

▼ Install Requirements

```
#clone YOLOv5 and
!git clone https://github.com/ultralytics/yolov5 # clone repo
%cd yolov5
%pip install -qr requirements.txt # install dependencies
%pip install -q roboflow
```

```
import torch
import os
from IPython.display import Image, clear_output # to display images
```

```
print(f"Setup complete. Using torch {torch.__version__} ({torch.cuda.get_device_properties(0).name if torch.cuda.is_available() else 'CPU'})")
```

Cloning into 'yolov5'...

remote: Enumerating objects: 13033, done.
remote: Total 13033 (delta 0), reused 0 (delta 0), pack-reused 13033
Receiving objects: 100% (13033/13033), 11.96 MiB | 20.15 MiB/s, done.
Resolving deltas: 100% (9059/9059), done.
/content/yolov5

	596 kB	7.8 MB/s
	145 kB	6.8 MB/s
	178 kB	49.7 MB/s
	1.1 MB	30.7 MB/s
	67 kB	6.9 MB/s
	54 kB	3.3 MB/s
	138 kB	64.1 MB/s
	63 kB	2.0 MB/s

Building wheel for roboflow (setup.py) ... done
Building wheel for wget (setup.py) ... done
ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following dependency conflicts.
google-colab 1.0.0 requires requests~=2.23.0, but you have requests 2.27.1 which is incompatible.
datascience 0.10.6 requires folium==0.2.1, but you have folium 0.8.3 which is incompatible.
albumations 0.1.12 requires imgaug<0.2.7,>=0.2.5, but you have imgaug 0.2.9 which is incompatible.
Setup complete. Using torch 1.11.0+cu113 (CPU)

▼ Importing Data

```
!pip install -q roboflow
from roboflow import Roboflow
rf = Roboflow(model_format="yolov5", notebook="ultralytics")
```

upload and label your dataset, and get an API KEY here: <https://app.roboflow.com/?model=yolov5&ref=ultralytics>

```
# set up environment
os.environ["DATASET_DIRECTORY"] = "/content/datasets"
```



```
!pip install roboflow
```

```
from roboflow import Roboflow
rf = Roboflow(api_key="lq6dYozmQy1cmPL3LfWZ")
project = rf.workspace("great-barrier-reef").project("great-barrier-reef-o5scc")
dataset = project.version(5).download("yolov5")
```


Requirement already satisfied: roboflow in /usr/local/lib/python3.7/dist-packages (0.2.4)
Requirement already satisfied: certifi==2021.5.30 in /usr/local/lib/python3.7/dist-packages (from roboflow) (2021.5.30)
Requirement already satisfied: PyYAML>=5.3.1 in /usr/local/lib/python3.7/dist-packages (from roboflow) (6.0)
Requirement already satisfied: urllib3==1.26.6 in /usr/local/lib/python3.7/dist-packages (from roboflow) (1.26.6)
Requirement already satisfied: requests-toolbelt in /usr/local/lib/python3.7/dist-packages (from roboflow) (0.9.1)
Requirement already satisfied: idna==2.10 in /usr/local/lib/python3.7/dist-packages (from roboflow) (2.10)
Requirement already satisfied: kiwisolver==1.3.1 in /usr/local/lib/python3.7/dist-packages (from roboflow) (1.3.1)
Requirement already satisfied: opencv-python>=4.1.2 in /usr/local/lib/python3.7/dist-packages (from roboflow) (4.1.2.30)
Requirement already satisfied: pyparsing==2.4.7 in /usr/local/lib/python3.7/dist-packages (from roboflow) (2.4.7)
Requirement already satisfied: chardet==4.0.0 in /usr/local/lib/python3.7/dist-packages (from roboflow) (4.0.0)
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages (from roboflow) (1.15.0)
Requirement already satisfied: wget in /usr/local/lib/python3.7/dist-packages (from roboflow) (3.2)
Requirement already satisfied: Pillow>=7.1.2 in /usr/local/lib/python3.7/dist-packages (from roboflow) (7.1.2)
Requirement already satisfied: python-dotenv in /usr/local/lib/python3.7/dist-packages (from roboflow) (0.20.0)
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from roboflow) (2.27.1)
Requirement already satisfied: cycler==0.10.0 in /usr/local/lib/python3.7/dist-packages (from roboflow) (0.10.0)
Requirement already satisfied: python-dateutil in /usr/local/lib/python3.7/dist-packages (from roboflow) (2.8.2)
Requirement already satisfied: tqdm==4.41.0 in /usr/local/lib/python3.7/dist-packages (from roboflow) (4.64.0)
Requirement already satisfied: numpy>=1.18.5 in /usr/local/lib/python3.7/dist-packages (from roboflow) (1.21.6)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.7/dist-packages (from roboflow) (3.2.2)
Requirement already satisfied: charset-normalizer~=2.0.0 in /usr/local/lib/python3.7/dist-packages (from requests->roboflow) (2.0.12)
loading Roboflow workspace...
loading Roboflow project...
Downloading Dataset Version Zip in /content/datasets/Great-Barrier-Reef-5 to yolov5pytorch: 100% [210739077 / 210739077] bytes
Extracting Dataset Version Zip to /content/datasets/Great-Barrier-Reef-5 in yolov5pytorch: 100%[██████████] 9838/9838 [00:09<00:00, 1048.24it/s]

▼ Training

```
!python train.py --img 416 --batch 16 --epochs 150 --data {dataset.location}/data.yaml --weights yolov5s.pt --cache
```

train: weights=yolov5s.pt, cfg=, data=/content/datasets/Great-Barrier-Reef-5/data.yaml, hyp=data/hyps/hyp.scratch-low.yaml, epochs=150, batch_size=16, imgsz=416, rect=False, resume=False, nosave=False,
github: up to date with <https://github.com/ultralytics/yolov5> 
YOLOv5  v6.1-163-gb53917d torch 1.11.0+cu113 CPU

hyperparameters: lr=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=0.05, cls=0.5, cls_pw=1.0, obj=1.0, obj_pw=1.0, iou_t=0.2, anch

Weights & Biases: run 'pip install wandb' to automatically track and visualize YOLOv5  runs (RECOMMENDED)

TensorBoard: Start with 'tensorboard --logdir runs/train', view at <http://localhost:6006/>

Downloading <https://ultralytics.com/assets/Arial.ttf> to /root/.config/Ultralytics/Arial.ttf...

100% 755k/755k [00:00<00:00, 25.3MB/s]

Downloading <https://github.com/ultralytics/yolov5/releases/download/v6.1/yolov5s.pt> to yolov5s.pt...

100% 14.1M/14.1M [00:00<00:00, 22.2MB/s]

Overriding model.yaml nc=80 with nc=1

	from	n	params	module	arguments
0	-1	1	3520	models.common.Conv	[3, 32, 6, 2, 1]
1	-1	1	18560	models.common.Conv	[32, 64, 3, 2]
2	-1	1	18816	models.common.C3	[64, 64, 1]
3	-1	1	73984	models.common.Conv	[64, 128, 3, 2]
4	-1	2	115712	models.common.C3	[128, 128, 2]
5	-1	1	295424	models.common.Conv	[128, 256, 3, 2]

```
7         -1 3      625152 models.common.C3 [256, 256, 3]
8         -1 1      1180672 models.common.Conv [256, 512, 3, 2]
9         -1 1      656896 models.common.SPPF [512, 512, 1]
10        -1 1      131584 models.common.Conv [512, 512, 5]
11        -1 1      0 torch.nn.modules.upsampling.Upsample [512, 256, 1, 1]
12        [-1, 6] 1      0 models.common.Concat [None, 2, 'nearest']
13        -1 1      361984 models.common.C3 [1]
14        -1 1      33024 models.common.Conv [512, 256, 1, False]
15        -1 1      0 torch.nn.modules.upsampling.Upsample [256, 128, 1, 1]
16        [-1, 4] 1      0 models.common.Concat [None, 2, 'nearest']
17        -1 1      90880 models.common.C3 [1]
18        -1 1      147712 models.common.Conv [256, 128, 1, False]
19        [-1, 14] 1      0 models.common.Concat [128, 128, 3, 2]
20        -1 1      296448 models.common.C3 [1]
21        -1 1      590336 models.common.Conv [256, 256, 1, False]
22        [-1, 10] 1      0 models.common.Concat [256, 256, 3, 2]
23        -1 1      1182720 models.common.C3 [1]
24        [17, 20, 23] 1      16182 models.yolo.Detect [512, 512, 1, False]
[1, [[10, 13, 16, 30, 33, 23], [30, 61, 62, 45, 59, 119], [116, 90, 156, 198, 373, 326]], [128, 256, 512]]
Model summary: 270 layers, 7022326 parameters, 7022326 gradients, 15.8 GFLOPs
```

Transferred 343/349 items from yolov5s.pt

Scaled weight_decay = 0.0005

optimizer: SGD with parameter groups 57 weight (no decay), 60 weight, 60 bias

albumentations: version 1.0.3 required by YOLOv5, but version 0.1.12 is currently installed

train: Scanning '/content/datasets/Great-Barrier-Reef-5/train/labels' images and labels...3438 found, 0 missing, 0 empty, 0 corrupt: 100% 3438/3438 [00:02<00:00, 1607.14it/s]

train: New cache created: /content/datasets/Great-Barrier-Reef-5/train/labels.cache

train: Caching images (1.8GB ram): 100% 3438/3438 [00:11<00:00, 305.13it/s]

val: Scanning '/content/datasets/Great-Barrier-Reef-5/valid/labels' images and labels...983 found, 0 missing, 0 empty, 0 corrupt: 100% 983/983 [00:00<00:00, 1166.06it/s]

val: New cache created: /content/datasets/Great-Barrier-Reef-5/valid/labels.cache

val: Caching images (0.5GB ram): 100% 983/983 [00:03<00:00, 306.39it/s]

Plotting labels to runs/train/exp/labels.jpg...

AutoAnchor: 4.52 anchors/target, 1.000 Best Possible Recall (BPR). Current anchors are a good fit to dataset ✔

Image sizes 416 train, 416 val

```
# Start tensorboard
# Launch after you have started training
# logs save in the folder "runs"
%load_ext tensorboard
%tensorboard --logdir runs
```

The tensorboard extension is already loaded. To reload it, use:

```
%reload_ext tensorboard
```

Reusing TensorBoard on port 6006 (pid 833), started 0:33:46 ago. (Use '!kill 833' to kill it.)

TensorBoard

GRAPHS

INACTIVE

Search nodes (regex)

Fit to screen

Download PNG

Upload file

Run (1) train/exp

Tag (2) Default

Graph type

Op graph

Conceptual graph

Profile

Node options

Trace inputs

Legend

colors

same substructure

unique substructure

(* = expandable)

Namespace* 2

OpNode 2

Unconnected series* 2

Connected series* 2

Constant 2

Summary 2

Dataflow edge 2

Control dependency edge 2

Reference edge 2

Main Graph

output

Model

input

Run Inference With Trained Weights

Run inference with a pretrained checkpoint on contents of test/images folder downloaded from Roboflow.

```
!python detect.py --weights runs/train/exp/weights/best.pt --img 416 --conf 0.1 --source {dataset.location}/test/images
```

```
detect: weights='runs/train/exp/weights/best.pt', source=/content/datasets/Great-Barrier-Reef-5/test/images, data=data/coco128.yaml, imgsz=[416, 416], conf_thres=0.1, iou_thres=0.45, max_det=1000, de
YOLOv5 v6.1-163-gb53917d torch 1.11.0+cu113 CPU
```

Fusing layers...

Model summary: 213 layers, 7012822 parameters, 0 gradients, 15.8 GFLOPs

image 1/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1007.jpg.rf.122bd536b1c919a281abe78051fde020.jpg: 416x416 1 0, Done. (0.206s)

image 2/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-100.jpg.rf.aad62d0d2aa19b1defd1af777c2653c5.jpg: 416x416 2 0s, Done. (0.182s)

image 3/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1010.jpg.rf.9f4147c2c0e5ce721e77bca11cb37364.jpg: 416x416 1 0, Done. (0.168s)

image 4/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1021.jpg.rf.1a6911e7e6c138252f7ceb56a95df1ca.jpg: 416x416 1 0, Done. (0.173s)

image 5/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1027.jpg.rf.c244bb737c2476d1e81de6dc833465b8.jpg: 416x416 1 0, Done. (0.168s)

image 6/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-109.jpg.rf.eadb48bf5a5add5fb9fbc67702084d3.jpg: 416x416 1 0, Done. (0.173s)

image 7/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-112.jpg.rf.8ae4ea2c477576d68aca5b6661a24288.jpg: 416x416 2 0s, Done. (0.167s)

image 8/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-117.jpg.rf.9a45ea560d52ec6741a38a3896dc9d03.jpg: 416x416 2 0s, Done. (0.167s)

image 9/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-11869.jpg.rf.7dfea4667b83c7f938ead26cd32457a2.jpg: 416x416 1 0, Done. (0.168s)

image 10/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-11887.jpg.rf.ddfef675158bb30fd1335617100124d.jpg: 416x416 1 0, Done. (0.169s)

image 11/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-11905.jpg.rf.351c47034ca43f29e0b95395a93afb58.jpg: 416x416 2 0s, Done. (0.178s)

image 12/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-11917.jpg.rf.dfd454eb967a3968e5e1c1df3f3521da.jpg: 416x416 1 0, Done. (0.170s)

```
image 13/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-120.jpg.rf.587b171439c6a3570617e10a48a29b93.jpg. 416x416 1 0, Done. (0.1675)
image 14/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-121.jpg.rf.7391ffa788fedf03a810626c0ce79beb.jpg. 416x416 1 0, Done. (0.1665)
image 15/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12193.jpg.rf.55f741f8f62d7500ef77e6b25cd046d8.jpg. 416x416 1 0, Done. (0.1665)
image 16/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12200.jpg.rf.1693c91d86967d49a451f6592400e6bc.jpg. 416x416 2 0s, Done. (0.1715)
image 17/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12202.jpg.rf.3d092b5d20e817efd5f5fb84634374acd.jpg. 416x416 2 0s, Done. (0.1815)
image 18/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12205.jpg.rf.43a5e0c889c61ba8021fbb38d04ecfa.jpg. 416x416 2 0s, Done. (0.1705)
image 19/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12210.jpg.rf.8ed413259f57b6a3d6bc3b41cac9430f.jpg. 416x416 2 0s, Done. (0.1685)
image 20/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12213.jpg.rf.c6429499063c111d993da66e9ef5c7d.jpg. 416x416 2 0s, Done. (0.1655)
image 21/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12219.jpg.rf.78dd2819707476d18802187b61e6e3d2.jpg. 416x416 3 0s, Done. (0.1675)
image 22/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12227.jpg.rf.50c13a822f2417b159315bc2098bbddb.jpg. 416x416 2 0s, Done. (0.1645)
image 23/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12230.jpg.rf.2f6c3c3e885840f0ee402165eb748eb3.jpg. 416x416 2 0s, Done. (0.1785)
image 24/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12237.jpg.rf.6eb2fe8b15cbd6348ef7f2c461ed7a99.jpg. 416x416 2 0s, Done. (0.1715)
image 25/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12254.jpg.rf.1bdf36de1174cac73c6b4579840551c8.jpg. 416x416 3 0s, Done. (0.1675)
image 26/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12261.jpg.rf.c3546ac2bcd38259202f4bdb6d58ce5b.jpg. 416x416 2 0s, Done. (0.1645)
image 27/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12263.jpg.rf.24860ecce3554cd7bbcd8135f2b579bf.jpg. 416x416 2 0s, Done. (0.1695)
image 28/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12289.jpg.rf.02012b1d385e39cae3f77c0fa1f02310.jpg. 416x416 1 0, Done. (0.1775)
image 29/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12310.jpg.rf.9e49299e22d11949c61534e108ced22c.jpg. 416x416 1 0, Done. (0.1745)
image 30/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-127.jpg.rf.c967d48ca6e1cc2fd6306e5fe22d8b94.jpg. 416x416 1 0, Done. (0.1715)
image 31/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-130.jpg.rf.393646ec2cef582af80e402ea03cc2e3.jpg. 416x416 2 0s, Done. (0.2055)
image 32/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-143.jpg.rf.3ffc66dc99f8ded220cef16f35619421.jpg. 416x416 1 0, Done. (0.1685)
image 33/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-151.jpg.rf.258e7b51518c32ed04e00603baede27a.jpg. 416x416 2 0s, Done. (0.1705)
image 34/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1546.jpg.rf.df19680358efd8492029aee09694aa.jpg. 416x416 1 0, Done. (0.1815)
image 35/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1560.jpg.rf.1d126f552e4c7cac69217a166d8ded9b.jpg. 416x416 1 0, Done. (0.1725)
image 36/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1561.jpg.rf.8357b8c7790bdca2bbdb210fbaa0ee6f.jpg. 416x416 1 0, Done. (0.1665)
image 37/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-156.jpg.rf.2926b04bdb79a39557390155bb581ff8.jpg. 416x416 1 0, Done. (0.1655)
image 38/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-167.jpg.rf.2e37047d86a9252bc86947e67c6739b.jpg. 416x416 1 0, Done. (0.1665)
image 39/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-170.jpg.rf.9a4e2438bbeb09b79fad61b02df64446.jpg. 416x416 2 0s, Done. (0.1745)
image 40/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-171.jpg.rf.d2c4a4b82336e858fca46c8b1a7f4a7.jpg. 416x416 2 0s, Done. (0.1695)
image 41/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1863.jpg.rf.c4a4b7332deb9b071cf2c916b2329640.jpg. 416x416 1 0, Done. (0.1655)
image 42/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1868.jpg.rf.c31767c5594b21d221dc46946d97a3cb.jpg. 416x416 1 0, Done. (0.1695)
image 43/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1880.jpg.rf.4c4dbccce99aa4ab4afd06df34149c3ca.jpg. 416x416 1 0, Done. (0.1645)
image 44/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1884.jpg.rf.a46266dd9f79f72962dab7bd9e273da6.jpg. 416x416 1 0, Done. (0.1785)
image 45/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-18.jpg.rf.d28d9f1fdc760200864dc8aa00b4dc8d.jpg. 416x416 1 0, Done. (0.1825)
image 46/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1930.jpg.rf.690905aaf5d5cb9f5048a723e4d93ad6.jpg. 416x416 1 0, Done. (0.1735)
image 47/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-20.jpg.rf.9c980298085782ec597ce4ac3ff0cc7c.jpg. 416x416 1 0, Done. (0.1645)
image 48/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-21.jpg.rf.39d94ec7a2ea22e6888efc015040ab17.jpg. 416x416 1 0, Done. (0.1665)
image 49/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2275.jpg.rf.8033b4231aad446e9e2a4ed3591a3aa4.jpg. 416x416 1 0, Done. (0.1705)
image 50/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2280.jpg.rf.40413a0ad4f88fc16c52970951ddf225.jpg. 416x416 1 0, Done. (0.1695)
image 51/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2289.jpg.rf.45843d6ba21e2ed82b8679d39f9f34e2.jpg. 416x416 1 0, Done. (0.1775)
image 52/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2298.jpg.rf.b528a70d973749d0821244a0b93e536d.jpg. 416x416 1 0, Done. (0.1415)
image 53/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-22.jpg.rf.698c600eb720d944a83b1377f0ffdbf7.jpg. 416x416 1 0, Done. (0.1545)
image 54/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2308.jpg.rf.c00d61fa688182da0e6061263e7a52d77.jpg. 416x416 1 0, Done. (0.1485)
image 55/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2311.jpg.rf.f7200527f9966a1897a0f964c5859f2.jpg. 416x416 1 0, Done. (0.1475)
image 56/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2315.jpg.rf.d8fddcf1238c368fe662df41efda0abc.jpg. 416x416 1 0, Done. (0.1555)
image 57/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2318.jpg.rf.ea9c2a5ccc2f5aa3f9f714f0549df2b4.jpg. 416x416 1 0, Done. (0.1495)
image 58/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2320.jpg.rf.8c96e708db30058da691ee711238220.jpg. 416x416 1 0, Done. (0.1455)
image 59/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2325.jpg.rf.df12661fa98583ea6b4604548e8db68.jpg. 416x416 1 0, Done. (0.1515)
image 60/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2331.jpg.rf.e9559d10cb02832c97c39ca3528517bf.jpg. 416x416 1 0, Done. (0.1445)
image 61/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-238.jpg.rf.a06dc8d81c70dfc1fa9e06aa4e71fb5.jpg. 416x416 1 0, Done. (0.1485)
image 62/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-239.jpg.rf.471c11a72379a9f73cf47f83db1df70a5.jpg. 416x416 1 0, Done. (0.1465)
image 63/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-240.jpg.rf.a925dca0965eb3a6f8aed6f43c246a3d.jpg. 416x416 1 0, Done. (0.1455)
image 64/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-246.jpg.rf.0eb9c24dda04baf9a9528bf96d780d9.jpg. 416x416 1 0, Done. (0.1475)
image 65/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-25.jpg.rf.1961e53e385cedc21b8d73e8a4d301b9.jpg. 416x416 2 0s, Done. (0.1485)
image 66/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-273.jpg.rf.c709b0caff4e2940ef1cbe3eff87fd6d.jpg. 416x416 1 0, Done. (0.1555)
image 67/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-281.jpg.rf.3c175da04e48495d55f4a91d340b13e3.jpg. 416x416 1 0, Done. (0.1485)
image 68/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-282.jpg.rf.35c76d0d1ee00ae040bb1e95040997.jpg. 416x416 1 0, Done. (0.1475)
image 69/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-30.jpg.rf.d0bbb569c2d41c77ee97b377879e09ba.jpg. 416x416 2 0s, Done. (0.1455)
image 70/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-337.jpg.rf.b66de836b130e8d2cd2d1921b3096ec.jpg. 416x416 1 0, Done. (0.1455)
image 71/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-342.jpg.rf.4e67f5c8996e087fe5f1f726791b57e.jpg. 416x416 1 0, Done. (0.1465)
image 72/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-344.jpg.rf.b0c73973136ab30f18cba753618c2165.jpg. 416x416 1 0, Done. (0.1535)
image 73/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-348.jpg.rf.5423330d1d346932a26ca0ce64d286f7.jpg. 416x416 1 0, Done. (0.1485)
image 74/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-354.jpg.rf.f8a27731a66204922900e27b34dd11a.jpg. 416x416 2 0s, Done. (0.1475)
image 75/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-359.jpg.rf.748b12365a3c0e3d9cb819af4b43fe43.jpg. 416x416 1 0, Done. (0.1475)
image 76/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-367.jpg.rf.6cd696a40eb4b914964d97fea389842e0.jpg. 416x416 1 0, Done. (0.1455)
image 77/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-36.jpg.rf.1294db9363d166462f5d0921276f20db.jpg. 416x416 2 0s, Done. (0.1445)
image 78/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-372.jpg.rf.ae1c0539dba08bae7657a2bb5e079e71.jpg. 416x416 1 0, Done. (0.1515)
image 79/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-389.jpg.rf.ceb7fb781e724e684bd145cdf68abf2.jpg. 416x416 1 0, Done. (0.1535)
image 80/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4210.jpg.rf.5eac8c80c5d9a0e749de7b7a00e67c61.jpg. 416x416 1 0, Done. (0.1495)
image 81/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4230.jpg.rf.af27ff31a648f855f48432d4b0ffca5.jpg. 416x416 1 0, Done. (0.1455)
image 82/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4235.jpg.rf.f72b9a67b528a18c209737af8e39650d.jpg. 416x416 1 0, Done. (0.1485)
image 83/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4261.jpg.rf.beb6d7f9848ad1a3bf4a15eb2f4dbfb5.jpg. 416x416 1 0, Done. (0.1475)
image 84/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4271.jpg.rf.cd2caac2d643d0d0f1557ca2d6bbe26b.jpg. 416x416 1 0, Done. (0.1485)
image 85/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4280.jpg.rf.6b794dff33a17151db96de4e0faa0edd.jpg. 416x416 1 0, Done. (0.1555)
image 86/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4283.jpg.rf.0aae2ceb6f91d87e9830ce045c9ed7b1.jpg. 416x416 1 0, Done. (0.1465)
image 87/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4286.jpg.rf.00c2cb765b1fb8bec0ef01ed6e92093d.jpg. 416x416 2 0s, Done. (0.1585)
image 88/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4290.jpg.rf.bdb146318f291ce80700915470dde4f6.jpg. 416x416 1 0, Done. (0.1545)
image 89/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4484.jpg.rf.32d28dd2332c2f264ced13179dc872.jpg. 416x416 2 0s, Done. (0.1515)
image 90/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4507.jpg.rf.01449935449db8b7d930a83dc465642.jpg. 416x416 3 0s, Done. (0.1505)
image 91/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4509.jpg.rf.9922e486397c67618d4a898e7e7a7a9.jpg. 416x416 3 0s, Done. (0.1525)
image 92/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4510.jpg.rf.6cdb20b552f46f30de42cb89a7e3e6c3.jpg. 416x416 3 0s, Done. (0.1485)
image 93/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4550.jpg.rf.11b45f02c88ca102a0e243e58a1006914.jpg. 416x416 3 0s, Done. (0.1515)
image 94/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4552.jpg.rf.d5da968191d006d19820a1e98ee36610.jpg. 416x416 4 0s, Done. (0.1525)
image 95/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4576.jpg.rf.194996eba7d81b972076072848cb8eff.jpg. 416x416 4 0s, Done. (0.1515)
image 96/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4578.jpg.rf.be20ed6df6bcb1ca1a0ff1fbb2daaf4.jpg. 416x416 4 0s, Done. (0.1515)
```

```
#display inference on ALL test images
```

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

```
for imageName in glob.glob('/content/yolov5/runs/detect/exp/*.jpg'): #assuming JPG
    display(Image(filename=imageName))
    print("\n")
```

Conclusion and Next Steps

```
#export your model's weights for future use
from google.colab import files
files.download('./runs/train/exp/weights/best.pt')
```

```
# reload the saved model and detect on testing images
```

```
!python detect.py --weights runs/train/exp/weights/best.pt --img 416 --conf 0.1 --source {dataset.location}/test/images
```

```
image 13/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-120.jpg.rf.587b171439c6a3570617e10a48a29b93.jpg. 416x416 1 0, Done. (0.1675)
image 14/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-121.jpg.rf.7391ffa788fedf03a810626c0ce79beb.jpg. 416x416 1 0, Done. (0.1665)
image 15/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12193.jpg.rf.55f741f8f62d7500ef77e6b25cd046d8.jpg. 416x416 1 0, Done. (0.1665)
image 16/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12200.jpg.rf.1693c91d86967d49a451f6592400e6bc.jpg. 416x416 2 0s, Done. (0.1715)
image 17/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12202.jpg.rf.3d092b5d20e817efd5f5fb84634374acd.jpg. 416x416 2 0s, Done. (0.1815)
image 18/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12205.jpg.rf.43a5e0c889c61ba8021fbb38d04ecfa.jpg. 416x416 2 0s, Done. (0.1705)
image 19/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12210.jpg.rf.8ed413259f57b6a3d6bc3b41cac9430f.jpg. 416x416 2 0s, Done. (0.1685)
image 20/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12213.jpg.rf.c6429499063c111d993da66e9ef5c7d.jpg. 416x416 2 0s, Done. (0.1655)
image 21/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12219.jpg.rf.78dd2819707476d18802187b61e6e3d2.jpg. 416x416 3 0s, Done. (0.1675)
image 22/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12227.jpg.rf.50c13a822f2417b159315bc2098bbddb.jpg. 416x416 2 0s, Done. (0.1645)
image 23/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12230.jpg.rf.2f6c3c3e885840f0ee402165eb748eb3.jpg. 416x416 2 0s, Done. (0.1785)
image 24/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12237.jpg.rf.6eb2fe8b15cbd6348ef7f2c461ed7a99.jpg. 416x416 2 0s, Done. (0.1715)
image 25/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12254.jpg.rf.1bdf36de1174cac73c6b4579840551c8.jpg. 416x416 3 0s, Done. (0.1675)
image 26/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12261.jpg.rf.c3546ac2bcd38259202f4bdb6d58ce5b.jpg. 416x416 2 0s, Done. (0.1645)
image 27/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12263.jpg.rf.24860ecce3554cd7bbcd8135f2b579bf.jpg. 416x416 2 0s, Done. (0.1695)
image 28/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12289.jpg.rf.02012b1d385e39cae3f77c0fa1f02310.jpg. 416x416 1 0, Done. (0.1775)
image 29/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-12310.jpg.rf.9e49299e22d11949c61534e108ced22c.jpg. 416x416 1 0, Done. (0.1745)
image 30/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-127.jpg.rf.c967d48ca6e1cc2fd6306e5fe22d8b94.jpg. 416x416 1 0, Done. (0.1715)
image 31/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-130.jpg.rf.393646ec2cef582af80e402ea03cc2e3.jpg. 416x416 2 0s, Done. (0.2055)
image 32/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-143.jpg.rf.3ffc66dc99f8ded220cef16f35619421.jpg. 416x416 1 0, Done. (0.1685)
image 33/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-151.jpg.rf.258e7b51518c32ed04e00603baede27a.jpg. 416x416 2 0s, Done. (0.1705)
image 34/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1546.jpg.rf.df19680358efd8492029aee09694aa.jpg. 416x416 1 0, Done. (0.1815)
image 35/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1560.jpg.rf.1d126f552e4c7cac69217a166d8ded9b.jpg. 416x416 1 0, Done. (0.1725)
image 36/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1561.jpg.rf.8357b8c7790bdca2bbdb210fbaa0ee6f.jpg. 416x416 1 0, Done. (0.1665)
image 37/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-156.jpg.rf.2926b04bdb79a39557390155bb581ff8.jpg. 416x416 1 0, Done. (0.1655)
image 38/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-167.jpg.rf.2e37047d86a9252bc86947e67c6739b.jpg. 416x416 1 0, Done. (0.1665)
image 39/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-170.jpg.rf.9a4e2438bbeb09b79fad61b02df64446.jpg. 416x416 2 0s, Done. (0.1745)
image 40/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-171.jpg.rf.d2c4a4b82336e858fca46c8b1a7f4a7.jpg. 416x416 2 0s, Done. (0.1695)
image 41/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1863.jpg.rf.c4a4b7332deb9b071cf2c916b2329640.jpg. 416x416 1 0, Done. (0.1655)
image 42/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1868.jpg.rf.c31767c5594b21d221dc46946d97a3cb.jpg. 416x416 1 0, Done. (0.1695)
image 43/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1880.jpg.rf.4c4dbccce99aa4ab4afd06df34149c3ca.jpg. 416x416 1 0, Done. (0.1645)
image 44/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1884.jpg.rf.a46266dd9f79f72962dab7bd9e273da6.jpg. 416x416 1 0, Done. (0.1785)
image 45/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-18.jpg.rf.d28d9f1fdc760200864dc8aa00b4dc8d.jpg. 416x416 1 0, Done. (0.1825)
image 46/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-1930.jpg.rf.690905aaf5d5cb9f5048a723e4d93ad6.jpg. 416x416 1 0, Done. (0.1735)
image 47/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-20.jpg.rf.9c980298085782ec597ce4ac3ff0cc7c.jpg. 416x416 1 0, Done. (0.1645)
image 48/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-21.jpg.rf.39d94ec7a2ea22e6888efc015040ab17.jpg. 416x416 1 0, Done. (0.1665)
image 49/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2275.jpg.rf.8033b4231aad446e9e2a4ed3591a3aa4.jpg. 416x416 1 0, Done. (0.1705)
image 50/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2280.jpg.rf.40413a0ad4f88fc16c52970951ddf225.jpg. 416x416 1 0, Done. (0.1695)
image 51/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2289.jpg.rf.45843d6ba21e2ed82b8679d39f9f34e2.jpg. 416x416 1 0, Done. (0.1775)
image 52/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2298.jpg.rf.b528a70d973749d0821244a0b93e536d.jpg. 416x416 1 0, Done. (0.1415)
image 53/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-22.jpg.rf.698c600eb720d944a83b1377f0ffdbf7.jpg. 416x416 1 0, Done. (0.1545)
image 54/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2308.jpg.rf.c00d61fa688182da0e6061263e7a52d77.jpg. 416x416 1 0, Done. (0.1485)
image 55/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2311.jpg.rf.f7200527f9966a1897a0f964c5859f2.jpg. 416x416 1 0, Done. (0.1475)
image 56/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2315.jpg.rf.d8fddcf1238c368fe662df41efda0abc.jpg. 416x416 1 0, Done. (0.1555)
image 57/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2318.jpg.rf.ea9c2a5ccc2f5aa3f9f714f0549df2b4.jpg. 416x416 1 0, Done. (0.1495)
image 58/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2320.jpg.rf.8c96e708db30058da691ee711238220.jpg. 416x416 1 0, Done. (0.1455)
image 59/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2325.jpg.rf.df12661fa98583ea6b4604548e8db68.jpg. 416x416 1 0, Done. (0.1515)
image 60/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-2331.jpg.rf.e9559d10cb02832c97c39ca3528517bf.jpg. 416x416 1 0, Done. (0.1445)
image 61/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-238.jpg.rf.a06dc8d81c70dfc1fa9e06aa4e71fb5.jpg. 416x416 1 0, Done. (0.1485)
image 62/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-239.jpg.rf.471c11a72379a9f73cf47f83db1df70a5.jpg. 416x416 1 0, Done. (0.1465)
image 63/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-240.jpg.rf.a925dca0965eb3a6f8aed6f43c246a3d.jpg. 416x416 1 0, Done. (0.1455)
image 64/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-246.jpg.rf.0eb9c24dda04baf9a9528bf96d780d9.jpg. 416x416 1 0, Done. (0.1475)
image 65/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-25.jpg.rf.1961e53e385cedc21b8d73e8a4d301b9.jpg. 416x416 2 0s, Done. (0.1485)
image 66/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-273.jpg.rf.c709b0caff4e2940ef1cbe3eff87fd6d.jpg. 416x416 1 0, Done. (0.1555)
image 67/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-281.jpg.rf.3c175da04e48495d55f4a91d340b13e3.jpg. 416x416 1 0, Done. (0.1485)
image 68/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-282.jpg.rf.35c76d0d1ee00ae04
```

```
image 97/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4585_jpg.rf.6848c384b58c8090dcc01b4eb66b9876.jpg: 416x416 4 0s, Done. (0.152s)
image 98/492 /content/datasets/Great-Barrier-Reef-5/test/images/0-4586_jpg.rf.c03d22c564965d3eada4b01f74be100e.jpg: 416x416 4 0s, Done. (0.156s)
```

```
#display inference on ALL test images
```

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

for imageName in glob.glob('/content/yolov5/runs/detect/exp/*.jpg'): #assuming JPG
    display(Image(filename=imageName))
    print("\n")
```