-3.12.7 torch-2.5.1+cu124 CUDA:0 (NVIDIA RTX A2000 12GB, 12036MiB)
YOLOv8n summary (fused): 168 layers, 3,008,573 parameters, 0 gradients, 8.1 GFLOPs
                 Class     Images  Instances      Box(P          R      mA
                   all       1001       1891      0.664      0.466      0.548      0.353
                  Mask         77         90      0.866      0.678      0.785       0.53
                   can         18         20      0.761       0.15      0.289     0.0748
             cellphone         61         71        0.9      0.944      0.972      0.821
           electronics         27         40      0.465      0.475      0.483      0.271
               gbottle         36         82      0.557      0.634        0.6      0.383
                 glove         37         55      0.775        0.8      0.818      0.638
                 metal         10         22      0.733     0.0455      0.143     0.0594
                  misc         48         51      0.423      0.255      0.348      0.227
                   net        146        148      0.728      0.764      0.833      0.545
                  pbag        290        330      0.777      0.912       0.93      0.753
               pbottle        122        284      0.656      0.632      0.638      0.364
               plastic         51         59      0.543      0.119      0.251      0.113
                   rod          7          9          0          0      0.105     0.0386
            sunglasses          3          3          1          0      0.304       0.17
                  tire        143        627       0.78       0.59      0.714      0.315
Speed: 0.2ms preprocess, 1.9ms inference, 0.0ms loss, 0.9ms postprocess per image
Results saved to runs/detect/train2
```

```
import cv2
img = cv2.imread("//home/vishal/ObjectDetection/Ocean-2/runs/detect/train2/P_curve.png")
if img is None:
    print("Image not loaded. Check the file path or image integrity.")
else:
    print("Image loaded successfully.")
```

```
Image loaded successfully.
```

```
list_of_metrics = ["P_curve.png","R_curve.png","confusion_matrix.png"]
for i in list_of_metrics:
    img = cv2.imread(f"/home/vishal/ObjectDetection/Ocean-2/runs/detect/train2/{i}")
    plt.figure(figsize = (16, 12))
    plt.imshow(np.array(img))
    plt.show()
```

```
<Figure size 1600x1200 with 1 Axes>
<Figure size 1600x1200 with 1 Axes>
<Figure size 1600x1200 with 1 Axes>
```

```
results = pd.read_csv("/home/vishal/ObjectDetection/Ocean-2/runs/detect/train2/results.csv")
results.head()
```

	epoch	time	train/box_loss	train/cls_loss	train/dfl_loss	metrics/precision(B)	metrics/recall(B)	metrics/mAP50(B)	metrics/mA 9
0	1	42.1148	3.33394	4.95037	4.14458	0.60257	0.01426	0.00162	0.0
1	2	80.2926	3.07048	4.59609	3.69187	0.53884	0.01717	0.00309	0.0
2	3	118.7550	2.64226	4.23562	3.15993	0.49159	0.01251	0.00933	0.0
3	4	158.9810	2.33966	3.85756	2.81156	0.38025	0.04556	0.03023	0.0
4	5	197.8370	2.12116	3.53113	2.60001	0.48278	0.05341	0.04541	0.0

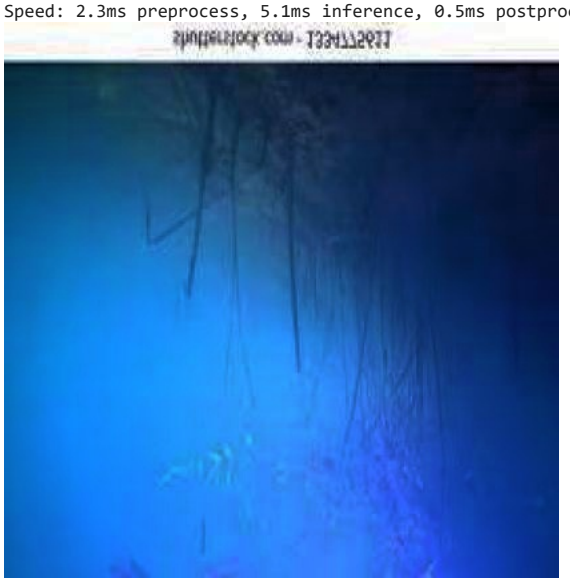
```
Best_model = YOLO('/home/vishal/ObjectDetection/Ocean-2/runs/detect/train2/weights/best.pt')


metrics = Best_model.val(split = 'val')
```

```
Ultralytics 8.3.34 🚀 Python-3.12.7 torch-2.5.1+cu124 CUDA:0 (NVIDIA RTX A2000 12GB, 12036MiB)
YOLOv8n summary (fused): 168 layers, 3,008,573 parameters, 0 gradients, 8.1 GFLOPs
val: Scanning /home/vishal/ObjectDetection/Ocean-2/Dataset/val/labels.cach
                   Class     Images  Instances      Box(P          R      mA
                     all       1001       1891      0.671      0.466      0.548      0.353
                    Mask         77         90      0.884      0.678      0.785      0.532
                     can         18         20      0.765       0.15      0.293     0.0761
              cellphone         61         71        0.9      0.944      0.972      0.823
            electronics         27         40      0.467      0.475      0.484      0.263
                gbottle         36         82      0.568      0.634      0.602      0.382
                  glove         37         55      0.777        0.8      0.817      0.638
                  metal         10         22      0.746     0.0455      0.143     0.0594
                   misc         48         51      0.449      0.255      0.347      0.227
                    net        146        148      0.729      0.764      0.834      0.545
                   pbag        290        330      0.778      0.912       0.93      0.753
                pbottle        122        284      0.663       0.63      0.638      0.362
                plastic         51         59      0.549      0.119      0.251      0.113
                    rod          7          9          0          0      0.106     0.0386
             sunglasses          3          3          1          0      0.304       0.17
                   tire        143        627      0.783      0.588      0.713      0.315
Speed: 0.3ms preprocess, 3.5ms inference, 0.0ms loss, 0.6ms postprocess per image
Results saved to runs/detect/val3
```

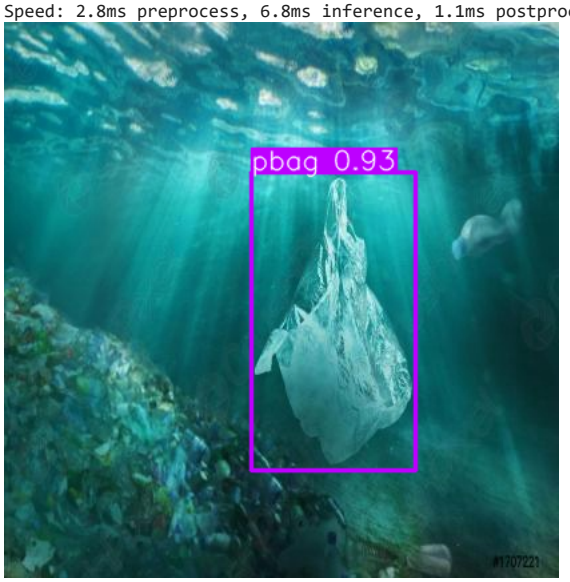
```
images = os.listdir("/home/vishal/ObjectDetection/Ocean-2/Dataset/test/images")
for i in range(0,501):
    image = os.path.join("/home/vishal/ObjectDetection/Ocean-2/Dataset/test/images", images[i])
    result_predict = Best_model.predict(source = image, imgsz=(640), iou=0.4)

    plot = result_predict[0].plot()
    plot = cv2.cvtColor(plot, cv2.COLOR_BGR2RGB)
    display(Image.fromarray(plot))
```

```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/uwg_g-421_jpg.rf.e1606619bcbca17b5363ea51cc04b699.jpg: 640x640 1 cell
Speed: 3.4ms preprocess, 7.2ms inference, 1.6ms postprocess per image at shape (1, 3, 640, 640)
```


```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/uwg_g-1285__flipv_jpg.rf.164503c6dad99ce8c147cb3706586431.jpg: 640x64
Speed: 2.3ms preprocess, 5.1ms inference, 0.5ms postprocess per image at shape (1, 3, 640, 640)
```

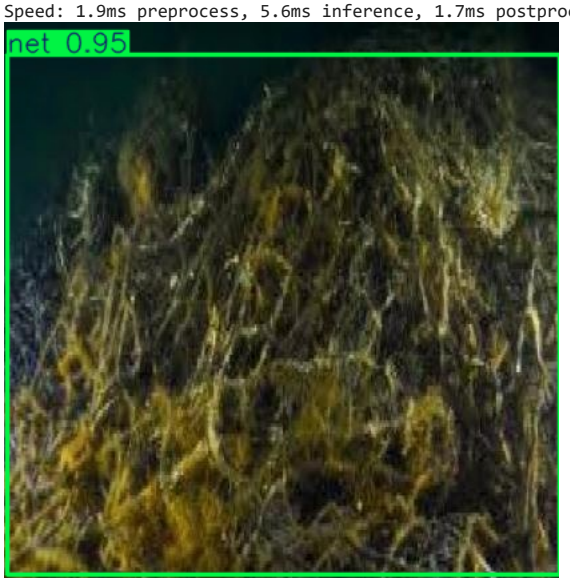


```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/uwg_g-924-1-_jpg.rf.945026dc557b7ffa081a80eb67ce7898.jpg: 640x640 1 p
Speed: 2.8ms preprocess, 6.8ms inference, 1.1ms postprocess per image at shape (1, 3, 640, 640)
```

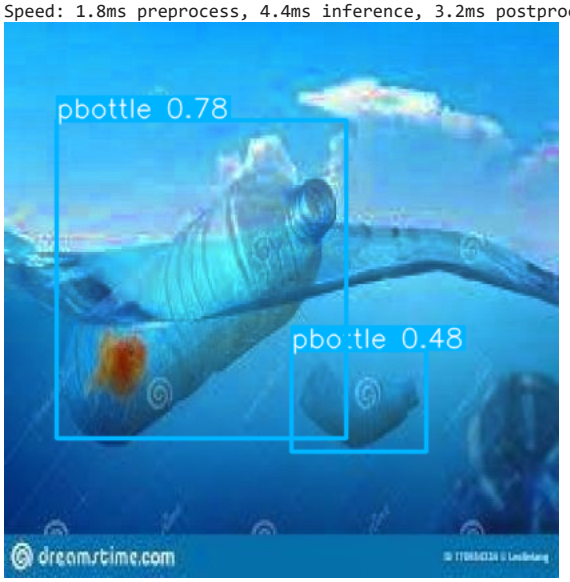



```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/STOCK_DSC8177_3opix2_jpg.rf.e9f5811cd21ce1f2ac92b50c20df9b5d.jpg: 640
Speed: 1.8ms preprocess, 4.5ms inference, 1.0ms postprocess per image at shape (1, 3, 640, 640)
```

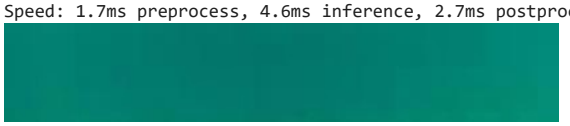

```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/uwg_g-101__fliph_jpg.rf.34dbd94ef6012f20e44adea79100b5f6.jpg: 640x640
Speed: 1.9ms preprocess, 5.6ms inference, 1.7ms postprocess per image at shape (1, 3, 640, 640)
```



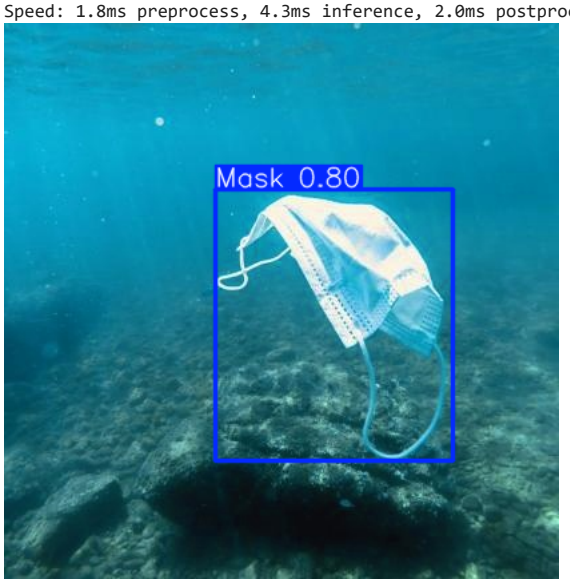

```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/uwg_g-1037_jpg.rf.1b27dc3c2704b787f784b62437b90b4e.jpg: 640x640 2 pbo
Speed: 1.8ms preprocess, 4.4ms inference, 3.2ms postprocess per image at shape (1, 3, 640, 640)
```




```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/uwg_g-1262_jpg.rf.6e186a50c72e49e6f677aa7888151aa8.jpg: 640x640 1 tir
Speed: 1.7ms preprocess, 4.6ms inference, 2.7ms postprocess per image at shape (1, 3, 640, 640)
```




```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/file-20201009-15-1atu53y_jpeg_jpg.rf.3691dca4293ba92ad96095cedf156803
Speed: 1.8ms preprocess, 4.3ms inference, 2.0ms postprocess per image at shape (1, 3, 640, 640)
```




```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/uwg_g-1215__fliph_jpg.rf.d066e8675e509d5c538d3243c576988e.jpg: 640x64
Speed: 1.7ms preprocess, 4.5ms inference, 0.4ms postprocess per image at shape (1, 3, 640, 640)
```

```
image 1/1 /home/vishal/ObjectDetection/Ocean-2/Dataset/test/images/uwg_g-789__flipv_jpg.rf.09c080a24083a01cd2daadc734c0949c.jpg: 640x640
Speed: 2.5ms preprocess, 4.3ms inference, 0.4ms postprocess per image at shape (1, 3, 640, 640)
```