

```

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import glob
import shutil
import cv2
import os
from tqdm import tqdm

%pip install ultralytics
import ultralytics
ultralytics.checks()

Ultralytics 8.3.13 □ Python-3.10.14 torch-2.4.0 CUDA:0 (Tesla T4,
15095MiB)
Setup complete □ (4 CPUs, 31.4 GB RAM, 5933.9/8062.4 GB disk)

from ultralytics import YOLO

import os
import os.path as pt
import random
import shutil

import pandas as pd
import yaml
from tqdm import tqdm

def exists(path):
    if not os.path.exists(path):
        os.makedirs(path)

def move_image(src_folder, dest_folder, image_name):
    # The path of the source file.
    src_path = os.path.join(src_folder, image_name)

    # The path of the target file.
    dest_path = os.path.join(dest_folder, image_name)

    # Move the file.
    shutil.copy(src_path, dest_path)

def progress(list_, img_target, label_target, labels, data_path):
    yy = tqdm(list_)
    for csv_filename in yy:
        df = pd.read_csv(os.path.join(data_path, csv_filename))
        csv_name = csv_filename.split('.')[0]
        txt_file_name = csv_name + '.txt'

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    img_file_name = csv_name + '.jpg'

    for i in df.values:
        # i-->[file_name, w, h, label, x1, y1, x2, y2]
        txt_name, w, h, label, x1, y1, x2, y2 = i

        # Removed condition to exclude specific labels
        move_image(data_path, img_target, img_file_name)
        if label not in labels:
            labels.append(label)
        label = labels.index(label)

        x_ = (x1 + x2) / (2 * w)
        y_ = (y1 + y2) / (2 * h)
        w_ = (x2 - x1) / w
        h_ = (y2 - y1) / h
        with open(pt.join(label_target, txt_file_name), 'a') as f:
            f.write(f"{label} {x_} {y_} {w_} {h_}\n")

def generate_yaml(train_path, val_path, names, nc, base):
    data = {
        "train": train_path,
        "val": val_path,
        "names": names,
        "nc": nc
    }

    with open(pt.join(base, 'mydata.yaml'), 'w') as outfile:
        yaml.dump(data, outfile, default_flow_style=False)

def main(save_path, source_path, scale):
    # Create a path to save the TXT file.
    base = save_path
    img_path = pt.join(base, 'images')
    label_path = pt.join(base, 'labels')
    img_path_train = pt.join(img_path, 'train')
    img_path_val = pt.join(img_path, 'val')
    label_path_train = pt.join(label_path, 'train')
    label_path_val = pt.join(label_path, 'val')
    exists(img_path_train)
    exists(img_path_val)
    exists(label_path_train)
    exists(label_path_val)

    data_path = source_path
    filenames = os.listdir(data_path)
    csv_filenames = [filename for filename in filenames if
filename.endswith('.csv')]

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# Split the CSV file into train and validation sets proportionally.
labels1 = {}
for csv_name in csv_filenames:
    df = pd.read_csv(os.path.join(data_path, csv_name))
    for i in df.values:
        txt_name, w, h, label, x1, y1, x2, y2 = i
        if label in labels1:
            labels1[label].append(csv_name)
        else:
            labels1[label] = [csv_name]
    break

train_files = []
valid_files = []
for i in labels1.values():
    random.shuffle(i)
    num_train = int(len(i) * scale)

    train_files.extend(i[:num_train])
    valid_files.extend(i[num_train:])

Alabels = []
print(len(train_files) / len(valid_files))

progress(train_files, img_path_train, label_path_train, Alabels,
data_path)
progress(valid_files, img_path_val, label_path_val, Alabels,
data_path)

names = {i: name for i, name in enumerate(Alabels)}
nc = len(Alabels)
generate_yaml(img_path_train, img_path_val, names, nc, base)

if __name__ == "__main__":
    main(save_path='/kaggle/working/data',
source_path='/kaggle/input/militaryaircraftdetectiondataset/dataset',
scale=0.9
    )

8.813503043718871

100%|██████████| 15926/15926 [04:44<00:00, 56.06it/s]
100%|██████████| 1807/1807 [00:32<00:00, 55.30it/s]

!git clone https://github.com/THU-MIG/yolov10.git
%cd yolov10

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Cloning into 'yolov10'...
remote: Enumerating objects: 20332, done.  ote: Counting objects: 100%
(2446/2446), done.  ote: Compressing objects: 100% (250/250), done.  ote:
Total 20332 (delta 2317), reused 2197 (delta 2196), pack-reused 17886
(from 1)

model = YOLO("yolov10s.pt")
results = model.train(data='/kaggle/working/data/mydata.yaml',
epoch=100, imgsz=640, lrf=0.1)

Downloading
https://github.com/ultralytics/assets/releases/download/v8.3.0/yolov10s.pt to 'yolov10s.pt'...
100%|██████████| 15.9M/15.9M [00:00<00:00, 120MB/s]

Ultralytics 8.3.13 □ Python-3.10.14 torch-2.4.0 CUDA:0 (Tesla T4,
15095MiB)
engine/trainer: task=detect, mode=train, model=yolov10s.pt,
data=/kaggle/working/data/mydata.yaml, epoch=100, time=None,
patience=100, batch=16, imgsz=640, save=True, save_period=-1,
cache=False, device=None, workers=8, project=None, name=train,
exist_ok=False, pretrained=True, optimizer=auto, verbose=True, seed=0,
deterministic=True, single_cls=False, rect=False, cos_lr=False,
close_mosaic=10, resume=False, amp=True, fraction=1.0, profile=False,
freeze=None, multi_scale=False, overlap_mask=True, mask_ratio=4,
dropout=0.0, val=True, split=val, save_json=False, save_hybrid=False,
conf=None, iou=0.7, max_det=300, half=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=torchscript, keras=False,
optimize=False, int8=False, dynamic=False, simplify=True, opset=None,
workspace=4, nms=False, lr0=0.01, lrf=0.1, momentum=0.937,
weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8,
warmup_bias_lr=0.1, box=7.5, cls=0.5, df=1.5, pose=12.0, kobj=1.0,
label_smoothing=0.0, nbs=64, hsv_h=0.015, hsv_s=0.7, hsv_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, mosaic=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=runs/detect/train
Downloading https://ultralytics.com/assets/Arial.ttf to
'/root/.config/Ultralytics/Arial.ttf'...

100%|██████████| 755k/755k [00:00<00:00, 14.0MB/s]
2024-10-15 03:49:25,177    INFO util.py:124 -- Outdated packages:
ipywidgets==7.7.1 found, needs ipywidgets>=8
Run `pip install -U ipywidgets`, then restart the notebook server for
```

```
rich notebook output.  
2024-10-15 03:49:25,717    INFO util.py:124 -- Outdated packages:  
    ipywidgets==7.7.1 found, needs ipywidgets>=8  
Run `pip install -U ipywidgets`, then restart the notebook server for  
rich notebook output.
```

```
Overriding model.yaml nc=80 with nc=73
```

	from	n	params	module
arguments				
0	-1	1	928	ultralytics.nn.modules.conv.Conv
[3, 32, 3, 2]				
1	-1	1	18560	ultralytics.nn.modules.conv.Conv
[32, 64, 3, 2]				
2	-1	1	29056	ultralytics.nn.modules.block.C2f
[64, 64, 1, True]				
3	-1	1	73984	ultralytics.nn.modules.conv.Conv
[64, 128, 3, 2]				
4	-1	2	197632	ultralytics.nn.modules.block.C2f
[128, 128, 2, True]				
5	-1	1	36096	
ultralytics.nn.modules.block.SCDown				[128, 256, 3, 2]
6	-1	2	788480	ultralytics.nn.modules.block.C2f
[256, 256, 2, True]				
7	-1	1	137728	ultralytics.nn.modules.block.SCDown
				[256, 512, 3, 2]
8	-1	1	958464	
ultralytics.nn.modules.block.C2fCIB				[512, 512, 1, True, True]
9	-1	1	656896	
ultralytics.nn.modules.block.SPPF				[512, 512, 5]
10	-1	1	990976	ultralytics.nn.modules.block.PSA
[512, 512]				
11	-1	1	0	torch.nn.modules.upsampling.Upsample
				[None, 2, 'nearest']
12	[-1, 6]	1	0	
ultralytics.nn.modules.conv.Concat				[1]
13	-1	1	591360	ultralytics.nn.modules.block.C2f
[768, 256, 1]				
14	-1	1	0	torch.nn.modules.upsampling.Upsample
				[None, 2, 'nearest']
15	[-1, 4]	1	0	
ultralytics.nn.modules.conv.Concat				[1]

```
16          -1  1    148224 ultralytics.nn.modules.block.C2f
[384, 128, 1]
17          -1  1    147712 ultralytics.nn.modules.conv.Conv
[128, 128, 3, 2]
18          [-1, 13] 1      0
ultralytics.nn.modules.conv.Concat           [1]

19          -1  1    493056 ultralytics.nn.modules.block.C2f
[384, 256, 1]
20          -1  1    68864
ultralytics.nn.modules.block.SCDown        [256, 256, 3, 2]

21          [-1, 10] 1      0
ultralytics.nn.modules.conv.Concat           [1]

22          -1  1    1089536
ultralytics.nn.modules.block.C2fCIB        [768, 512, 1, True, True]

23          [16, 19, 22] 1    1695302
ultralytics.nn.modules.head.v10Detect      [73, [128, 256, 512]]

YOLOv10s summary: 402 layers, 8,122,854 parameters, 8,122,838
gradients, 25.1 GFLOPs

Transferred 607/619 items from pretrained weights
TensorBoard: Start with 'tensorboard --logdir runs/detect/train', view
at http://localhost:6006/

wandb: Using wandb-core as the SDK backend. Please refer to
https://wandb.me/wandb-core for more information.
wandb: Logging into wandb.ai. (Learn how to deploy a W&B server
locally: https://wandb.me/wandb-server)
wandb: You can find your API key in your browser here:
https://wandb.ai/authorize
wandb: Paste an API key from your profile and hit enter, or press
ctrl+c to quit:

.....
wandb: Appending key for api.wandb.ai to your netrc file: /root/.netrc
{"model_id": "b847a13af2ba4398bc7a17e4741c5a41", "version_major": 2, "vers
ion_minor": 0}

<IPython.core.display.HTML object>
<IPython.core.display.HTML object>
<IPython.core.display.HTML object>
<IPython.core.display.HTML object>
```

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<IPython.core.display.HTML object>

Freezing layer 'model.23.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOL01ln...
Downloading
https://github.com/ultralytics/assets/releases/download/v8.3.0/yol01ln
.pt to 'yol01ln.pt'...

100%|██████████| 5.35M/5.35M [00:00<00:00, 66.6MB/s]

AMP: checks passed □

train: Scanning /kaggle/working/data/labels/train... 15926 images, 0
backgrounds, 0 corrupt: 100%|██████████| 15926/15926 [00:14<00:00,
1081.18it/s]

train: New cache created: /kaggle/working/data/labels/train.cache
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01,
blur_limit=(3, 7)), ToGray(p=0.01, num_output_channels=3,
method='weighted_average'), CLAHE(p=0.01, clip_limit=(1, 4.0),
tile_grid_size=(8, 8))

/opt/conda/lib/python3.10/site-packages/albumentations/_init_.py:13:
UserWarning: A new version of Albumentations is available: 1.4.18 (you
have 1.4.17). Upgrade using: pip install -U albumentations. To disable
automatic update checks, set the environment variable
NO_ALBUMENTATIONS_UPDATE to 1.
    check_for_updates()
/opt/conda/lib/python3.10/multiprocessing/popen_fork.py:66:
RuntimeWarning: os.fork() was called. os.fork() is incompatible with
multithreaded code, and JAX is multithreaded, so this will likely lead
to a deadlock.
    self.pid = os.fork()
val: Scanning /kaggle/working/data/labels/val... 1807 images, 0
backgrounds, 0 corrupt: 100%|██████████| 1807/1807 [00:01<00:00,
1117.36it/s]

val: New cache created: /kaggle/working/data/labels/val.cache
Plotting labels to runs/detect/train/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and
'momentum=0.937' and determining best 'optimizer', 'lr0' and
'momentum' automatically...
optimizer: SGD(lr=0.01, momentum=0.9) with parameter groups 99
weight(decay=0.0), 112 weight(decay=0.0005), 111 bias(decay=0.0)
TensorBoard: model graph visualization added □
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train
Starting training for 100 epochs...
```

Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	1/100	6.1G	1.93	9.662	2.345	22
640:	100%	[██████████ 996/996 [06:22<00:00, 2.60it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:22<00:00, 2.58it/s]				
		all	1807	3208	0.418	0.0845
	0.0436	0.0353				
	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size	2/100	5.57G	2.148	6.562	2.394	28
640:	100%	[██████████ 996/996 [06:26<00:00, 2.58it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.68it/s]				
		all	1807	3208	0.32	0.0922
	0.0526	0.0378				
	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size	3/100	6.03G	2.441	6.67	2.565	18
640:	100%	[██████████ 996/996 [06:17<00:00, 2.64it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:22<00:00, 2.49it/s]				
		all	1807	3208	0.329	0.0737
	0.0369	0.0242				
	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size	4/100	6.07G	2.551	6.686	2.621	27
640:	100%	[██████████ 996/996 [06:20<00:00, 2.62it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.66it/s]				
		all	1807	3208	0.371	0.0799
	0.0513	0.0373				
	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size	5/100	5.64G	2.409	6.246	2.533	14
640:	100%	[██████████ 996/996 [06:08<00:00, 2.70it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.71it/s]				

		all	1807	3208	0.304	0.133
0.0653	0.0495					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
6/100	6.56G	2.285	5.945	2.45	16	
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.66it/s]						
	all	1807	3208	0.33	0.176	
0.0938	0.0719					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
7/100	5.67G	2.198	5.705	2.406	21	
640: 100% ██████████ 996/996 [06:11<00:00, 2.68it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.63it/s]						
	all	1807	3208	0.313	0.193	
0.124	0.0953					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
8/100	5.9G	2.123	5.531	2.369	18	
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.73it/s]						
	all	1807	3208	0.303	0.223	
0.141	0.112					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
9/100	5.54G	2.071	5.385	2.347	19	
640: 100% ██████████ 996/996 [06:08<00:00, 2.70it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.76it/s]						
	all	1807	3208	0.32	0.225	
0.156	0.125					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
10/100	5.75G	2.044	5.256	2.322	21	
640: 100% ██████████ 996/996 [06:09<00:00, 2.69it/s]						

mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.28	0.263
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	11/100	6.26G	1.984	5.125	2.293	16	
	100% ██████████	996/996	[06:09<00:00,	2.70it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.397	0.258
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	12/100	6.54G	1.956	5.014	2.272	21	
	100% ██████████	996/996	[06:09<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.346	0.279
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	13/100	5.65G	1.912	4.883	2.259	20	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.375	0.289
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	14/100	5.88G	1.899	4.801	2.242	29	
	100% ██████████	996/996	[06:09<00:00,	2.70it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.398	0.301
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	

15/100	5.98G	1.873	4.706	2.227	13
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.76it/s]				
	all	1807	3208	0.367	0.316
0.275	0.231				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
16/100	5.4G	1.859	4.626	2.221	22
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.64it/s]				
	all	1807	3208	0.421	0.337
0.311	0.263				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
17/100	6.12G	1.837	4.54	2.204	18
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.74it/s]				
	all	1807	3208	0.416	0.351
0.338	0.282				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
18/100	5.96G	1.807	4.465	2.191	22
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.72it/s]				
	all	1807	3208	0.406	0.354
0.346	0.293				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
19/100	6.43G	1.787	4.326	2.176	22
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.76it/s]				
	all	1807	3208	0.396	0.376
0.366	0.313				

Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	20/100	6.09G	1.764	4.27	2.17	31
640:	100%	[██████████ 996/996 [06:09<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.61it/s]				
		all	1807	3208	0.434	0.371
	0.387	0.334				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	21/100	5.53G	1.753	4.183	2.167	13
640:	100%	[██████████ 996/996 [06:09<00:00, 2.70it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.69it/s]				
		all	1807	3208	0.462	0.39
	0.407	0.352				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	22/100	5.56G	1.727	4.127	2.155	48
640:	100%	[██████████ 996/996 [06:08<00:00, 2.70it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:20<00:00, 2.78it/s]				
		all	1807	3208	0.45	0.384
	0.408	0.355				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	23/100	5.95G	1.725	4.053	2.156	38
640:	100%	[██████████ 996/996 [06:08<00:00, 2.70it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:20<00:00, 2.72it/s]				
		all	1807	3208	0.547	0.383
	0.433	0.372				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	24/100	5.64G	1.716	3.964	2.14	18
640:	100%	[██████████ 996/996 [06:09<00:00, 2.70it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.64it/s]				

		all	1807	3208	0.483	0.429
0.451	0.388					
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Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	25/100	5.86G	1.69	3.894	2.133	19
640:	100%	[██████]	996/996	[06:08<00:00,	2.70it/s]	
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95):	100%	[██████]	57/57	[00:20<00:00,	2.79it/s]
		all	1807	3208	0.524	0.431
0.455	0.395					
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Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	26/100	5.79G	1.688	3.844	2.132	41
640:	100%	[██████]	996/996	[06:09<00:00,	2.69it/s]	
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95):	100%	[██████]	57/57	[00:22<00:00,	2.58it/s]
		all	1807	3208	0.528	0.449
0.477	0.414					
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Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	27/100	5.71G	1.671	3.757	2.121	16
640:	100%	[██████]	996/996	[06:13<00:00,	2.66it/s]	
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95):	100%	[██████]	57/57	[00:22<00:00,	2.54it/s]
		all	1807	3208	0.575	0.447
0.504	0.438					
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Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	28/100	5.57G	1.675	3.701	2.123	20
640:	100%	[██████]	996/996	[06:10<00:00,	2.69it/s]	
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95):	100%	[██████]	57/57	[00:22<00:00,	2.53it/s]
		all	1807	3208	0.569	0.467
0.512	0.446					
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Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	29/100	5.68G	1.645	3.638	2.103	26
640:	100%	[██████]	996/996	[06:10<00:00,	2.69it/s]	

mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.585	0.498
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	30/100	6.02G	1.642	3.589	2.106	22	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.561	0.491
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	31/100	6.02G	1.634	3.548	2.098	22	
	100% ██████████	996/996	[06:09<00:00,	2.70it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.573	0.499
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	32/100	5.73G	1.62	3.486	2.095	29	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.606	0.511
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	33/100	5.99G	1.613	3.409	2.091	41	
	100% ██████████	996/996	[06:19<00:00,	2.63it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.586	0.517
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	

34/100	5.99G	1.608	3.408	2.092	16
640: 100% ██████████ 996/996 [06:19<00:00, 2.62it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.75it/s]					
	all	1807	3208	0.628	0.507
0.575	0.509				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
35/100	5.88G	1.598	3.335	2.079	28
640: 100% ██████████ 996/996 [06:07<00:00, 2.71it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.78it/s]					
	all	1807	3208	0.637	0.533
0.598	0.53				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
36/100	5.65G	1.598	3.286	2.075	38
640: 100% ██████████ 996/996 [06:08<00:00, 2.70it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.70it/s]					
	all	1807	3208	0.65	0.544
0.601	0.529				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
37/100	5.57G	1.581	3.254	2.076	24
640: 100% ██████████ 996/996 [06:08<00:00, 2.70it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.67it/s]					
	all	1807	3208	0.691	0.528
0.619	0.548				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
38/100	6.96G	1.578	3.198	2.076	14
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.74it/s]					
	all	1807	3208	0.652	0.56
0.622	0.554				

Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	39/100	6G	1.565	3.151	2.069	13
640:	100%	[██████████ 996/996 [06:09<00:00, 2.70it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:20<00:00, 2.75it/s]				
		all	1807	3208	0.682	0.536
	0.618	0.545				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	40/100	5.94G	1.544	3.076	2.057	15
640:	100%	[██████████ 996/996 [06:08<00:00, 2.70it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:20<00:00, 2.77it/s]				
		all	1807	3208	0.697	0.549
	0.626	0.553				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	41/100	6.2G	1.544	3.049	2.055	38
640:	100%	[██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:22<00:00, 2.58it/s]				
		all	1807	3208	0.694	0.545
	0.635	0.561				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	42/100	5.56G	1.534	3.033	2.061	19
640:	100%	[██████████ 996/996 [06:09<00:00, 2.70it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.60it/s]				
		all	1807	3208	0.738	0.537
	0.646	0.573				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	43/100	5.71G	1.509	2.961	2.041	30
640:	100%	[██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.70it/s]				

		all	1807	3208	0.693	0.573
0.654	0.579					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
44/100	5.96G	1.52	2.881	2.046	17	
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.73it/s]						
	all	1807	3208	0.717	0.57	
0.663	0.586					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
45/100	5.77G	1.519	2.891	2.046	29	
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.65it/s]						
	all	1807	3208	0.726	0.575	
0.669	0.594					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
46/100	5.94G	1.498	2.856	2.039	18	
640: 100% ██████████ 996/996 [06:09<00:00, 2.69it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.70it/s]						
	all	1807	3208	0.753	0.575	
0.672	0.596					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
47/100	5.77G	1.503	2.801	2.034	27	
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.76it/s]						
	all	1807	3208	0.769	0.572	
0.677	0.6					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
48/100	5.73G	1.486	2.738	2.026	28	
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]						

mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.765	0.575
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	49/100	5.94G	1.483	2.721	2.027	49	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.803	0.558
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	50/100	5.53G	1.48	2.669	2.027	22	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.771	0.582
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	51/100	5.67G	1.477	2.65	2.025	19	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.767	0.59
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	52/100	5.88G	1.464	2.625	2.023	19	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.77	0.594
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	

53/100	5.99G	1.453	2.594	2.015	26
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.74it/s]				
0.697	0.621				
all	1807	3208	0.784	0.589	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
54/100	5.4G	1.461	2.563	2.019	25
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.64it/s]				
0.705	0.63				
all	1807	3208	0.764	0.609	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
55/100	5.65G	1.449	2.539	2.014	19
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.68it/s]				
0.713	0.638				
all	1807	3208	0.776	0.612	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
56/100	5.84G	1.42	2.477	2.006	21
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.65it/s]				
0.72	0.645				
all	1807	3208	0.803	0.603	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
57/100	5.9G	1.432	2.454	2.005	26
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]					
Class	Images	Instances	Box(P)	R	
mAP50	mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.76it/s]				
0.723	0.648				
all	1807	3208	0.814	0.603	

Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	58/100	6G	1.431	2.423	1.998	32
640:	100%	[██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:19<00:00, 2.87it/s]				
		all	1807	3208	0.813	0.604
0.721	0.648					
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	59/100	6.15G	1.434	2.405	2.004	32
640:	100%	[██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.68it/s]				
		all	1807	3208	0.809	0.61
0.729	0.655					
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	60/100	6.43G	1.416	2.375	1.999	19
640:	100%	[██████████ 996/996 [06:11<00:00, 2.68it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.67it/s]				
		all	1807	3208	0.795	0.612
0.73	0.656					
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	61/100	5.68G	1.409	2.329	1.991	22
640:	100%	[██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:20<00:00, 2.72it/s]				
		all	1807	3208	0.802	0.618
0.733	0.659					
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	62/100	5.94G	1.393	2.302	1.985	21
640:	100%	[██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:20<00:00, 2.72it/s]				

		all	1807	3208	0.812	0.616
0.735	0.661					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
63/100	5.64G	1.386	2.299	1.985	20	
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.80it/s]						
	all	1807	3208	0.813	0.618	
0.738	0.663					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
64/100	5.92G	1.387	2.278	1.989	26	
640: 100% ██████████ 996/996 [06:11<00:00, 2.68it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:22<00:00, 2.50it/s]						
	all	1807	3208	0.819	0.621	
0.738	0.663					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
65/100	5.65G	1.393	2.228	1.99	17	
640: 100% ██████████ 996/996 [06:21<00:00, 2.61it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:24<00:00, 2.35it/s]						
	all	1807	3208	0.83	0.616	
0.738	0.664					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
66/100	5.92G	1.371	2.218	1.983	22	
640: 100% ██████████ 996/996 [06:14<00:00, 2.66it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.67it/s]						
	all	1807	3208	0.796	0.634	
0.737	0.663					
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Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
67/100	5.98G	1.355	2.172	1.968	20	
640: 100% ██████████ 996/996 [06:13<00:00, 2.67it/s]						

mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.808	0.63
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	68/100	5.76G	1.367	2.153	1.974	23	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.83	0.618
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	69/100	5.9G	1.348	2.117	1.965	31	
	100% ██████████	996/996	[06:11<00:00,	2.68it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.829	0.621
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	70/100	5.66G	1.35	2.079	1.968	40	
	100% ██████████	996/996	[06:10<00:00,	2.69it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.841	0.619
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	
640:	71/100	5.88G	1.344	2.07	1.965	14	
	100% ██████████	996/996	[06:12<00:00,	2.67it/s]			
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
			all	1807	3208	0.837	0.624
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	

72/100	5.48G	1.348	2.06	1.961	32
640: 100% ██████████ 996/996 [06:11<00:00, 2.68it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.66it/s]					
0.745	0.67				
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
73/100	6.02G	1.319	2.019	1.958	25
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.71it/s]					
0.746	0.671	all	1807	3208	0.837
0.746	0.671	0.623			
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
74/100	6.17G	1.339	2.013	1.958	16
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.66it/s]					
0.748	0.673	all	1807	3208	0.841
0.748	0.673	0.625			
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
75/100	6.4G	1.321	1.978	1.951	11
640: 100% ██████████ 996/996 [06:11<00:00, 2.68it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.74it/s]					
0.748	0.673	all	1807	3208	0.839
0.748	0.673	0.623			
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
76/100	5.77G	1.298	1.955	1.946	15
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]	Class	Images	Instances	Box(P)	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.74it/s]					
0.749	0.674	all	1807	3208	0.832
0.749	0.674	0.625			

Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	77/100	5.65G	1.303	1.928	1.948	13
640:	100%	[██████ 996/996 [06:09<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.63it/s]				
0.75		all	1807	3208	0.835	0.624
		0.675				
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	78/100	5.65G	1.284	1.885	1.938	28
640:	100%	[██████ 996/996 [06:10<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:20<00:00, 2.73it/s]				
0.75		all	1807	3208	0.782	0.658
	0.675					
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	79/100	5.75G	1.294	1.876	1.943	22
640:	100%	[██████ 996/996 [06:09<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.68it/s]				
0.752		all	1807	3208	0.775	0.661
	0.676					
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	80/100	5.71G	1.278	1.858	1.936	16
640:	100%	[██████ 996/996 [06:09<00:00, 2.69it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.71it/s]				
0.753		all	1807	3208	0.78	0.665
	0.677					
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	81/100	6.13G	1.28	1.838	1.939	24
640:	100%	[██████ 996/996 [06:11<00:00, 2.68it/s]	Class	Images	Instances	Box(P R
mAP50	mAP50-95):	100% ██████████ 57/57 [00:21<00:00, 2.67it/s]				

		all	1807	3208	0.781	0.665
0.754	0.677					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
82/100	5.94G	1.267	1.819	1.933	27	
640: 100% ██████████ 996/996 [06:11<00:00, 2.68it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.67it/s]						
	all	1807	3208	0.783	0.667	
0.755	0.678					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
83/100	5.7G	1.259	1.782	1.928	18	
640: 100% ██████████ 996/996 [06:12<00:00, 2.68it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.61it/s]						
	all	1807	3208	0.787	0.664	
0.755	0.678					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
84/100	6.19G	1.265	1.778	1.929	32	
640: 100% ██████████ 996/996 [06:12<00:00, 2.68it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.61it/s]						
	all	1807	3208	0.802	0.66	
0.757	0.68					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
85/100	5.6G	1.249	1.745	1.923	12	
640: 100% ██████████ 996/996 [06:08<00:00, 2.70it/s]	Class	Images	Instances	Box(P	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.66it/s]						
	all	1807	3208	0.817	0.653	
0.756	0.679					
<hr/>						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
86/100	5.77G	1.241	1.716	1.922	13	
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]						

mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
0.758	0.681		all	1807	3208	0.825	0.65
			Epoch	GPU_mem	box_loss	cls_loss	dfl_loss Instances
			Size				
			87/100	5.86G	1.236	1.682	1.917 20
			640: 100% ██████████	996/996 [06:08<00:00,	2.70it/s]		
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
0.76	0.683		all	1807	3208	0.824	0.656
			Epoch	GPU_mem	box_loss	cls_loss	dfl_loss Instances
			Size				
			88/100	5.85G	1.232	1.67	1.916 16
			640: 100% ██████████	996/996 [06:08<00:00,	2.70it/s]		
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
0.761	0.683		all	1807	3208	0.824	0.655
			Epoch	GPU_mem	box_loss	cls_loss	dfl_loss Instances
			Size				
			89/100	6.12G	1.217	1.651	1.912 16
			640: 100% ██████████	996/996 [06:09<00:00,	2.70it/s]		
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
0.762	0.684		all	1807	3208	0.826	0.656
			Epoch	GPU_mem	box_loss	cls_loss	dfl_loss Instances
			Size				
			90/100	6.26G	1.218	1.634	1.91 17
			640: 100% ██████████	996/996 [06:09<00:00,	2.70it/s]		
mAP50	mAP50-95):	100% ██████████	Class	Images	Instances	Box(P	R
0.763	0.685		all	1807	3208	0.832	0.654
		Closing dataloader mosaic					
		albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01,					
		blur_limit=(3, 7)), ToGray(p=0.01, num_output_channels=3,					

```

method='weighted_average'), CLAHE(p=0.01, clip_limit=(1, 4.0),
tile_grid_size=(8, 8))

/opt/conda/lib/python3.10/multiprocessing/popen_fork.py:66:
RuntimeWarning: os.fork() was called. os.fork() is incompatible with
multithreaded code, and JAX is multithreaded, so this will likely lead
to a deadlock.
    self.pid = os.fork()
/opt/conda/lib/python3.10/multiprocessing/popen_fork.py:66:
RuntimeWarning: os.fork() was called. os.fork() is incompatible with
multithreaded code, and JAX is multithreaded, so this will likely lead
to a deadlock.
    self.pid = os.fork()

```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
91/100	5.79G	0.971	0.9656	1.753	6
640: 100% ██████████ 996/996 [06:09<00:00, 2.70it/s]					
	Class	Images	Instances	Box(P	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.64it/s]					
	all	1807	3208	0.828	0.654
0.762	0.685				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
92/100	5.8G	0.9568	0.9196	1.749	6
640: 100% ██████████ 996/996 [06:10<00:00, 2.69it/s]					
	Class	Images	Instances	Box(P	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:23<00:00, 2.39it/s]					
	all	1807	3208	0.828	0.655
0.762	0.685				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
93/100	5.71G	0.9466	0.9039	1.741	6
640: 100% ██████████ 996/996 [06:05<00:00, 2.73it/s]					
	Class	Images	Instances	Box(P	R
mAP50 mAP50-95): 100% ██████████ 57/57 [00:23<00:00, 2.43it/s]					
	all	1807	3208	0.83	0.656
0.763	0.685				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					

94/100	6.03G	0.931	0.87	1.732	9
640: 100% ██████████ 996/996 [06:05<00:00, 2.73it/s]					
Class	Images	Instances	Box(P)	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:22<00:00, 2.51it/s]					
0.763	0.685				
all	1807	3208	0.822	0.66	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
95/100	5.87G	0.9235	0.8355	1.731	17
640: 100% ██████████ 996/996 [06:05<00:00, 2.72it/s]					
Class	Images	Instances	Box(P)	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:22<00:00, 2.54it/s]					
0.763	0.685				
all	1807	3208	0.824	0.66	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
96/100	5.84G	0.9218	0.8412	1.733	8
640: 100% ██████████ 996/996 [06:05<00:00, 2.73it/s]					
Class	Images	Instances	Box(P)	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.69it/s]					
0.763	0.685				
all	1807	3208	0.821	0.661	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
97/100	5.71G	0.9127	0.8118	1.731	9
640: 100% ██████████ 996/996 [06:05<00:00, 2.73it/s]					
Class	Images	Instances	Box(P)	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:20<00:00, 2.75it/s]					
0.764	0.686				
all	1807	3208	0.82	0.662	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
98/100	5.77G	0.9023	0.7967	1.724	8
640: 100% ██████████ 996/996 [06:04<00:00, 2.73it/s]					
Class	Images	Instances	Box(P)	R	
mAP50 mAP50-95): 100% ██████████ 57/57 [00:21<00:00, 2.71it/s]					
0.763	0.686				
all	1807	3208	0.818	0.662	

Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	99/100	6G	0.8925	0.7774	1.72	7
640:	100%	[██████]	996/996 [06:06<00:00, 2.71it/s]			
		Class	Images	Instances	Box(P)	R
mAP50	mAP50-95):	100%	[██████]	57/57 [00:21<00:00, 2.68it/s]		
		all	1807	3208	0.816	0.662
0.763	0.685					
Size	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
	100/100	5.92G	0.8882	0.7589	1.715	9
640:	100%	[██████]	996/996 [06:04<00:00, 2.73it/s]			
		Class	Images	Instances	Box(P)	R
mAP50	mAP50-95):	100%	[██████]	57/57 [00:21<00:00, 2.67it/s]		
		all	1807	3208	0.818	0.666
0.764	0.686					
100 epochs completed in 10.943 hours.						
Optimizer stripped from runs/detect/train/weights/last.pt, 16.6MB						
Optimizer stripped from runs/detect/train/weights/best.pt, 16.6MB						
Validating runs/detect/train/weights/best.pt...						
Ultralytics 8.3.13 □ Python-3.10.14 torch-2.4.0 CUDA:0 (Tesla T4, 15095MiB)						
YOLOv10s summary (fused): 293 layers, 8,091,462 parameters, 0 gradients, 24.8 GFLOPs						
		Class	Images	Instances	Box(P)	R
mAP50	mAP50-95):	100%	[██████]	57/57 [00:21<00:00, 2.71it/s]		
		all	1807	3208	0.82	0.664
0.764	0.687					
		EF2000	47	79	0.649	0.62
0.713	0.664					
		Tu95	20	30	0.926	0.833
0.889	0.789					
		Mig29	13	14	0.86	0.438
0.713	0.679					
		Tornado	31	47	0.838	0.66
0.737	0.658					
		F15	79	127	0.833	0.706
0.803	0.707					
		F16	92	157	0.685	0.58
0.681	0.596					
		C130	70	135	0.751	0.8
0.767	0.635					

		An72	13	14	0.659	0.5
0.668	0.588	P3	25	49	0.884	0.469
0.573	0.554	F18	73	142	0.6	0.718
0.765	0.651	Rafale	35	80	0.61	0.352
0.581	0.475	B52	39	47	0.899	0.681
0.791	0.742	Mirage2000	24	50	0.874	0.553
0.647	0.59	Tu160	27	33	0.846	0.788
0.862	0.817	JF17	15	18	0.817	0.745
0.864	0.835	J10	24	87	0.908	0.586
0.708	0.612	A400M	34	42	0.819	0.595
0.738	0.672	F35	85	114	0.81	0.623
0.785	0.679	Su34	33	45	0.863	0.844
0.875	0.824	A10	46	72	0.906	0.673
0.818	0.698	B1	40	53	0.872	0.77
0.859	0.791	AH64	22	60	0.681	0.433
0.513	0.37	F4	40	64	0.978	0.704
0.84	0.758	F22	38	52	0.62	0.615
0.645	0.59	KC135	19	21	0.78	0.81
0.825	0.76	B2	41	58	0.882	0.776
0.865	0.743	V22	53	82	0.966	0.698
0.811	0.676	F117	22	58	0.773	0.469
0.648	0.583	C5	34	34	0.789	0.618
0.726	0.677	C17	46	57	0.703	0.754
0.765	0.688	J20	37	63	0.911	0.816
0.892	0.818	AV8B	28	45	0.943	0.711

0.828	0.745					
0.948	0.892	US2	57	66	0.874	0.864
0.743	0.732	E7	16	19	0.837	0.684
0.658	0.6	Su25	20	36	0.757	0.583
0.894	0.872	Mi28	8	18	0.888	0.833
0.589	0.498	UH60	11	14	0.788	0.532
0.916	0.855	CH47	17	24	0.861	0.875
0.722	0.609	Ka52	12	28	0.934	0.51
0.867	0.748	An124	7	7	0.681	0.857
0.773	0.676	JAS39	35	58	0.818	0.69
0.851	0.836	C390	14	14	0.797	0.857
0.87	0.736	E2	34	53	0.879	0.849
0.818	0.776	Be200	28	32	0.944	0.781
0.984	0.945	AG600	23	23	1	0.941
0.735	0.674	JH7	16	39	0.849	0.578
0.418	0.348	Y20	11	13	0.89	0.231
0.892	0.739	H6	20	45	0.966	0.64
0.984	0.921	WZ7	7	9	0.911	0.889
0.809	0.678	MQ9	30	45	0.843	0.719
0.926	0.865	C2	62	76	0.93	0.868
0.872	0.824	U2	26	28	0.783	0.857
0.868	0.77	Vulcan	32	40	0.936	0.725
0.909	0.743	SR71	22	24	0.9	0.833
0.389	0.367	F14	29	56	0.716	0.321
0.865	0.696	RQ4	25	29	0.881	0.768

		Mi24	12	16	0.692	0.75
0.803	0.677	Tu22M	16	32	0.922	0.741
0.841	0.734	Mig31	24	45	0.726	0.529
0.623	0.551	Su57	23	36	0.843	0.694
0.777	0.728	KJ600	4	4	0.612	0.25
0.341	0.341	XB70	16	16	0.79	0.75
0.842	0.789	KF21	11	14	0.906	0.691
0.817	0.817	YF23	11	13	0.924	0.846
0.851	0.836	B21	4	4	0.78	0.5
0.745	0.702	Su24	23	38	0.757	0.579
0.71	0.608	CL415	15	17	0.869	0.647
0.782	0.715	Ka27	6	6	0.61	0.526
0.749	0.633	TB2	11	119	0.899	0.597
0.831	0.455	TB001	8	8	0.861	0.875
0.9	0.852	An225	6	6	0.35	0.183
0.321	0.311	An22	5	5	0.722	0.6
0.627	0.627	Z19	3	4	1	0.494
0.707	0.681					

Speed: 0.1ms preprocess, 3.8ms inference, 0.0ms loss, 0.2ms postprocess per image

Results saved to runs/detect/train

```
{"model_id": "", "version_major": 2, "version_minor": 0}
```

```
<IPython.core.display.HTML object>
```

```
<IPython.core.display.HTML object>
```

```
<IPython.core.display.HTML object>
```

```
!ls /kaggle/working/yolov10/runs/detect/train
```

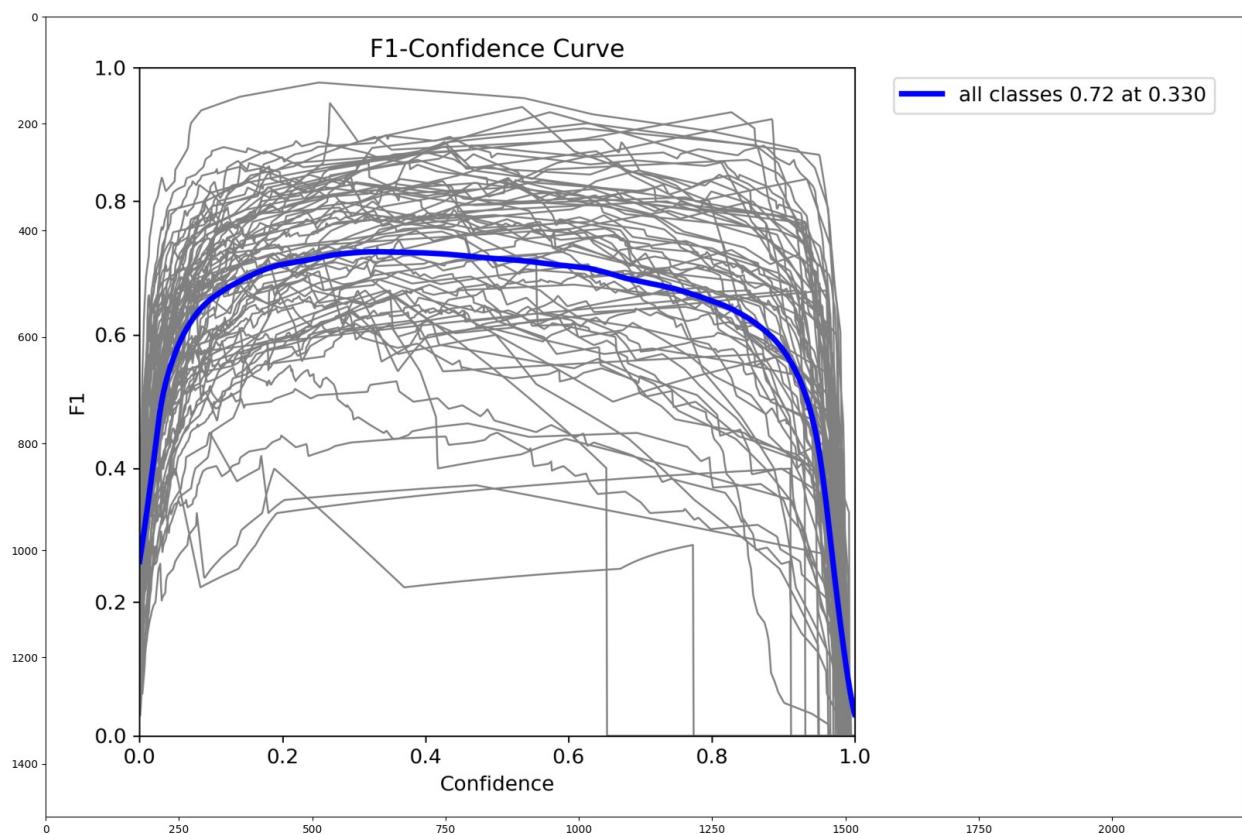
```
/opt/conda/lib/python3.10/pty.py:89: RuntimeWarning: os.fork() was called. os.fork() is incompatible with multithreaded code, and JAX is
```

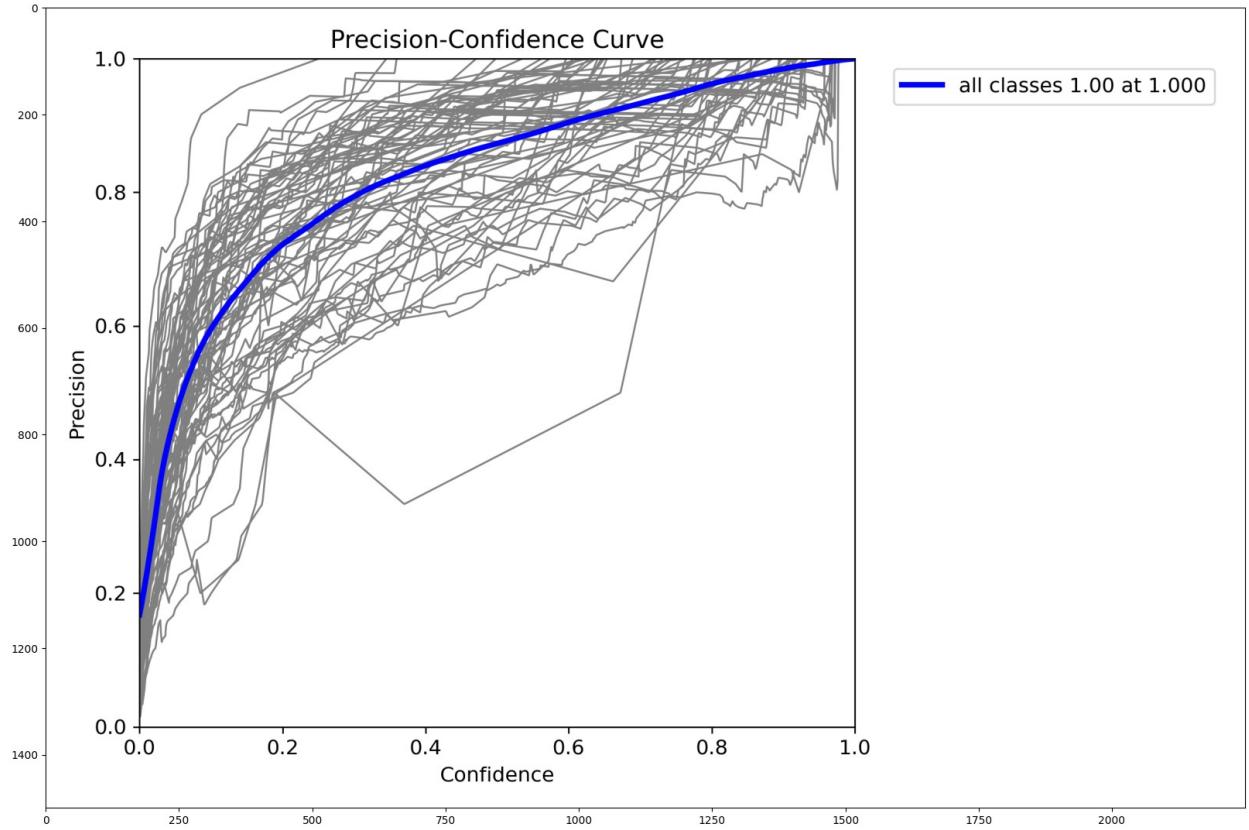
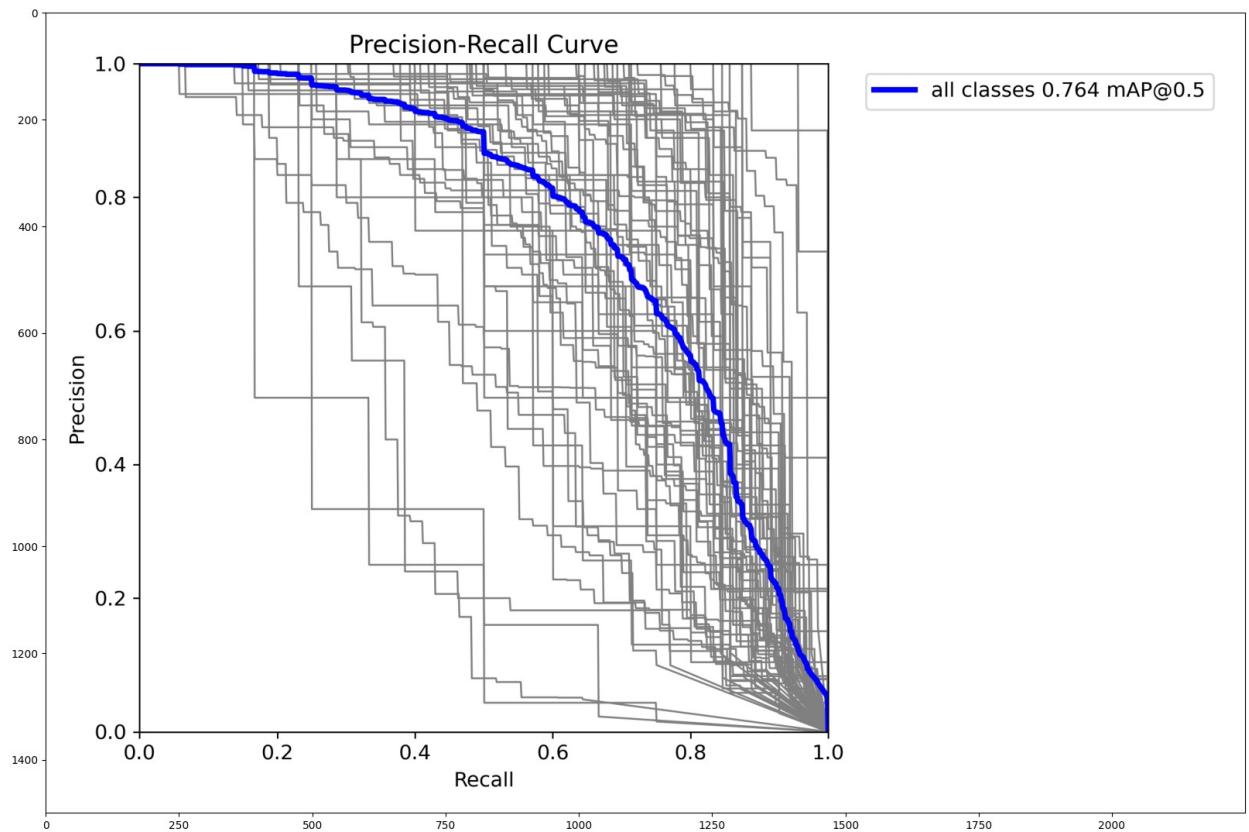
```

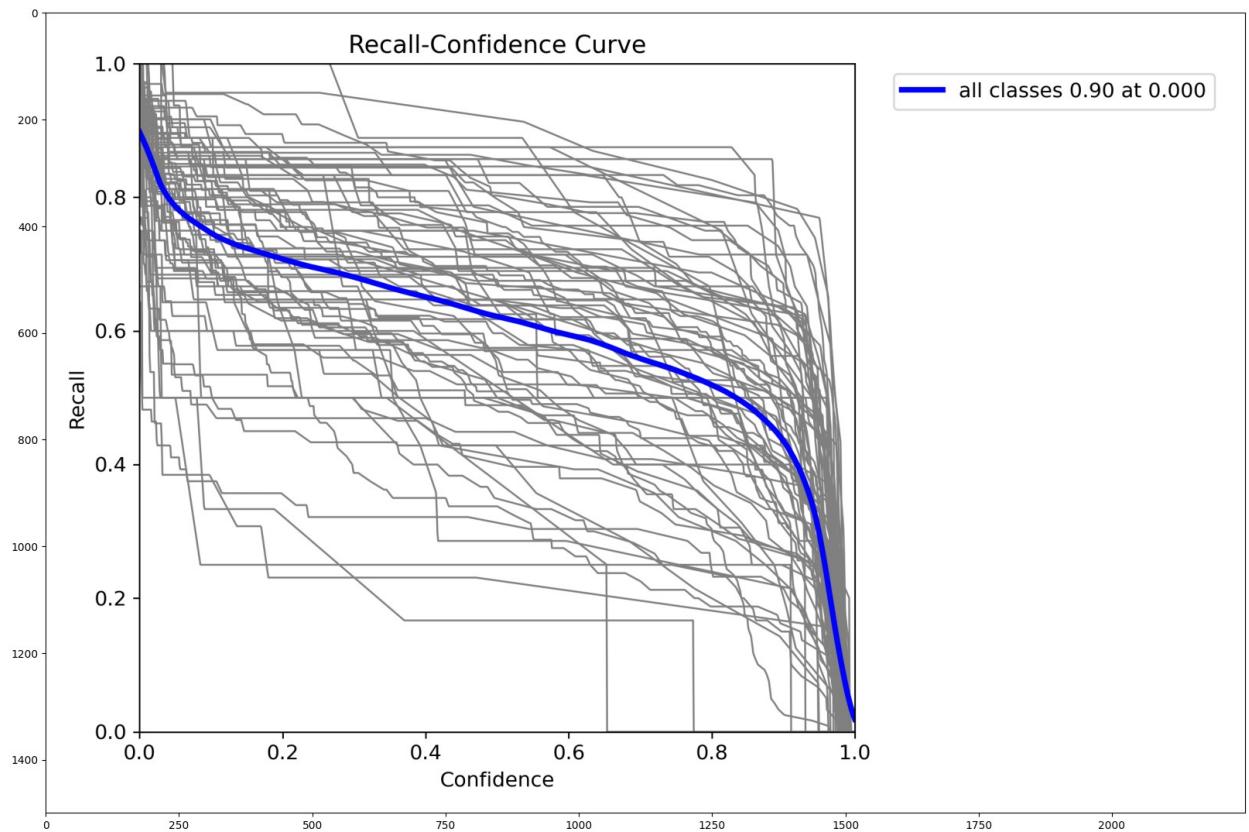
multithreaded, so this will likely lead to a deadlock.
pid, fd = os.forkpty()

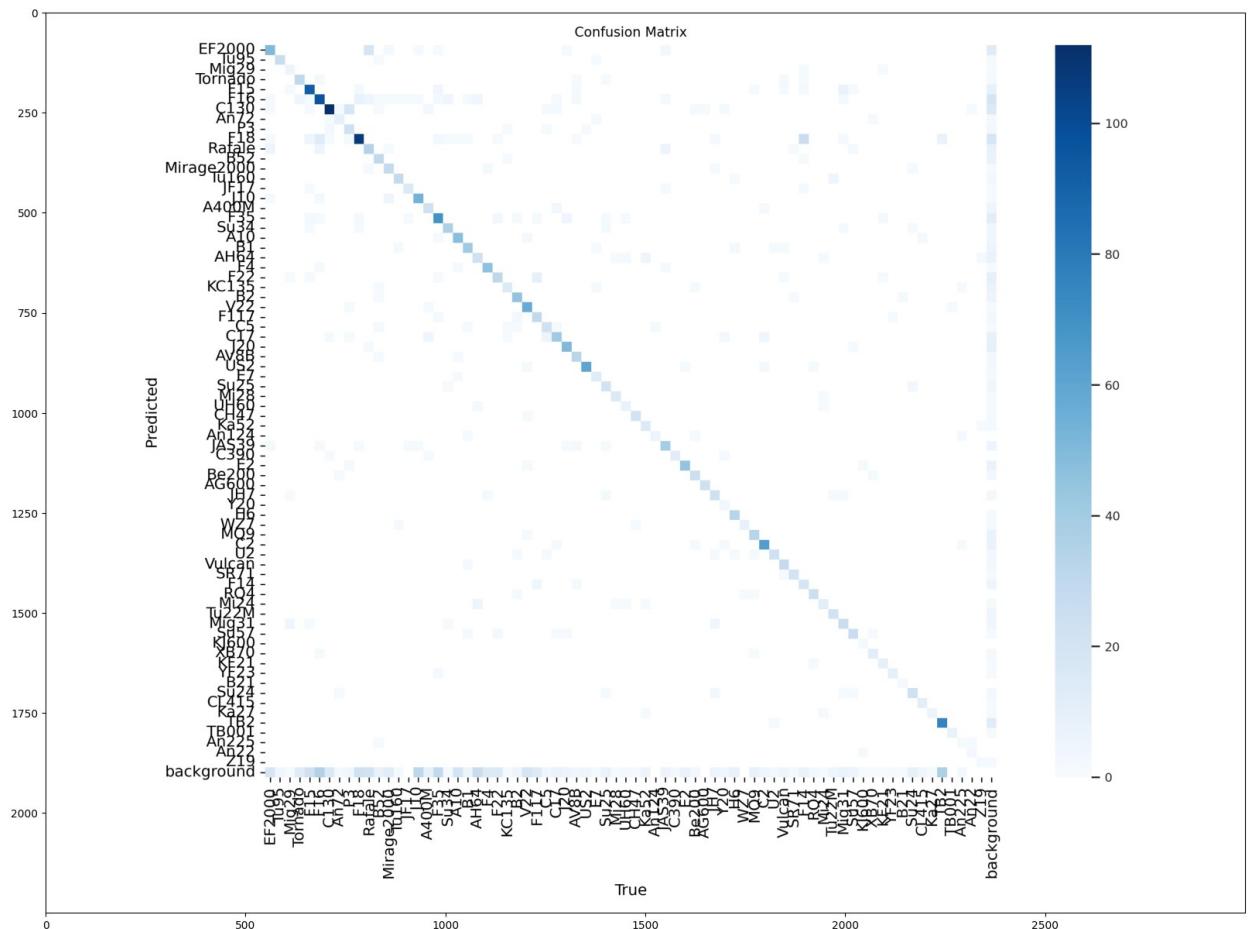
F1_curve.png           train_batch1.jpg
PR_curve.png          train_batch2.jpg
P_curve.png           train_batch89640.jpg
R_curve.png           train_batch89641.jpg
args.yaml              train_batch89642.jpg
confusion_matrix.png   val_batch0_labels.jpg
confusion_matrix_normalized.png   val_batch0_pred.jpg
events.out.tfevents.1728964178.174cf03a97ca.30.0
val_batch1_labels.jpg   val_batch1_pred.jpg
labels.jpg             val_batch2_labels.jpg
labels_correlogram.jpg val_batch2_pred.jpg
results.csv            weights
results.png
train_batch0.jpg
for path in
sorted(glob.glob('/kaggle/working/yolov10/runs/detect/train/*.png')):
    image = cv2.imread(path)[:, :, :-1]
    plt.figure(figsize=(20, 20))
    plt.imshow(image)
    plt.show()

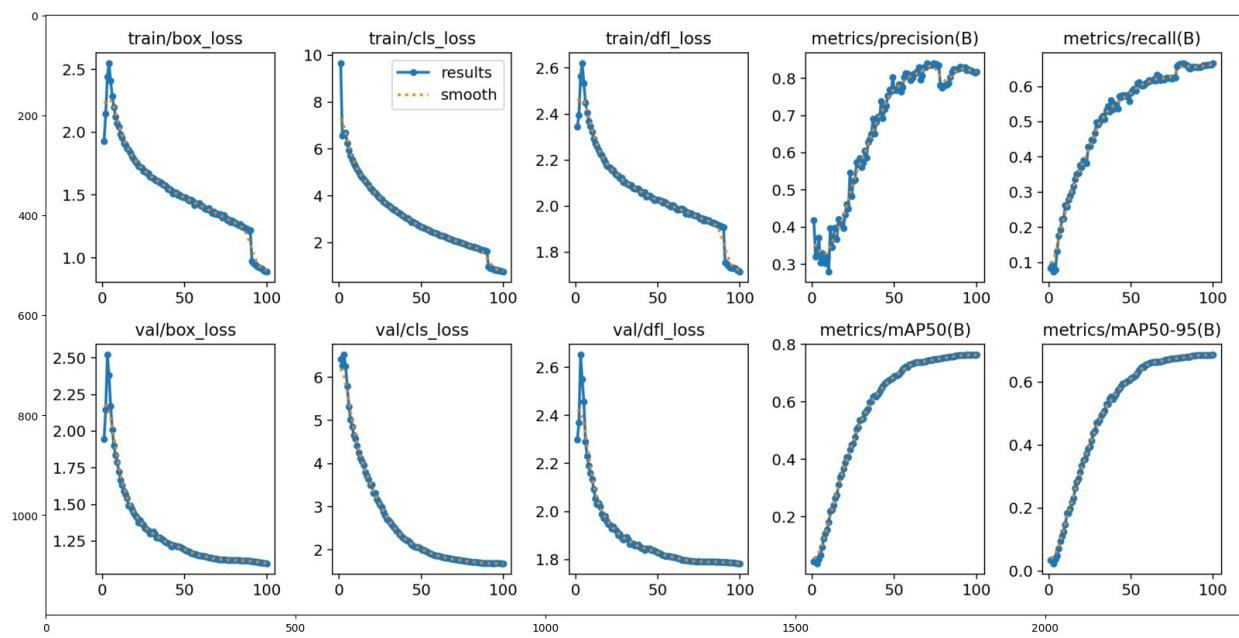
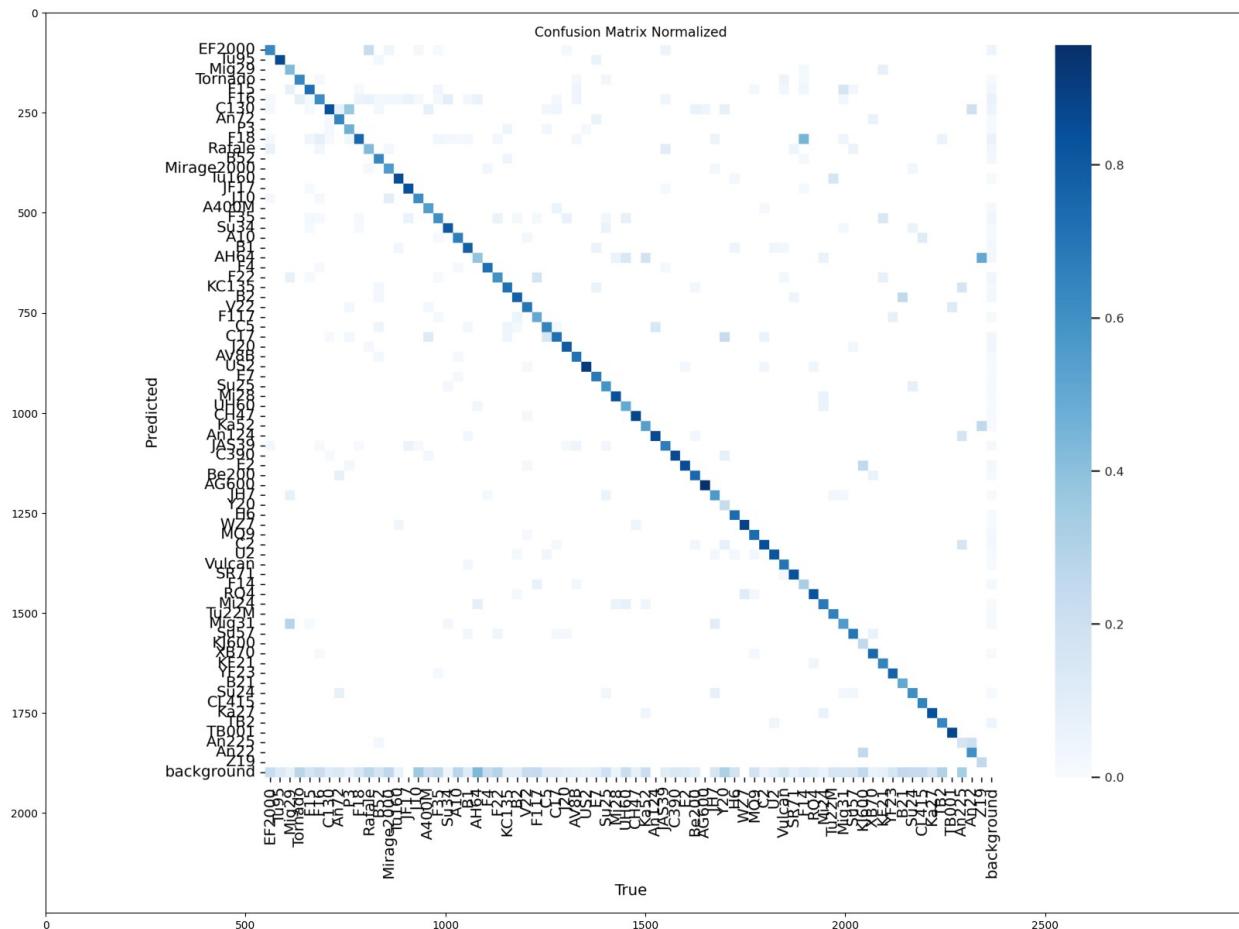
```









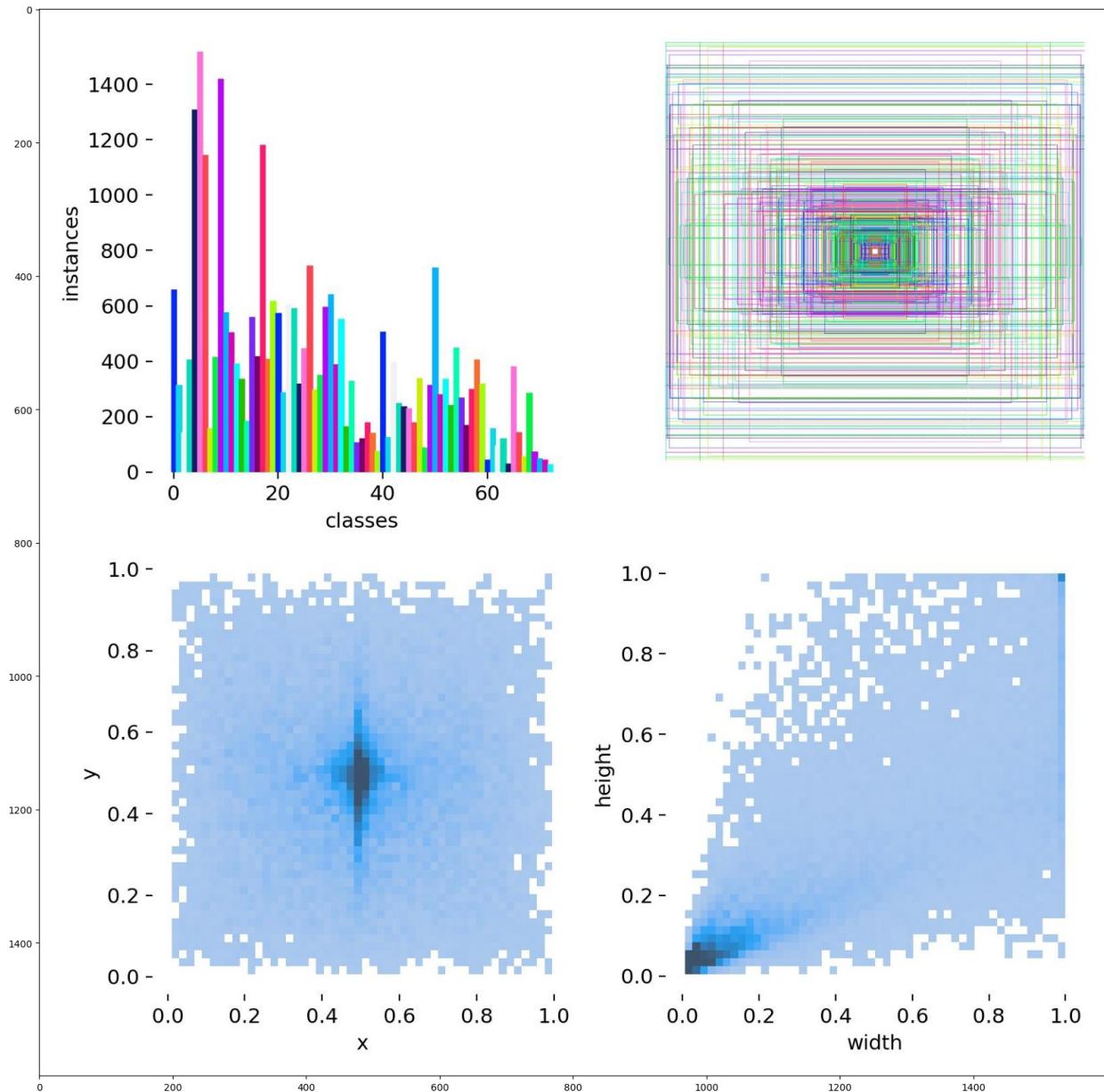


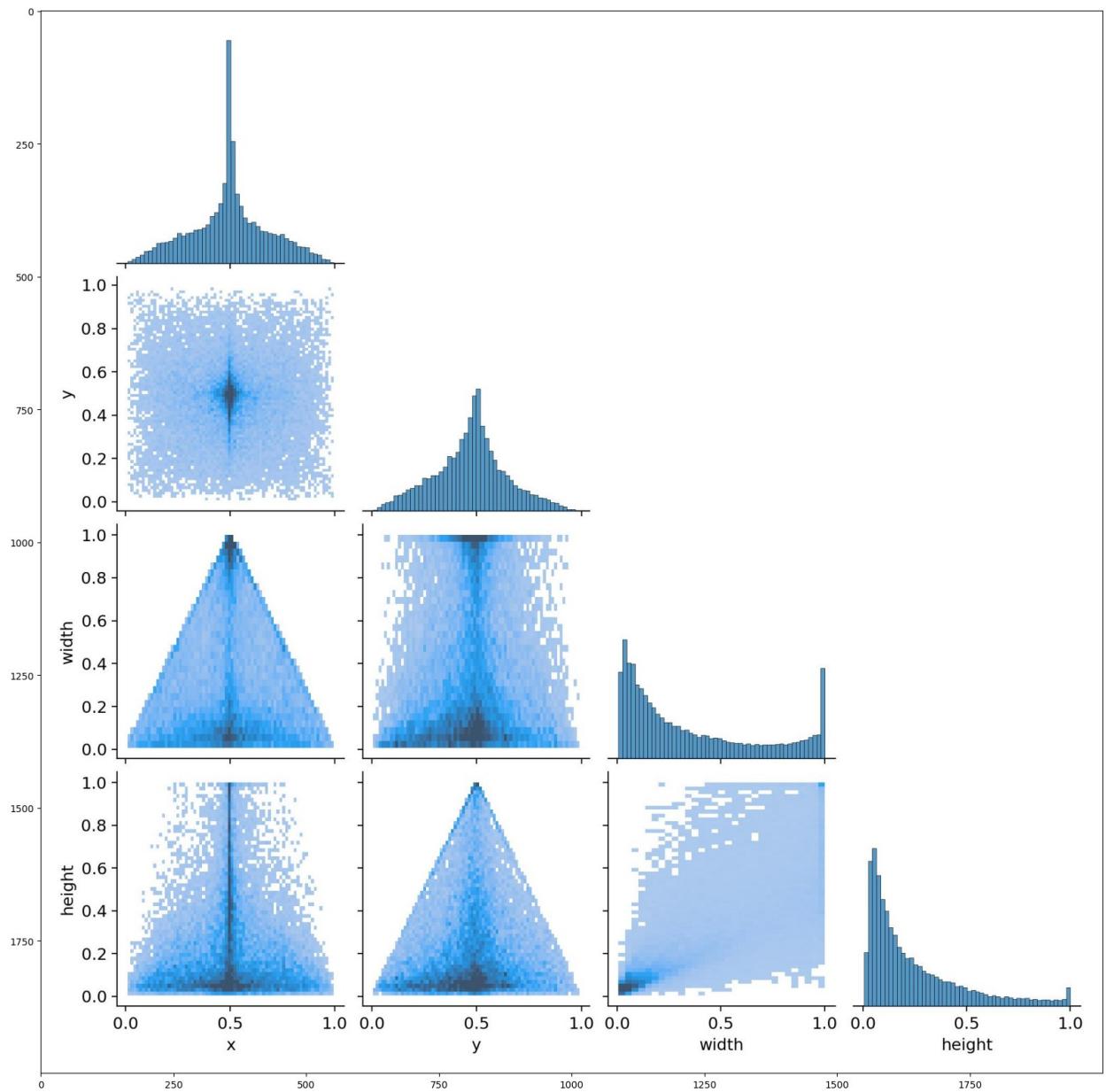
```
for path in
sorted(glob.glob('/kaggle/working/yolov10/runs/detect/train/*.jpg')):
```

```

image = cv2.imread(path)[:, :, ::-1]
plt.figure(figsize=(20,20))
plt.imshow(image)
plt.show()

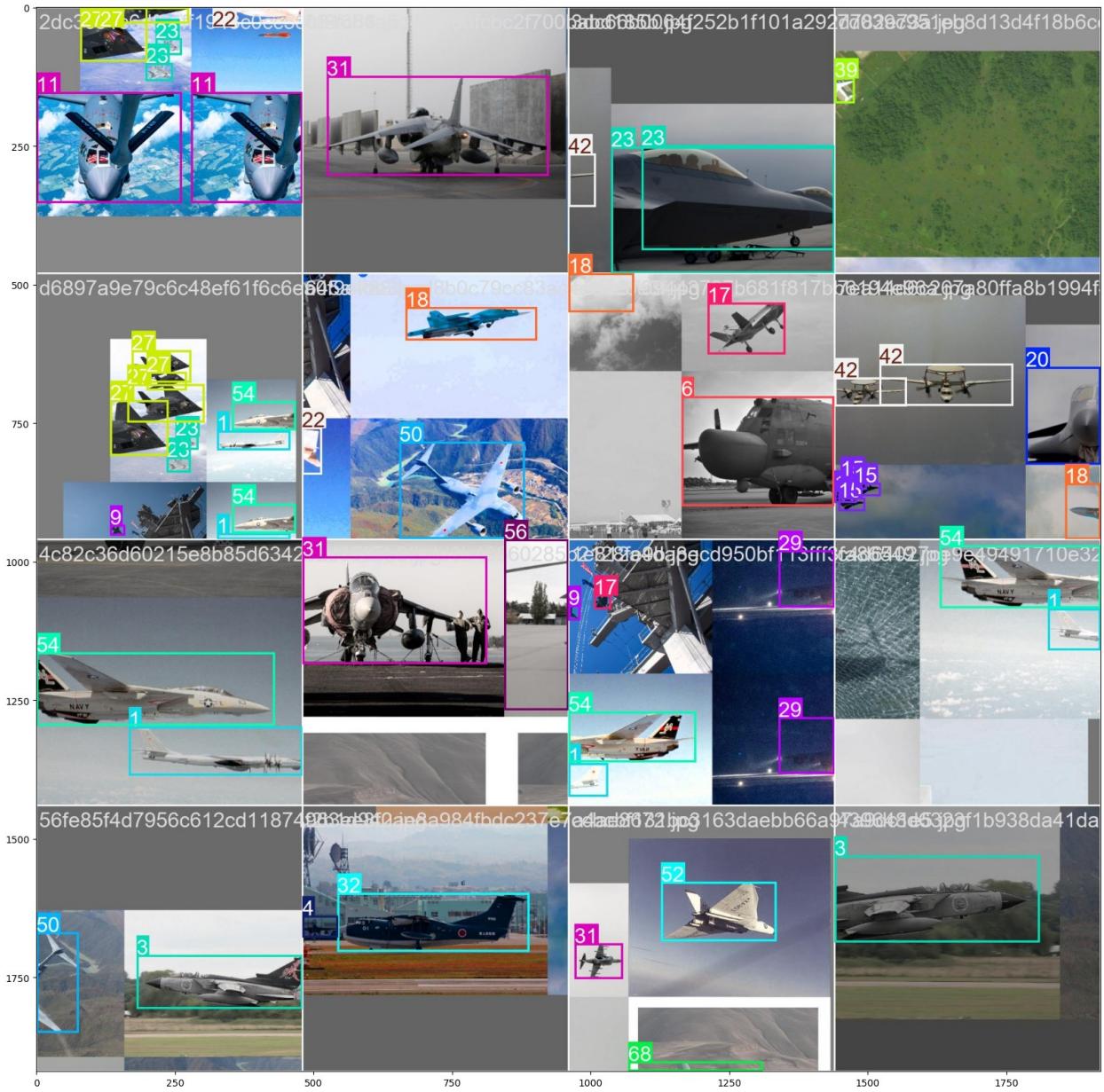
```

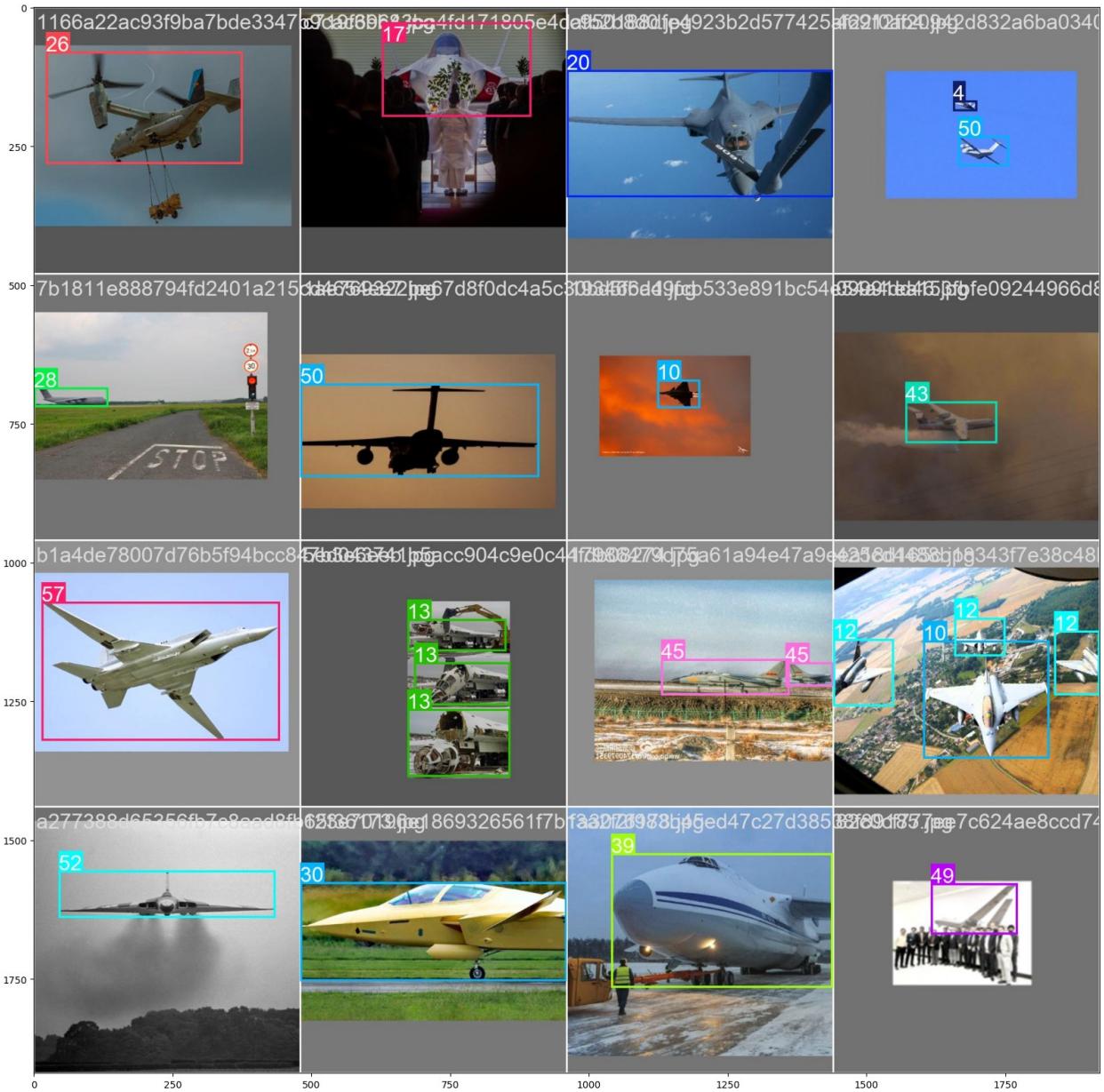


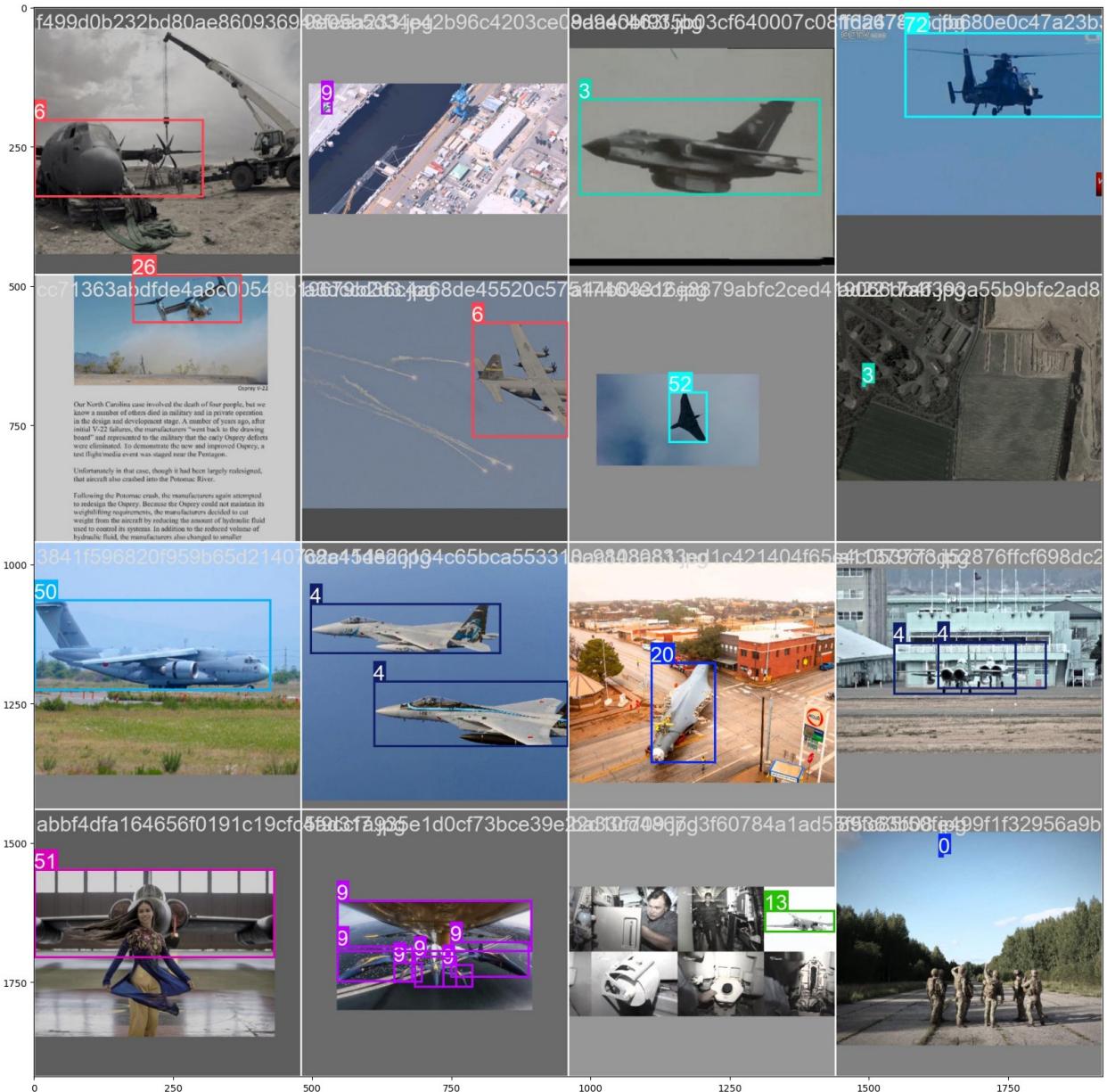


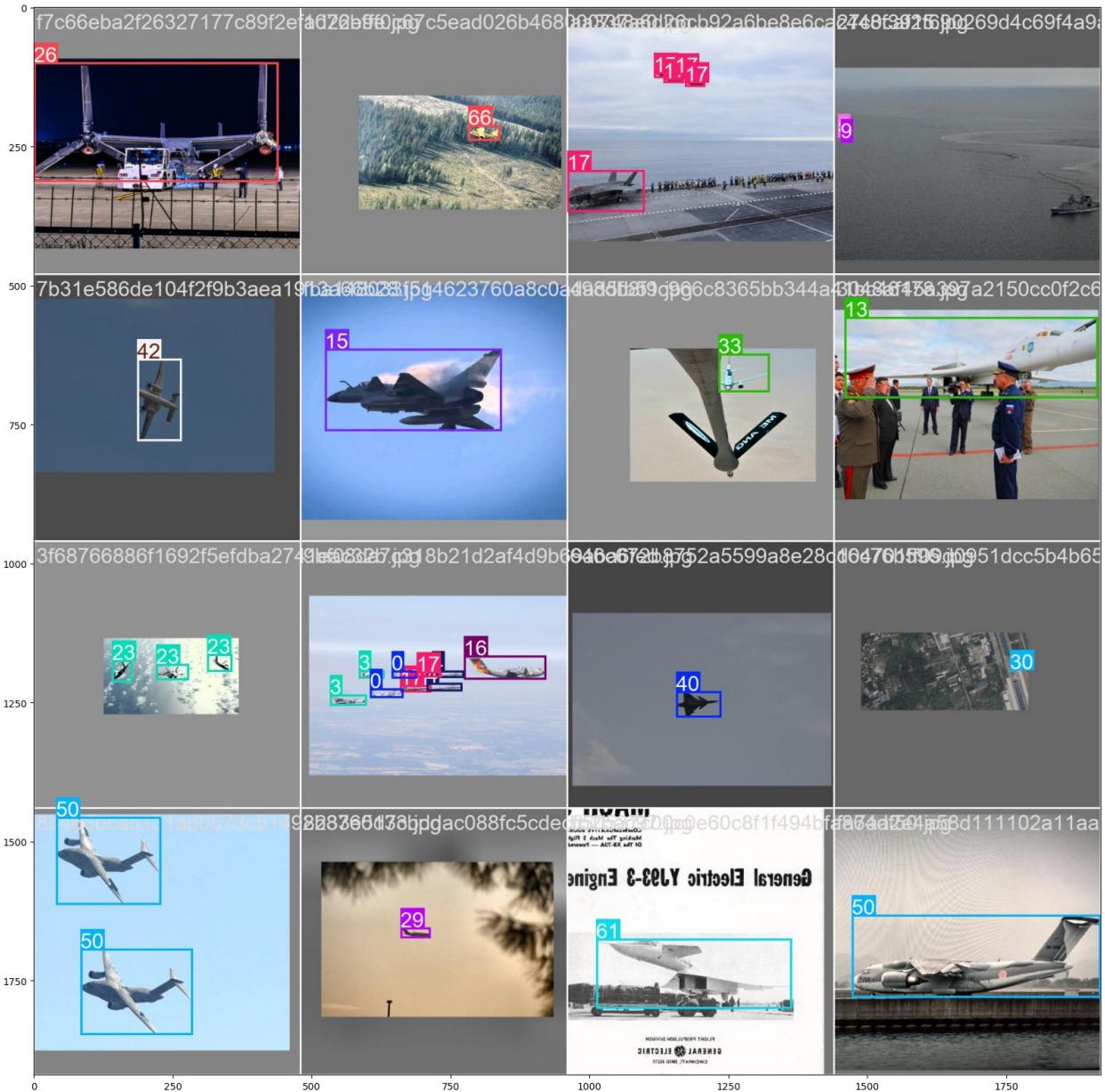




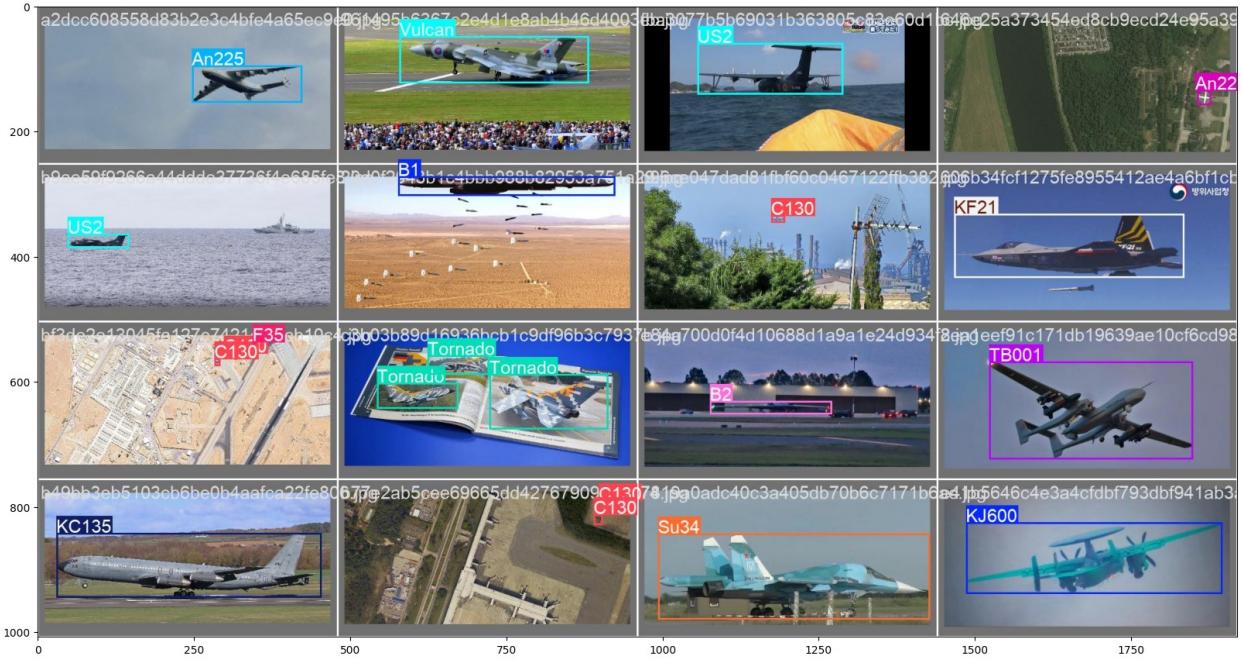














```
# Save the model after training (can be in ONNX, TorchScript, or other formats)
```

```
model.export(format='onnx') # This will save the model in ONNX format, change format if needed
```

```
Ultralytics 8.3.13 □ Python-3.10.14 torch-2.4.0 CPU (Intel Xeon 2.00GHz)
```

```
YOLOv10s summary (fused): 293 layers, 8,091,462 parameters, 0 gradients, 24.8 GFLOPs
```

```
PyTorch: starting from 'runs/detect/train/weights/best.pt' with input  
shape (1, 3, 640, 640) BCHW and output shape(s) (1, 300, 6) (15.9 MB)  
requirements: Ultralytics requirements ['onnxslim==0.1.34',  
'onnxruntime-gpu'] not found, attempting AutoUpdate...  
Collecting onnxslim==0.1.34  
  Downloading onnxslim-0.1.34-py3-none-any.whl.metadata (2.7 kB)  
Collecting onnxruntime-gpu  
  Downloading onnxruntime_gpu-1.19.2-cp310-cp310-  
manylinux_2_27_x86_64.manylinux_2_28_x86_64.whl.metadata (4.5 kB)  
Requirement already satisfied: onnx in /opt/conda/lib/python3.10/site-  
packages (from onnxslim==0.1.34) (1.17.0)  
Requirement already satisfied: sympy in  
/opt/conda/lib/python3.10/site-packages (from onnxslim==0.1.34)  
(1.13.3)  
Requirement already satisfied: packaging in  
/opt/conda/lib/python3.10/site-packages (from onnxslim==0.1.34) (21.3)  
Collecting coloredlogs (from onnxruntime-gpu)  
  Downloading coloredlogs-15.0.1-py2.py3-none-any.whl.metadata (12 kB)  
Requirement already satisfied: flatbuffers in  
/opt/conda/lib/python3.10/site-packages (from onnxruntime-gpu)  
(24.3.25)  
Requirement already satisfied: numpy>=1.21.6 in  
/opt/conda/lib/python3.10/site-packages (from onnxruntime-gpu)  
(1.26.4)  
Requirement already satisfied: protobuf in  
/opt/conda/lib/python3.10/site-packages (from onnxruntime-gpu)  
(3.20.3)  
Collecting humanfriendly>=9.1 (from coloredlogs->onnxruntime-gpu)  
  Downloading humanfriendly-10.0-py2.py3-none-any.whl.metadata (9.2  
kB)  
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in  
/opt/conda/lib/python3.10/site-packages (from packaging-  
>onnxslim==0.1.34) (3.1.2)  
Requirement already satisfied: mpmath<1.4,>=1.1.0 in  
/opt/conda/lib/python3.10/site-packages (from sympy->onnxslim==0.1.34)  
(1.3.0)  
Downloading onnxslim-0.1.34-py3-none-any.whl (140 kB)  
0:00:00 140.3/140.3 kB 7.2 MB/s eta  
e_gpu-1.19.2-cp310-cp310-  
manylinux_2_27_x86_64.manylinux_2_28_x86_64.whl (226.2 MB)  
0:00:00a 0:00:01 226.2/226.2 MB 189.1 MB/s eta  
0:00:00 46.0/46.0 kB 203.9 MB/s eta  
0:00:00 anfriendly-10.0-py2.py3-none-any.whl (86 kB)  
0:00:00 86.8/86.8 kB 224.3 MB/s eta
```

```

anfriendly, onnxslim, coloredlogs, onnxruntime-gpu
Successfully installed coloredlogs-15.0.1 humanfriendly-10.0
onnxruntime-gpu-1.19.2 onnxslim-0.1.34

requirements: AutoUpdate success □ 18.6s, installed 2 packages:
['onnxslim==0.1.34', 'onnxruntime-gpu']
requirements: △ Restart runtime or rerun command for updates to take
effect

ONNX: starting export with onnx 1.17.0 opset 19...
ONNX: slimming with onnxslim 0.1.34...
ONNX: export success □ 23.4s, saved as
'runs/detect/train/weights/best.onnx' (27.9 MB)

Export complete (25.7s)
Results saved to /kaggle/working/yolov10/runs/detect/train/weights
Predict:          yolo predict task=detect
model=runs/detect/train/weights/best.onnx imgsz=640
Validate:         yolo val task=detect
model=runs/detect/train/weights/best.onnx imgsz=640
data=/kaggle/working/data/mydata.yaml
Visualize:        https://netron.app

'runs/detect/train/weights/best.onnx'

# Save model weights manually (e.g., in PyTorch format)
model.save('best_model.pt')

import cv2
import numpy as np
import matplotlib.pyplot as plt

def predict_image(model, image_path):
    # Load the image
    img = cv2.imread(image_path)
    img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB) # Convert BGR to RGB

    # Make a prediction
    results = model(img)

    # Visualize the predictions
    # If the results have bounding boxes
    if results and len(results) > 0 and hasattr(results[0], 'boxes'):
        for box in results[0].boxes:
            # Get coordinates and class ID
            x1, y1, x2, y2 = box.xyxy[0].cpu().numpy() # Bounding box
coordinates
            class_id = int(box.cls[0].cpu().numpy()) # Class ID

            # Draw the bounding box

```

```

        cv2.rectangle(img, (int(x1), int(y1)), (int(x2), int(y2)),
(0, 255, 0), 2)
        cv2.putText(img, str(class_id), (int(x1), int(y1) - 10),
cv2.FONT_HERSHEY_SIMPLEX, 0.5, (255, 0, 0), 2)

# Display the image
plt.imshow(img)
plt.axis('off') # Hide axis
plt.show()

# Example usage to predict an image
image_path = r'/kaggle/input/images/1200px-RAF_Eurofighter_EF-
2000_Typhoon_F2_Lofting-1.jpg' # Replace with your image path
predict_image(model, image_path)

```

0: 448x640 1 EF2000, 109.3ms
Speed: 6.1ms preprocess, 109.3ms inference, 1.3ms postprocess per
image at shape (1, 3, 448, 640)



```

import cv2
import numpy as np
import matplotlib.pyplot as plt

def predict_image(model, image_path):
    # Load the image
    img = cv2.imread(image_path)
    img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB) # Convert BGR to RGB

```

```

# Make a prediction
results = model(img)

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# If the results have bounding boxes
if results and len(results) > 0 and hasattr(results[0], 'boxes'):
    for box in results[0].boxes:
        # Get coordinates and class ID
        x1, y1, x2, y2 = box.xyxy[0].cpu().numpy() # Bounding box
coordinates
        class_id = int(box.cls[0].cpu().numpy()) # Class ID

        # Draw the bounding box
        cv2.rectangle(img, (int(x1), int(y1)), (int(x2), int(y2)),
(0, 255, 0), 2)
        cv2.putText(img, str(class_id), (int(x1), int(y1) - 10),
cv2.FONT_HERSHEY_SIMPLEX, 0.5, (255, 0, 0), 2)

# Display the image
plt.imshow(img)
plt.axis('off') # Hide axis
plt.show()

# Example usage to predict an image
image_path = r'/kaggle/input/images/US2 and Su25 together.jpg' #
Replace with your image path
predict_image(model, image_path)

```

0: 384x640 1 A10, 1 Su25, 55.2ms
Speed: 2.0ms preprocess, 55.2ms inference, 0.6ms postprocess per image
at shape (1, 3, 384, 640)



```

import cv2
import numpy as np
import matplotlib.pyplot as plt

def predict_image(model, image_path):
    # Load the image
    img = cv2.imread(image_path)
    img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB) # Convert BGR to RGB

    # Make a prediction
    results = model(img)

    # Visualize the predictions
    # If the results have bounding boxes
    if results and len(results) > 0 and hasattr(results[0], 'boxes'):
        for box in results[0].boxes:
            # Get coordinates and class ID
            x1, y1, x2, y2 = box.xyxy[0].cpu().numpy() # Bounding box
coordinates
            class_id = int(box.cls[0].cpu().numpy()) # Class ID

            # Draw the bounding box
            cv2.rectangle(img, (int(x1), int(y1)), (int(x2), int(y2)),
(0, 255, 0), 2)
            cv2.putText(img, str(class_id), (int(x1), int(y1) - 10),
cv2.FONT_HERSHEY_SIMPLEX, 0.5, (255, 0, 0), 2)

    # Display the image
    plt.imshow(img)
    plt.axis('off') # Hide axis
    plt.show()

# Example usage to predict an image
image_path = r'/kaggle/input/images/ef2000_and_rafale.jpeg' # Replace
with your image path
predict_image(model, image_path)

```

0: 384x640 1 EF2000, 2 Rafales, 14.8ms
Speed: 2.3ms preprocess, 14.8ms inference, 0.5ms postprocess per image
at shape (1, 3, 384, 640)

