
Project Fish

Function 3- Task-2 (Dead Fish Identification and Dead fish count)

We've reached optimal accuracy with our object detection models designed for identifying deceased fishes. By training six models and implementing strategic parameter adjustments, we've achieved exceptional results. Exploring various optimizers and fine-tuning learning rates has been crucial in ensuring the top-notch performance of our dead fish detection system.

Using this model, we can reliably identify dead fishes in our tank and accurately determine the count of deceased fishes, providing valuable insights into the health of the aquatic environment.

mAP@50: Refers to the mean Average Precision calculated at an Intersection over Union (IoU) threshold of 0.5. This evaluates the accuracy of object detection based on bounding box overlap, considering a moderate level of spatial agreement.

mAP@50-95: Indicates the mean Average Precision calculated over a range of IoU thresholds, from 0.5 to 0.95 in increments of 0.05. This provides a more comprehensive evaluation of the model's accuracy across a spectrum of bounding box overlap requirements, offering insights into its performance under various conditions.

Model_1



```
import os

from ultralytics import YOLO
# Load a model
model = YOLO('yolov8n.yaml') # load pre trained model
# Use the model
results = model.train(data=os.path.join(ROOT_DIR, 'data1.yaml'), epochs=30, batch=8, optimizer='Adamax', lr0=0.01, seed=42)
```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/30	1.34G	3.156	3.709	3.95	12	640: 100% [██████] 38/38 [00:21<00:00, 1.76it/s]
	Class	Images	Instances	Box(P	R	mAP50
	all	80	89	0.0025	0.663	mAP50-95: 100% [██████] 5/5 [00:07<00:00, 1.44s/it]
						0.00559 0.00149
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
2/30	1.22G	3.166	3.456	3.647	12	640: 100% [██████] 38/38 [00:15<00:00, 2.38it/s]
	Class	Images	Instances	Box(P	R	mAP50
	all	80	89	0.0025	0.674	mAP50-95: 100% [██████] 5/5 [00:01<00:00, 3.81it/s]
						0.0102 0.00256
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
3/30	1.22G	3.153	3.273	3.511	11	640: 100% [██████] 38/38 [00:18<00:00, 2.11it/s]
	Class	Images	Instances	Box(P	R	mAP50
	all	80	89	0.00737	0.0337	mAP50-95: 100% [██████] 5/5 [00:01<00:00, 2.97it/s]
						0.0021 0.000524
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
4/30	1.21G	3.13	3.208	3.499	8	640: 100% [██████] 38/38 [00:19<00:00, 1.95it/s]
	Class	Images	Instances	Box(P	R	mAP50
	all	80	89	0.0217	0.0562	mAP50-95: 100% [██████] 5/5 [00:01<00:00, 3.14it/s]
						0.0093 0.00326

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
28/30	1.21G	2.522	2.807	3.063	4	640: 100% [██████] 38/38 [00:15<00:00, 2.42it/s]
	Class	Images	Instances	Box(P	R	mAP50
	all	80	89	0.198	0.247	mAP50-95: 100% [██████] 5/5 [00:01<00:00, 3.65it/s]
						0.126 0.0472
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
29/30	1.21G	2.404	2.847	3.028	4	640: 100% [██████] 38/38 [00:17<00:00, 2.14it/s]
	Class	Images	Instances	Box(P	R	mAP50
	all	80	89	0.236	0.225	mAP50-95: 100% [██████] 5/5 [00:02<00:00, 2.18it/s]
						0.139 0.0512
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
30/30	1.21G	2.443	2.853	3.032	4	640: 100% [██████] 38/38 [00:17<00:00, 2.16it/s]
	Class	Images	Instances	Box(P	R	mAP50
	all	80	89	0.252	0.191	mAP50-95: 100% [██████] 5/5 [00:01<00:00, 3.14it/s]
						0.164 0.0586

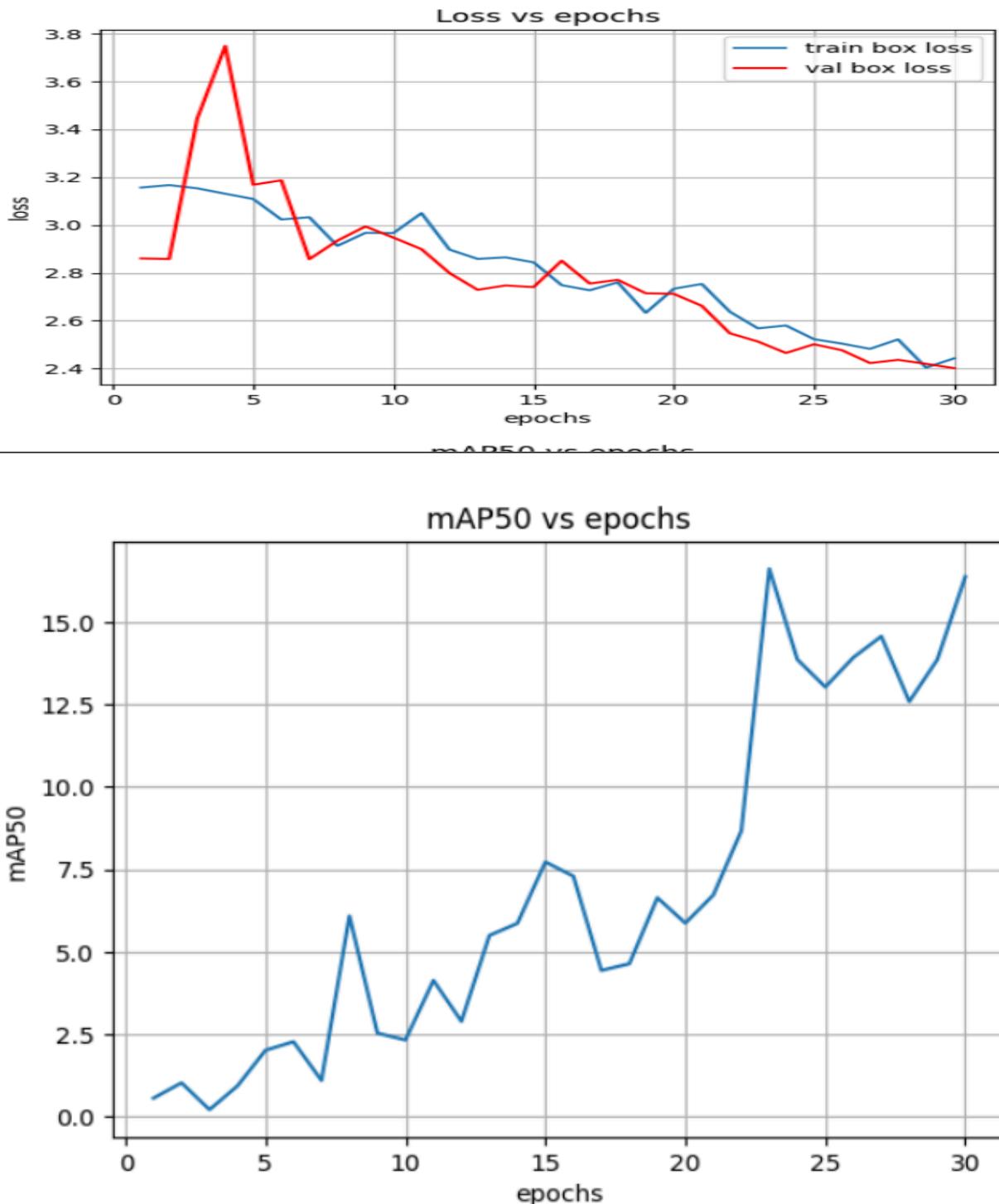
30 epochs completed in 0.186 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 6.2MB
Optimizer stripped from runs/detect/train/weights/best.pt, 6.2MB

Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.1.7 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GFLOPs
Class Images Instances Box(P R mAP50 mAP50-95: 100% [██████] | 5/5 [00:04<00:00, 1.03it/s]
all 80 89 0.252 0.191 0.159 0.0557

Speed: 0.3ms preprocess, 4.1ms inference, 0.0ms loss, 3.6ms postprocess per image
Results saved to [runs/detect/train](#)

- Map@50 ->15.9%
- Map@50-95 ->5.57%
- Epochs ->30
- Optimizer ->Adamax
- Momentum ->0.937
- Batch_Size ->8
- Learning_Rate ->0.01

Training Performance Analysis:



Model_2

Model 2

```
import os

from ultralytics import YOLO
# Load a model
model = YOLO('yolov8n.yaml') # load pre trained model
# Use the model
results = model.train(data=os.path.join(ROOT_DIR, 'data1.yaml'), epochs=50, batch=16, optimizer='Adam', lr0=0.01, seed=42)

Ultraalytics YOLOv8.1.7 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
engine/trainer: task=detect, mode=train, model=yolov8n.yaml, data=/content/drive/MyDrive/TrainYOLOv8CustomDataset/data1.yaml, epochs=50, time=None, patience=50, bat
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf'...
100%|██████████| 755k/755k [00:00<00:00, 27.9MB/s]
Overriding model.yaml nc=88 with nc=1
```

```
21           -1 1   493056  ultralytics.nn.modules.block.C2i      [384, 256, 1]
22     [15, 18, 21] 1   751507  ultralytics.nn.modules.head.Detect    [1, [64, 128, 256]]
YOLOv8n summary: 225 layers, 3011043 parameters, 3011027 gradients, 8.2 GFLOPs
```

```
TensorBoard: Start with 'tensorboard --logdir runs/detect/train', view at http://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
Downloading https://github.com/ultralytics/assets/releases/download/v8.1.0/yolov8n.pt to 'yolov8n.pt'...
100%|██████████| 6.23M/6.23M [00:00<00:00, 108MB/s]
AMP: checks passed ✅
train: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/train.cache... 300 images, 8 backgrounds, 0 corrupt: 100%|██████████| 300/300 [00:00<?
, augmentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01, clip_limit=(1, 4.0), tile_grid_size=(8, 8))
val: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/val.cache... 80 images, 2 backgrounds, 0 corrupt: 100%|██████████| 80/80 [00:00<?, ?it/s]
Plotting labels to runs/detect/train/labels.jpg...
optimizer: Adam(lr=0.01, momentum=0.937) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 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 50 epochs...
```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/50	2.39G	3.217	3.743	4.028	25	640: 100% ██████████ 19/19 [00:21<00:00, 1.14s/it]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95: 100% ██████████ 3/3 [00:05<00:00, 1.75s/it]
	all	80	89	0.00229	0.618	0.00215 0.000823

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
2/50	2.24G	3.203	3.48	3.528	26	640: 100% ██████████ 19/19 [00:14<00:00, 1.28it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95: 100% ██████████ 3/3 [00:02<00:00, 1.37it/s]
	all	80	89	0.0462	0.258	0.0223 0.00595

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
3/50	2.24G	3.194	3.342	3.403	31	640: 100% ██████████ 19/19 [00:16<00:00, 1.18it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95: 100% ██████████ 3/3 [00:01<00:00, 2.51it/s]
	all	80	89	0.00642	0.393	0.00415 0.00142

```

Epoch    GPU_mem   box_loss   cls_loss   dfl_loss   Instances   Size
48/50    2.24G     2.315      2.618      2.647      19          640: 100% [██████████] 19/19 [00:13<00:00,  1.42it/s]
          Class      Images    Instances      Box(P)      R          mAP50  mAP50-95): 100% [██████████] 3/3 [00:01<00:00,  1.74it/s]
          all        80         89          0.27       0.326      0.232      0.0797

Epoch    GPU_mem   box_loss   cls_loss   dfl_loss   Instances   Size
49/50    2.24G     2.295      2.577      2.593      12          640: 100% [██████████] 19/19 [00:14<00:00,  1.32it/s]
          Class      Images    Instances      Box(P)      R          mAP50  mAP50-95): 100% [██████████] 3/3 [00:00<00:00,  3.21it/s]
          all        80         89          0.226      0.315      0.211      0.0773

Epoch    GPU_mem   box_loss   cls_loss   dfl_loss   Instances   Size
50/50    2.26G     2.244      2.585      2.598      11          640: 100% [██████████] 19/19 [00:16<00:00,  1.15it/s]
          Class      Images    Instances      Box(P)      R          mAP50  mAP50-95): 100% [██████████] 3/3 [00:01<00:00,  1.72it/s]
          all        80         89          0.252      0.337      0.227      0.077

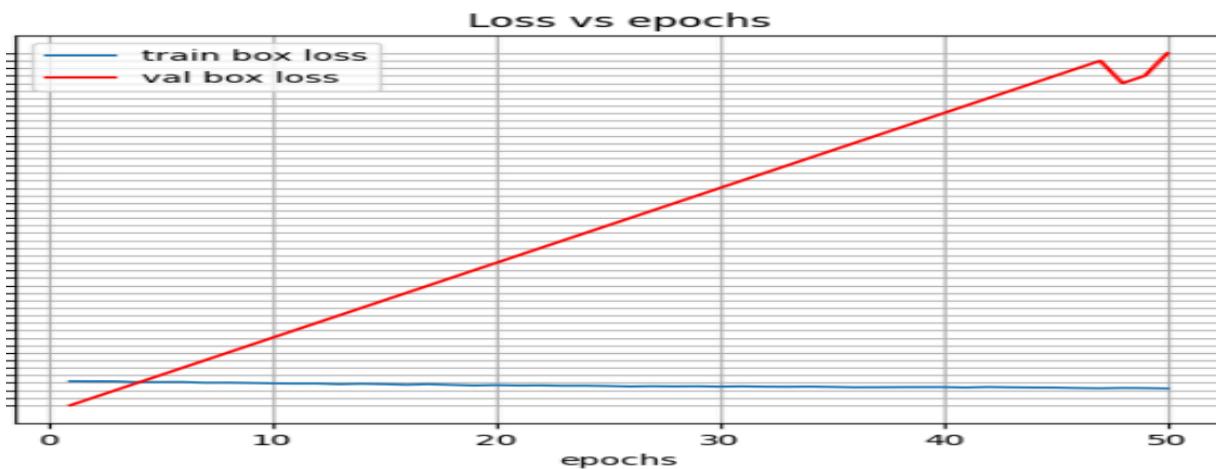
50 epochs completed in 0.263 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 6.2MB
Optimizer stripped from runs/detect/train/weights/best.pt, 6.2MB

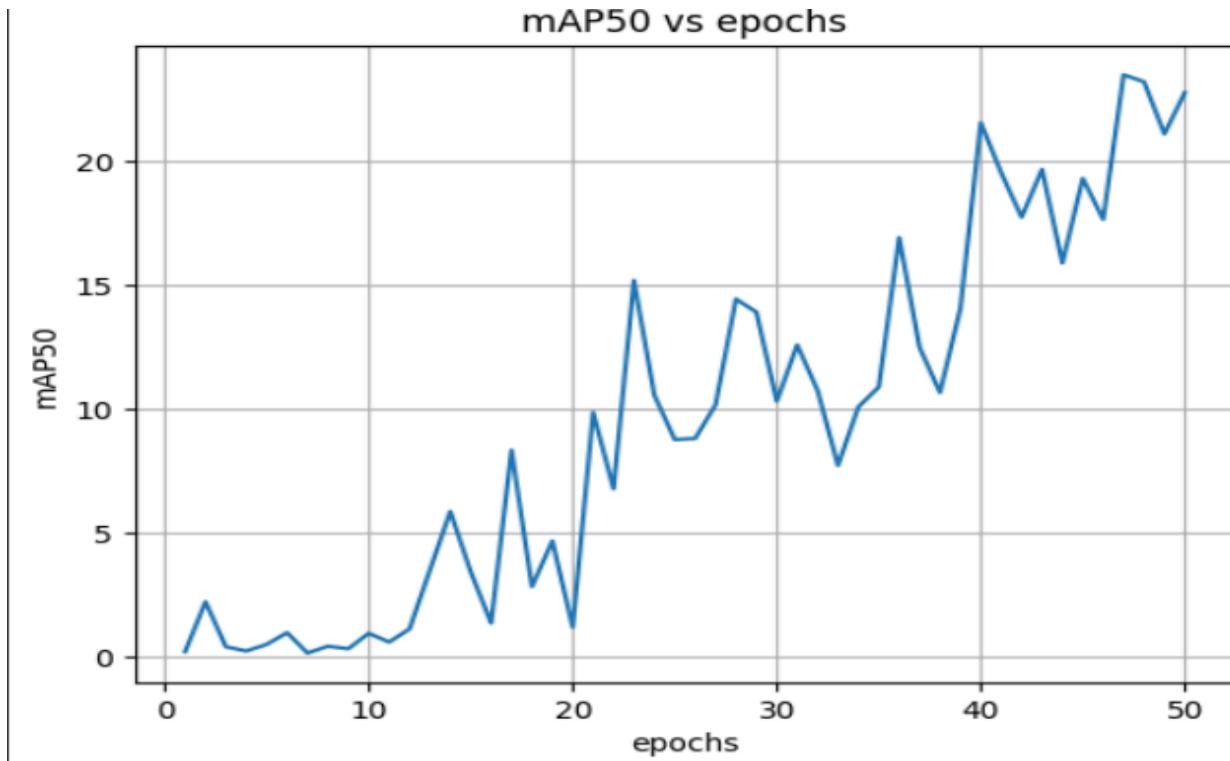
Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.1.7 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GFLOPs
          Class      Images    Instances      Box(P)      R          mAP50  mAP50-95): 100% [██████████] 3/3 [00:03<00:00,  1.25s/it]
          all        80         89          0.262      0.347      0.235      0.086
Speed: 0.2ms preprocess, 2.6ms inference, 0.0ms loss, 1.7ms postprocess per image
Results saved to runs/detect/train

```

- Map@50 ->23.5%
- Map@50-95 ->0.6%
- Epochs ->50
- Optimizer ->Adam
- Momentum ->0.937
- Batch_Size ->16
- Learning_Rate ->0.01

Training Performance Analysis:





Model_3

▼ Model 3

```

⌚ import os

from ultralytics import YOLO
# Load a model
model = YOLO('yolov8n.yaml') # load pre trained model
# Use the model
results = model.train(data=os.path.join(ROOT_DIR,'data1.yaml'), epochs=30,batch=8,optimizer='SGD',lr0=0.01,seed=42)

⌚ Epoch GPU_mem box_loss cls_loss dfl_loss Instances Size
1/30 1.34G 3.322 3.9 4.299 12 640: 100% [██████] 38/38 [00:20<00:00, 1.86it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████] 5/5 [00:03<00:00, 1.30it/s]
          all 80 89 0.00253 0.629 0.0088 0.0029

⌚ Epoch GPU_mem box_loss cls_loss dfl_loss Instances Size
2/30 1.21G 3.289 3.765 4.23 12 640: 100% [██████] 38/38 [00:17<00:00, 2.14it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████] 5/5 [00:02<00:00, 1.97it/s]
          all 80 89 0.00249 0.618 0.0103 0.00263

⌚ Epoch GPU_mem box_loss cls_loss dfl_loss Instances Size
3/30 1.21G 3.302 3.744 4.188 11 640: 100% [██████] 38/38 [00:20<00:00, 1.83it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████] 5/5 [00:01<00:00, 3.37it/s]
          all 80 89 0.00268 0.629 0.0282 0.00802

```

```

TensorBoard: Start with 'tensorboard --logdir runs/detect/train2', view at http://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
AMP: checks passed ✅
train: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/train.cache... 300 images, 8 backgrounds, 0 corrupt: 100%|██████████| 300/300 [00:00<?, 300/300 [00:00<?, ?it/s]

val: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/val.cache... 80 images, 2 backgrounds, 0 corrupt: 100%|██████████| 80/80 [00:00<?, ?it/s]
Plotting labels to runs/detect/train2/labels.jpg...
optimizer: SGD(lr=0.01, momentum=0.937) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
TensorBoard: model graph visualization added ✅
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train2
Starting training for 30 epochs...

```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
28/30	1.21G	2.42	2.709	3.045	4	640: 100% ██████████ 38/38 [00:17<00:00, 2.16it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% ██████████ 5/5 [00:01<00:00, 3.51it/s]
	all	80	89	0.257	0.292	0.189 0.0663

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
29/30	1.21G	2.429	2.679	3.073	4	640: 100% ██████████ 38/38 [00:19<00:00, 1.91it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% ██████████ 5/5 [00:01<00:00, 3.19it/s]
	all	80	89	0.201	0.316	0.15 0.0513

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
30/30	1.21G	2.495	2.709	3.099	4	640: 100% ██████████ 38/38 [00:16<00:00, 2.24it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% ██████████ 5/5 [00:02<00:00, 1.76it/s]
	all	80	89	0.183	0.27	0.146 0.0486

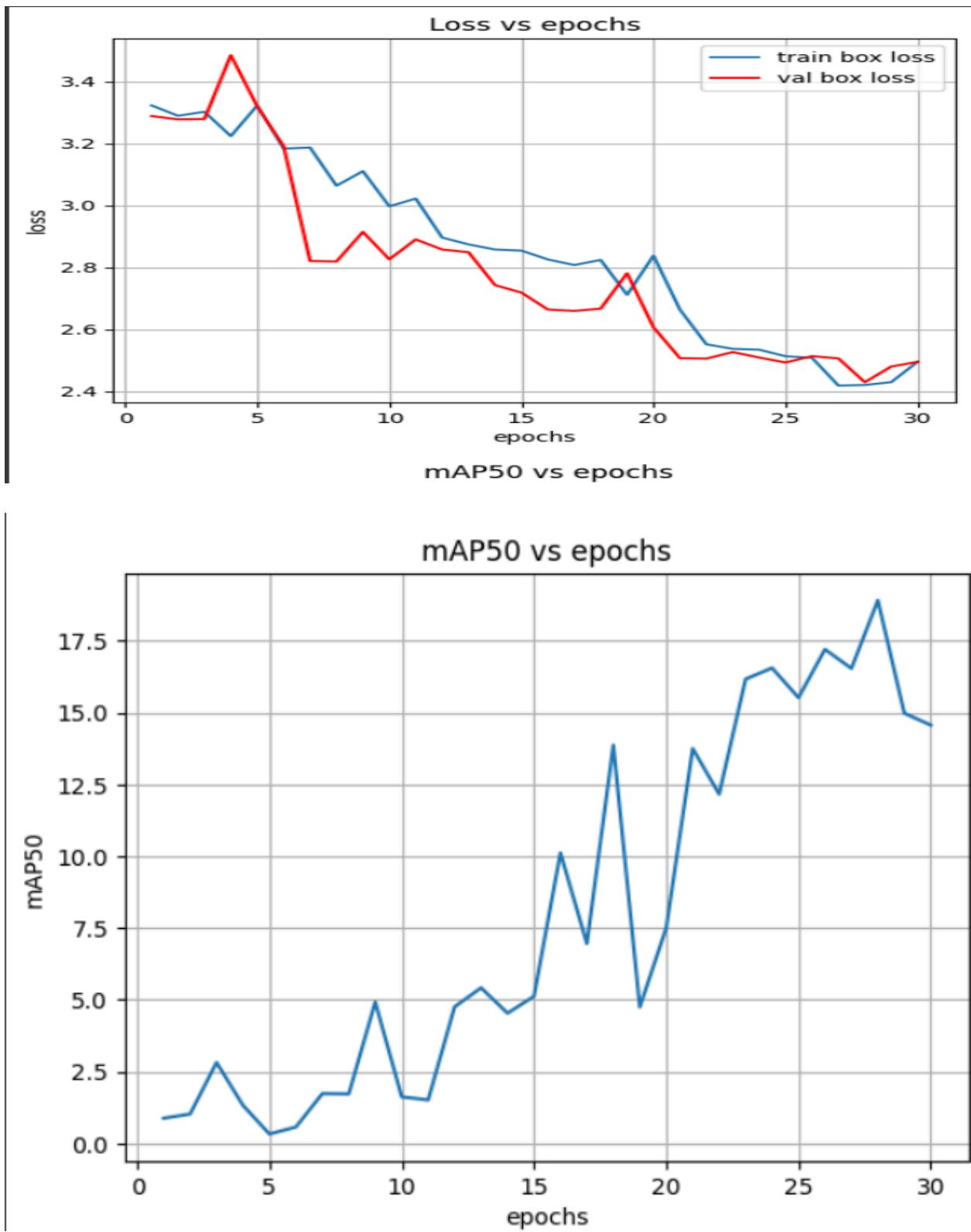
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
29/30	1.21G	2.429	2.679	3.073	4	640: 100% ██████████ 38/38 [00:19<00:00, 1.91it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% ██████████ 5/5 [00:01<00:00, 3.19it/s]
	all	80	89	0.201	0.316	0.15 0.0513

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
30/30	1.21G	2.495	2.709	3.099	4	640: 100% ██████████ 38/38 [00:16<00:00, 2.24it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% ██████████ 5/5 [00:02<00:00, 1.76it/s]
	all	80	89	0.183	0.27	0.146 0.0486

30 epochs completed in 0.189 hours.
Optimizer stripped from runs/detect/train2/weights/last.pt, 6.2MB
Optimizer stripped from runs/detect/train2/weights/best.pt, 6.2MB
Validating runs/detect/train2/weights/best.pt...
Ultralytics YOLOv8.1.7 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GFLOPs
Class Images Instances Box(P) R mAP50 mAP50-95): 100%|██████████| 5/5 [00:03<00:00, 1.27it/s]
all 80 89 0.256 0.292 0.189 0.0663
Speed: 0.2ms preprocess, 3.7ms inference, 0.0ms loss, 2.3ms postprocess per image
Results saved to runs/detect/train2

- Map@50 ->18.9%
- Map@50-95 ->6.63%
- Epochs ->30
- Optimizer ->SGD
- Momentum ->0.937
- Batch_Size ->8
- Learning_Rate ->0.01

Training Performance Analysis:



Model_4

Model 4

```
import os

from ultralytics import YOLO
# Load a model
model = YOLO('yolov8n.yaml') # load pre trained model
# Use the model
results = model.train(data=os.path.join(ROOT_DIR, 'data1.yaml'), epochs=50, batch=16, optimizer='AdamW', lr0=0.01, seed=42)

YOLOv8n summary: 225 layers, 3011043 parameters, 3011027 gradients, 8.2 GFLOPs
```

TensorBoard: Start with 'tensorboard --logdir runs/detect/train3', view at <http://localhost:6006>

Freezing layer 'model.22.dfl.conv.weight'

AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...

AMP: checks passed ✓

train: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/train.cache... 300 images, 8 backgrounds, 0 corrupt: 100% [██████████] 300/300 [00:00<?, ?it/s]

val: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/val.cache... 80 images, 2 backgrounds, 0 corrupt: 100% [██████████] 80/80 [00:00<?, ?it/s]

Plotting labels to runs/detect/train3/labels.jpg...

optimizer: AdamW(lr=0.01, momentum=0.937) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)

TensorBoard: model graph visualization added ✓

Epoch	GPU	mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/50	2.25G	3.204	3.756	4.016	25	640: 100% ██████████ 19/19 [00:15<00:00, 1.19it/s]	
	Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100% ██████████ 3/3 [00:01<00:00, 1.70it/s]
	all	80	89	0.00258	0.697	0.08574	0.00151
<hr/>							
2/50	2.25G	3.191	3.46	3.528	26	640: 100% ██████████ 19/19 [00:18<00:00, 1.02it/s]	
	Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100% ██████████ 3/3 [00:01<00:00, 1.70it/s]
	all	80	89	0.00116	0.169	0.000602	0.000139
<hr/>							
3/50	2.25G	3.14	3.381	3.373	31	640: 100% ██████████ 19/19 [00:14<00:00, 1.28it/s]	
	Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100% ██████████ 3/3 [00:01<00:00, 2.63it/s]
	all	80	89	0.001	0.27	0.000661	0.000217

```

Epoch GPU mem box_loss cls_loss dfl_loss Instances Size
48/50 2.25G 2.292 2.693 2.72 19 640: 100% [██████████] 19/19 [00:12<00:00, 1.50it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████████] 3/3 [00:02<00:00, 1.38it/s]
          all 80 89 0.269 0.337 0.206 0.0696

Epoch GPU mem box_loss cls_loss dfl_loss Instances Size
49/50 2.25G 2.273 2.629 2.685 12 640: 100% [██████████] 19/19 [00:14<00:00, 1.30it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████████] 3/3 [00:00<00:00, 3.50it/s]
          all 80 89 0.282 0.315 0.233 0.0853

Epoch GPU mem box_loss cls_loss dfl_loss Instances Size
50/50 2.27G 2.221 2.618 2.67 11 640: 100% [██████████] 19/19 [00:16<00:00, 1.14it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████████] 3/3 [00:01<00:00, 2.64it/s]
          all 80 89 0.253 0.326 0.211 0.0748

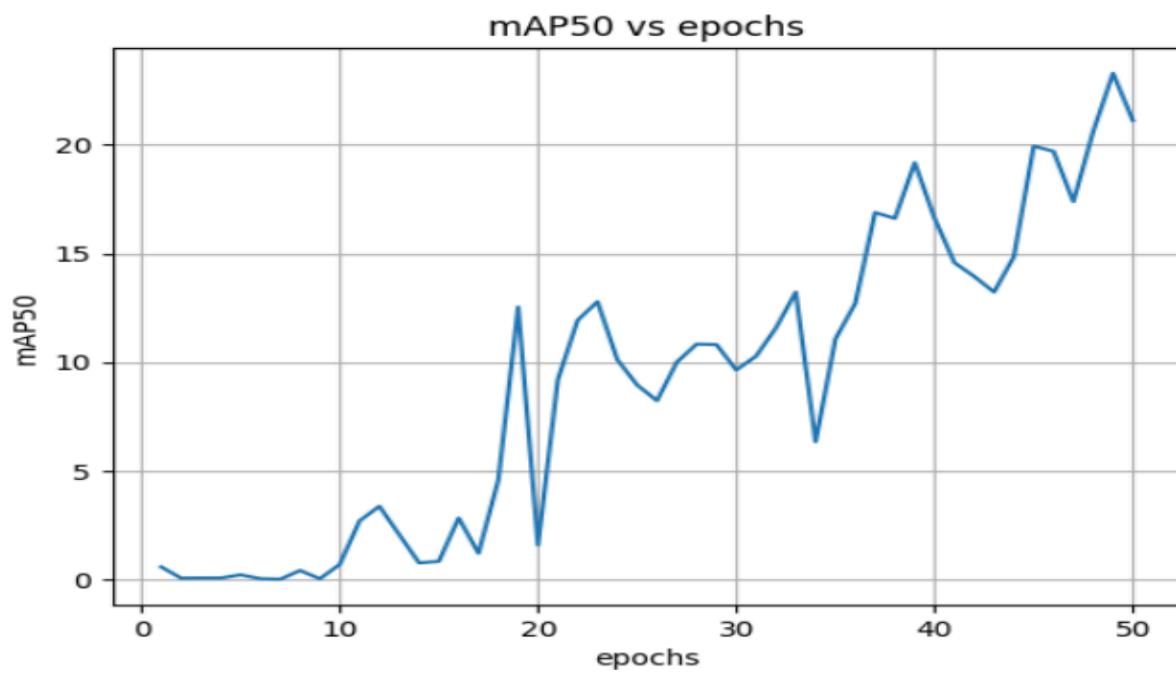
50 epochs completed in 0.268 hours.
Optimizer stripped from runs/detect/train3/weights/last.pt, 6.2MB
Optimizer stripped from runs/detect/train3/weights/best.pt, 6.2MB

Validating runs/detect/train3/weights/best.pt...
Ultralytics YOLOv8.1.7 🦄 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8 summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GFLOPs
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████████] 3/3 [00:04<00:00, 1.58s/it]
          all 80 89 0.283 0.315 0.232 0.0852
Speed: 0.2ms preprocess, 2.8ms inference, 0.0ms loss, 2.8ms postprocess per image
Results saved to runs/detect/train3

```

-
- Map@50 ->23.2%
 - Map@50-95 ->8.52%
 - Epochs ->50
 - Optimizer ->AdamW
 - Momentum ->0.937
 - Batch_Size ->16
 - Learning_Rate ->0.01

Training Performance Analysis:



Model_5

Model 5

```
▶ import os

from ultralytics import YOLO
# Load a model
model = YOLO('yolov8n.yaml') # load pre trained model
# Use the model
results = model.train(data=os.path.join(ROOT_DIR,'data1.yaml'), epochs=50,batch=16,optimizer='AdamW',lr0=0.001,seed=42)

19      -1  1  147712  ultralytics.nn.modules.conv.Conv      [128, 128, 3, 2]
20      [-1, 9]  1      0  ultralytics.nn.modules.conv.Concat  [1]
21      -1  1  493056  ultralytics.nn.modules.block.C2f      [384, 256, 1]
22      [15, 18, 21]  1  751507  ultralytics.nn.modules.head.Detect  [1, [64, 128, 256]]

YOLOv8n summary: 225 layers, 3011043 parameters, 3011027 gradients, 8.2 GFLOPs

TensorBoard: Start with 'tensorboard --logdir runs/detect/train2', view at http://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
AMP: checks passed ✅
train: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/train.cache... 300 images, 8 backgrounds, 0 corrupt: 100%|██████████| 300/300 [00:00<?, ?it/s]
albu augmentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01, clip_limit=(1, 4.0), tile_grid_size=(8, 8))
val: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/val.cache... 80 images, 2 backgrounds, 0 corrupt: 100%|██████████| 80/80 [00:00<?, ?it/s]
Plotting labels to runs/detect/train2/labels.jpg...
optimizer: AdamW(lr=0.001, momentum=0.937) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
TensorBoard: model graph visualization added ✅
Image sizes 640 train, 640 val
```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/50	2.39G	3.2	3.782	4.058	25	640: 100% ██████████ 19/19 [00:24<00:00, 1.27s/it]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% ██████████ 3/3 [00:02<00:00, 1.05it/s]
	all	80	89	0.00229	0.618	0.00189 0.00074
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
2/50	2.24G	3.171	3.547	3.63	26	640: 100% ██████████ 19/19 [00:14<00:00, 1.33it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% ██████████ 3/3 [00:01<00:00, 2.30it/s]
	all	80	89	0.00237	0.64	0.0296 0.00867
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
3/50	2.24G	3.171	3.299	3.498	31	640: 100% ██████████ 19/19 [00:16<00:00, 1.12it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% ██████████ 3/3 [00:01<00:00, 2.85it/s]
	all	80	89	0.00213	0.573	0.00752 0.00178

```

Epoch   GPU_mem   box_loss   cls_loss   dfl_loss   Instances   Size
48/50   2.24G     1.949     1.985     2.526     19          640: 100% [██████████] 19/19 [00:13<00:00,  1.45it/s]
          Class    Images   Instances   Box(P      R      mAP50  mAP50-95): 100% [██████████] 3/3 [00:01<00:00,  2.61it/s]
          all       80        89       0.569     0.449      0.5       0.288

Epoch   GPU_mem   box_loss   cls_loss   dfl_loss   Instances   Size
49/50   2.24G     1.969     1.993     2.508     12          640: 100% [██████████] 19/19 [00:15<00:00,  1.22it/s]
          Class    Images   Instances   Box(P      R      mAP50  mAP50-95): 100% [██████████] 3/3 [00:01<00:00,  1.84it/s]
          all       80        89       0.635     0.461      0.532     0.211

Epoch   GPU_mem   box_loss   cls_loss   dfl_loss   Instances   Size
50/50   2.26G     1.893     1.91      2.455     11          640: 100% [██████████] 19/19 [00:14<00:00,  1.35it/s]
          Class    Images   Instances   Box(P      R      mAP50  mAP50-95): 100% [██████████] 3/3 [00:01<00:00,  2.76it/s]
          all       80        89       0.488     0.596      0.544     0.209

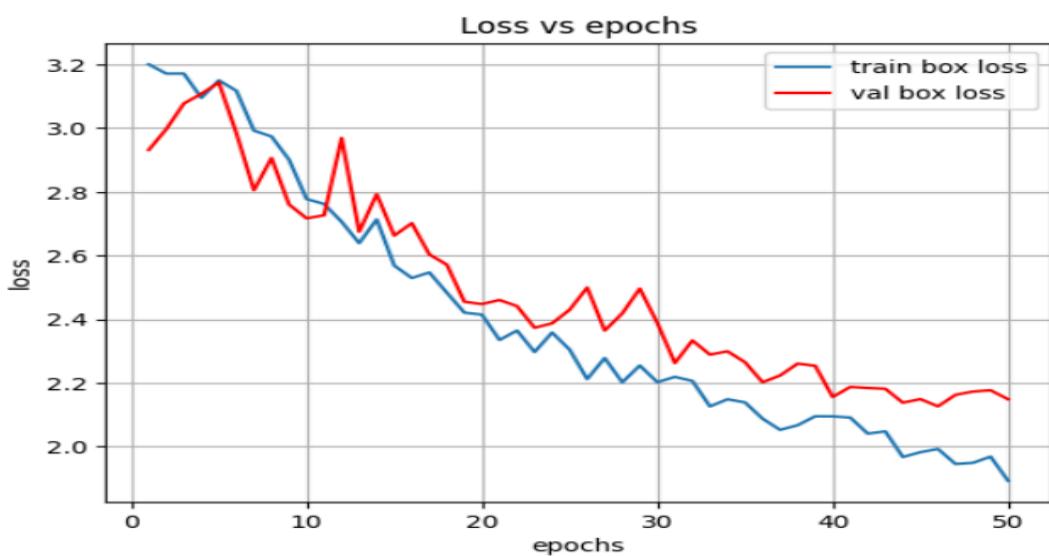
50 epochs completed in 0.265 hours.
Optimizer stripped from runs/detect/train2/weights/last.pt, 6.2MB
Optimizer stripped from runs/detect/train2/weights/best.pt, 6.2MB

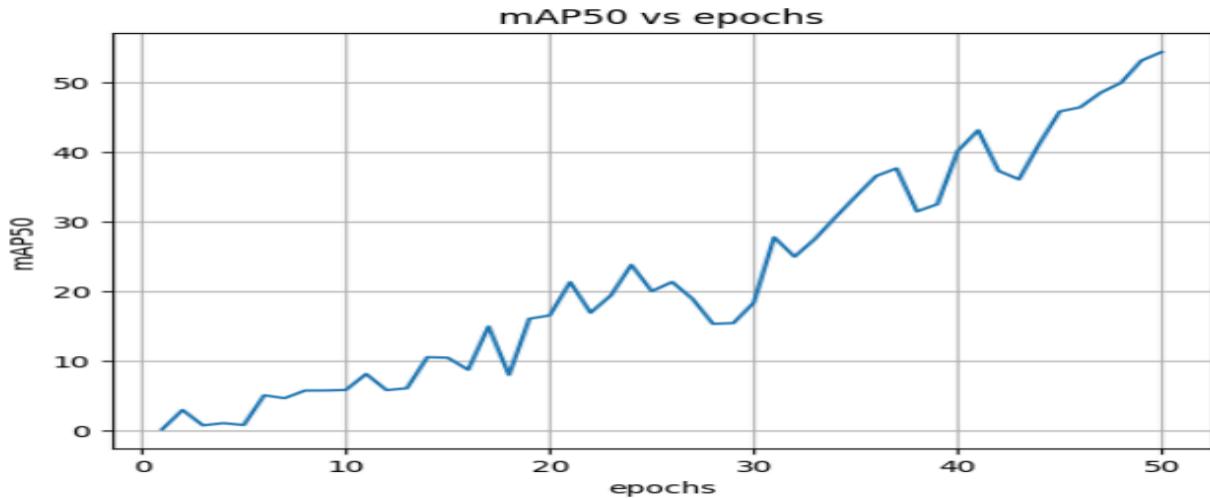
Validating runs/detect/train2/weights/best.pt...
Ultralytics YOLOv8.1.7 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GFLOPS
          Class    Images   Instances   Box(P      R      mAP50  mAP50-95): 100% [██████████] 3/3 [00:04<00:00,  1.47s/it]
          all       80        89       0.636     0.461      0.533     0.212
Speed: 0.2ms preprocess, 2.8ms inference, 0.0ms loss, 2.6ms postprocess per image
Results saved to runs/detect/train2

```

- Map@50 ->53.3%
- Map@50-95 ->21.2%
- Epochs ->50
- Optimizer ->AdamW
- Momentum ->0.937
- Batch_Size ->16
- Learning_Rate ->0.001

Training Performance Analysis:





Model_6(Best)

```

import os

from ultralytics import YOLO
# Load a model
model = YOLO('yolov8n.yaml') # load pre trained model
# Use the model
results = model.train(data=os.path.join(ROOT_DIR, 'data1.yaml'), epochs=110,batch=15)

@
      from n    params  module                                arguments
0     -1  1      464  ultralytics.nn.modules.conv.Conv      [3, 16, 3, 2]
1     -1  1     4672  ultralytics.nn.modules.conv.Conv      [16, 32, 3, 2]
2     -1  1     7360  ultralytics.nn.modules.block.C2f      [32, 32, 1, True]
3     -1  1    18560  ultralytics.nn.modules.conv.Conv      [32, 64, 3, 2]
4     -1  2     49664  ultralytics.nn.modules.block.C2f      [64, 64, 2, True]
5     -1  1     73984  ultralytics.nn.modules.conv.Conv      [64, 128, 3, 2]
6     -1  2    197632  ultralytics.nn.modules.block.C2f      [128, 128, 2, True]
7     -1  1    295424  ultralytics.nn.modules.conv.Conv      [128, 256, 3, 2]
8     -1  1    460288  ultralytics.nn.modules.block.C2f      [256, 256, 1, True]
9     -1  1   164608  ultralytics.nn.modules.block.SPPF      [256, 256, 5]
10    -1  1       0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']

```

```

TensorBoard: Start with 'tensorboard --logdir runs/detect/train5', view at http://localhost:6006
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
AMP: checks passed ✅
train: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/train.cache... 300 images, 8 backgrounds, 0 corrupt: 100%|██████████| 300/300 [00:00<?, ?it/s]
val: Scanning /content/drive/MyDrive/TrainYOLOv8CustomDataset/data/labels/val.cache... 80 images, 2 backgrounds, 0 corrupt: 100%|██████████| 80/80 [00:00<?, ?it/s]
Plotting labels to runs/detect/train5/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best 'optimizer', 'lr0' and 'momentum' automatically...
optimizer: AdamW(lr=0.002, momentum=0.9) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.00046875), 63 bias(decay=0.0)
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train5
Starting training for 110 epochs...

```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/110	2.25G	3.303	3.87	4.245	28	640: 100% [██████] 20/20 [00:18<00:00, 1.08it/s]
Class	Images	Instances	Box(P)	R	mAP50	mAP50-95: 100%
all	80	89	0.00242	0.629	0.00691	0.0024
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
2/110	2.11G	3.181	3.732	4.132	30	640: 100% [██████] 20/20 [00:17<00:00, 1.12it/s]
Class	Images	Instances	Box(P)	R	mAP50	mAP50-95: 100%
all	80	89	0.00234	0.607	0.00571	0.00177
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
3/110	2.11G	3.146	3.619	3.983	29	640: 100% [██████] 20/20 [00:16<00:00, 1.22it/s]
Class	Images	Instances	Box(P)	R	mAP50	mAP50-95: 100%
all	80	89	0.00235	0.618	0.0179	0.00438

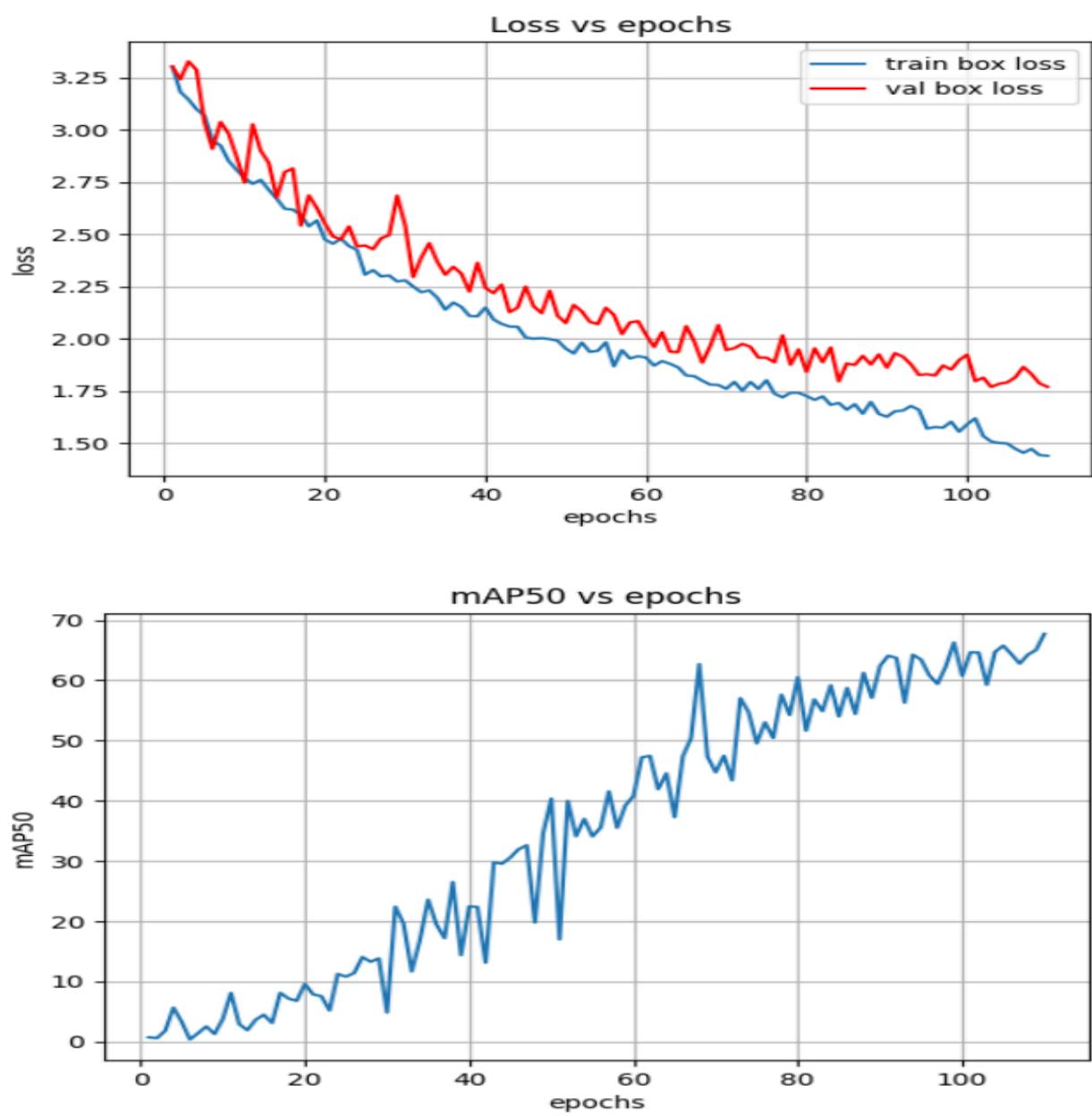
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
107/110	2.12G	1.453	1.378	2.034	15	640: 100% [██████] 20/20 [00:14<00:00, 1.34it/s]
Class	Images	Instances	Box(P)	R	mAP50	mAP50-95: 100%
all	80	89	0.632	0.64	0.628	0.313
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
108/110	2.12G	1.471	1.379	2.056	15	640: 100% [██████] 20/20 [00:17<00:00, 1.17it/s]
Class	Images	Instances	Box(P)	R	mAP50	mAP50-95: 100%
all	80	89	0.702	0.608	0.643	0.328
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
109/110	2.12G	1.442	1.349	2.037	15	640: 100% [██████] 20/20 [00:17<00:00, 1.17it/s]
Class	Images	Instances	Box(P)	R	mAP50	mAP50-95: 100%
all	80	89	0.745	0.618	0.651	0.331
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
110/110	2.12G	1.438	1.374	2.05	15	640: 100% [██████] 20/20 [00:17<00:00, 1.15it/s]
Class	Images	Instances	Box(P)	R	mAP50	mAP50-95: 100%
all	80	89	0.723	0.64	0.677	0.338

110 epochs completed in 0.644 hours.
Optimizer stripped from runs/detect/train5/weights/last.pt, 6.3MB
Optimizer stripped from runs/detect/train5/weights/best.pt, 6.3MB

Validating runs/detect/train5/weights/best.pt...
Ultralytics YOLOv8.0.227 Python-3.10.12 torch-2.1.0+cu118 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GFLOPs
Class Images Instances Box(P) R mAP50 mAP50-95: 100% [██████] 3/3 [00:03<00:00, 1.20s/it]
Speed: 0.2ms preprocess, 3.0ms inference, 0.0ms loss, 2.9ms postprocess per image

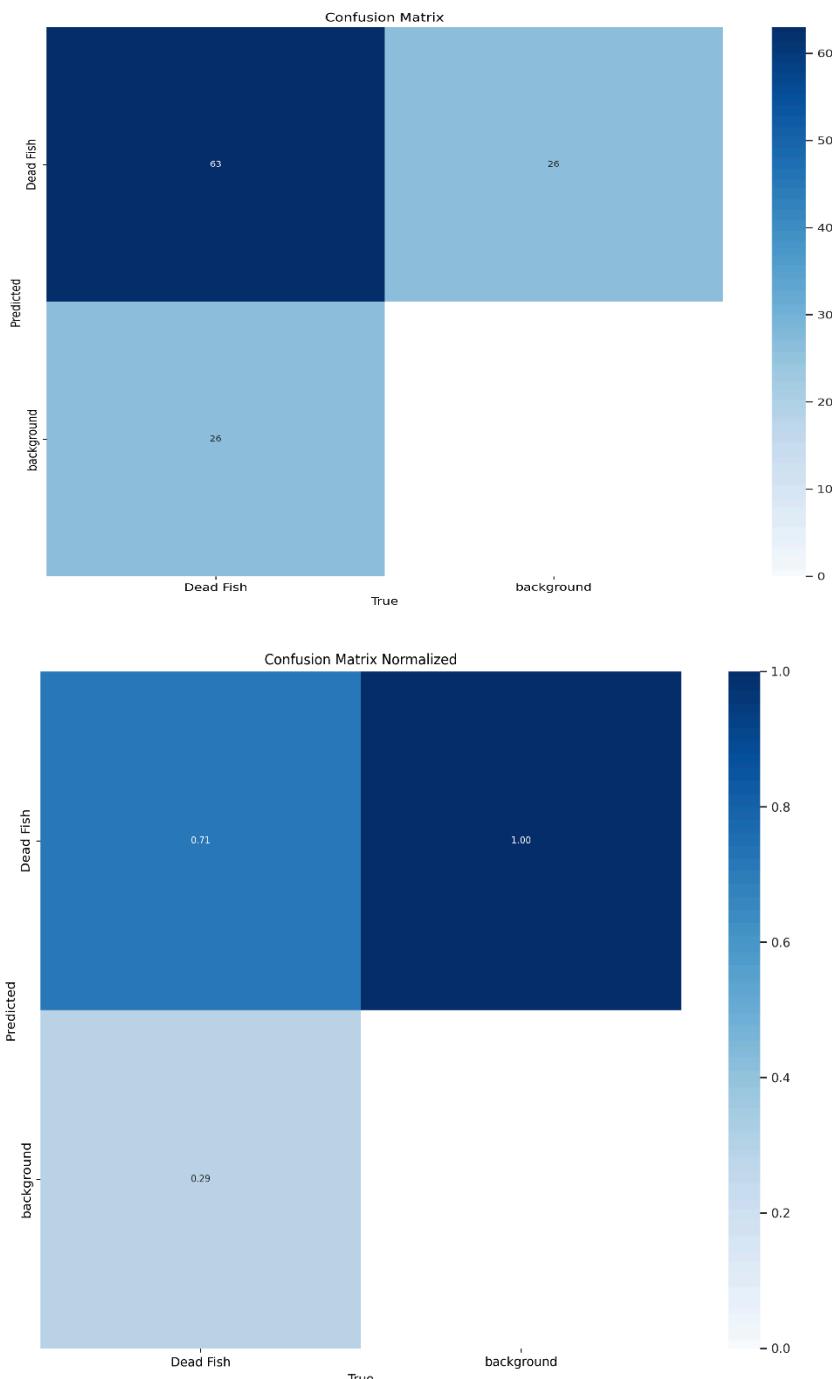
- Map@50 ->67.6%
- Map@50-95 ->33.8%
- Epochs ->110
- Optimizer ->AdamW
- Momentum ->0.9
- Batch_Size ->15
- Learning_Rate ->0.002

Training Performance Analysis:

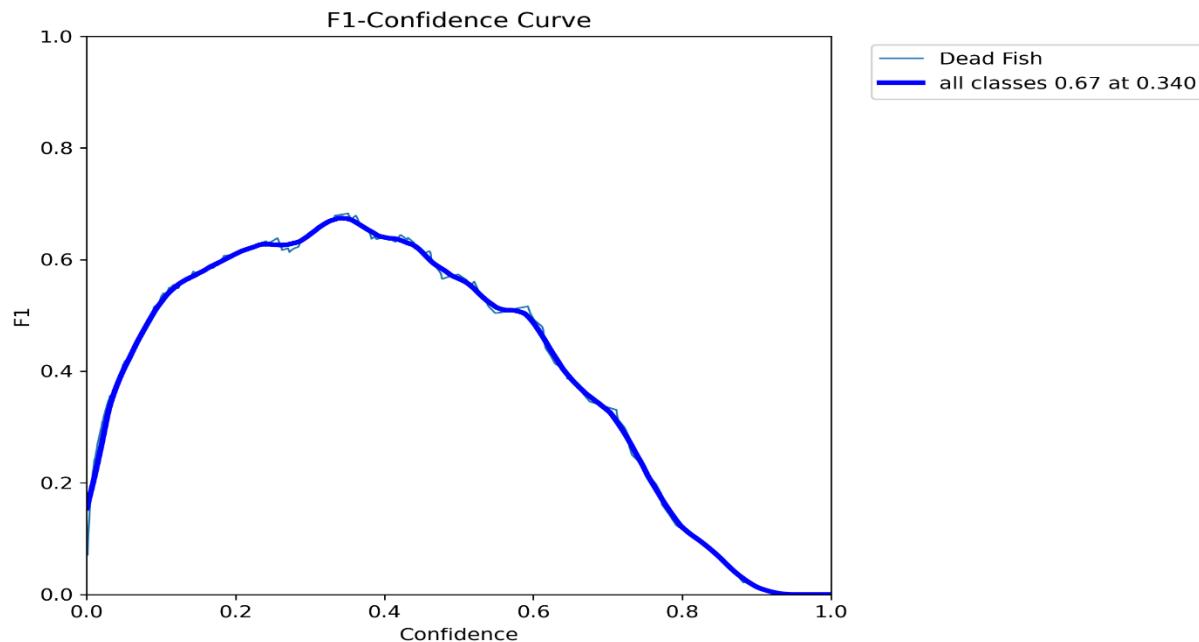


Another Few important Performance Metrics(Best Model):

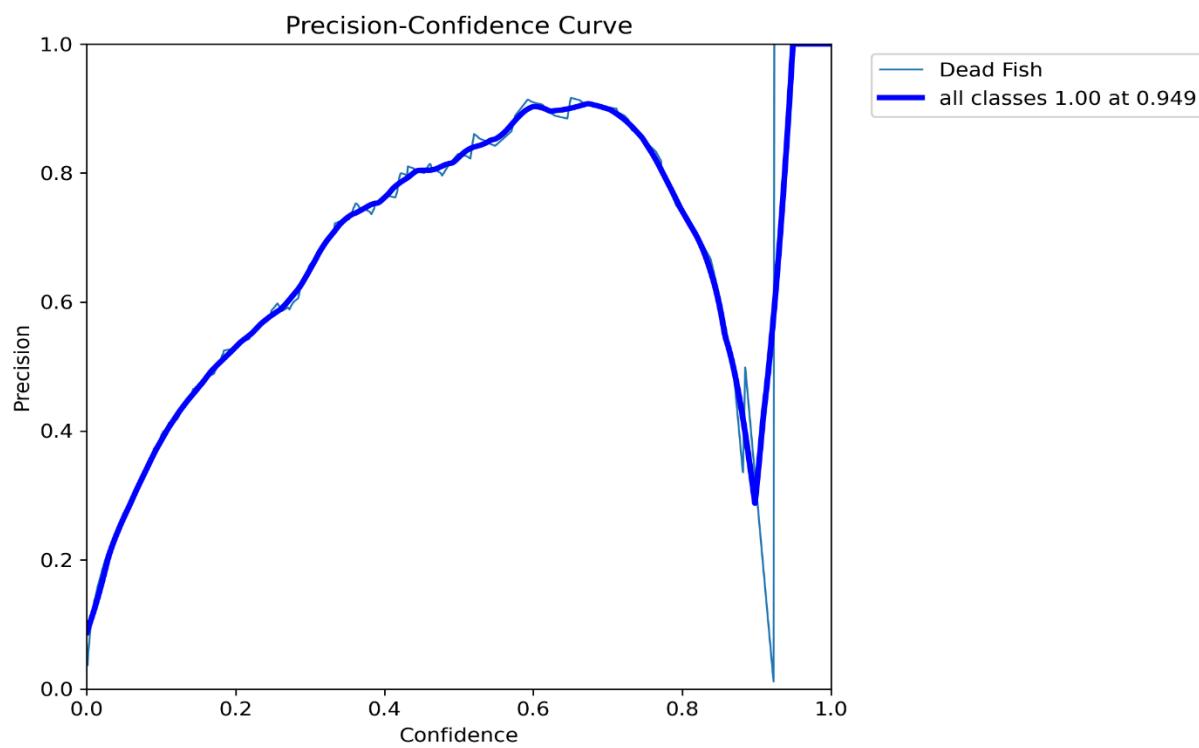
Confusion Matrix:



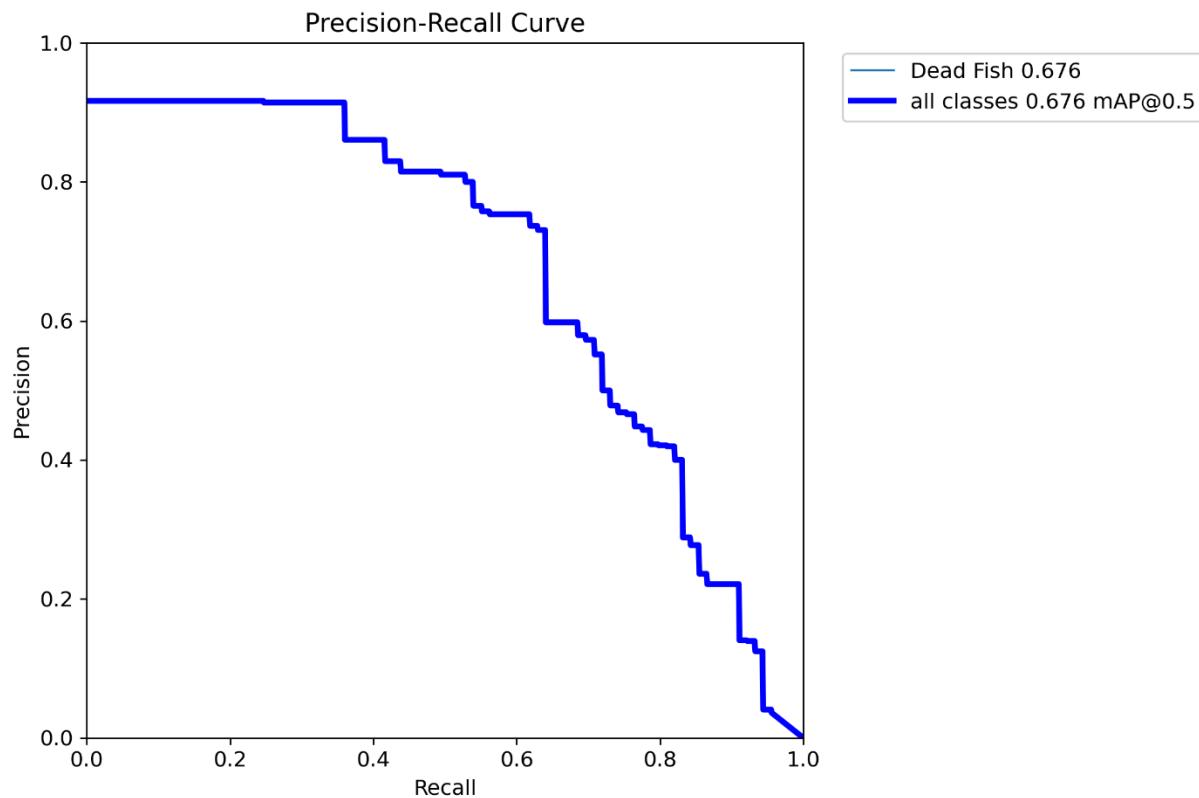
F1_curve:



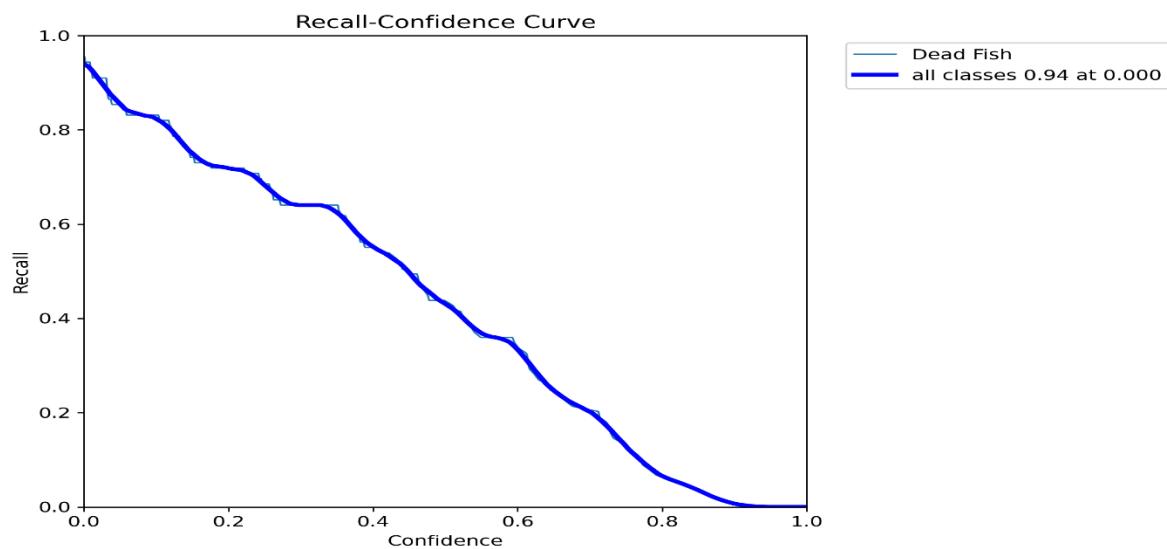
P_curve:

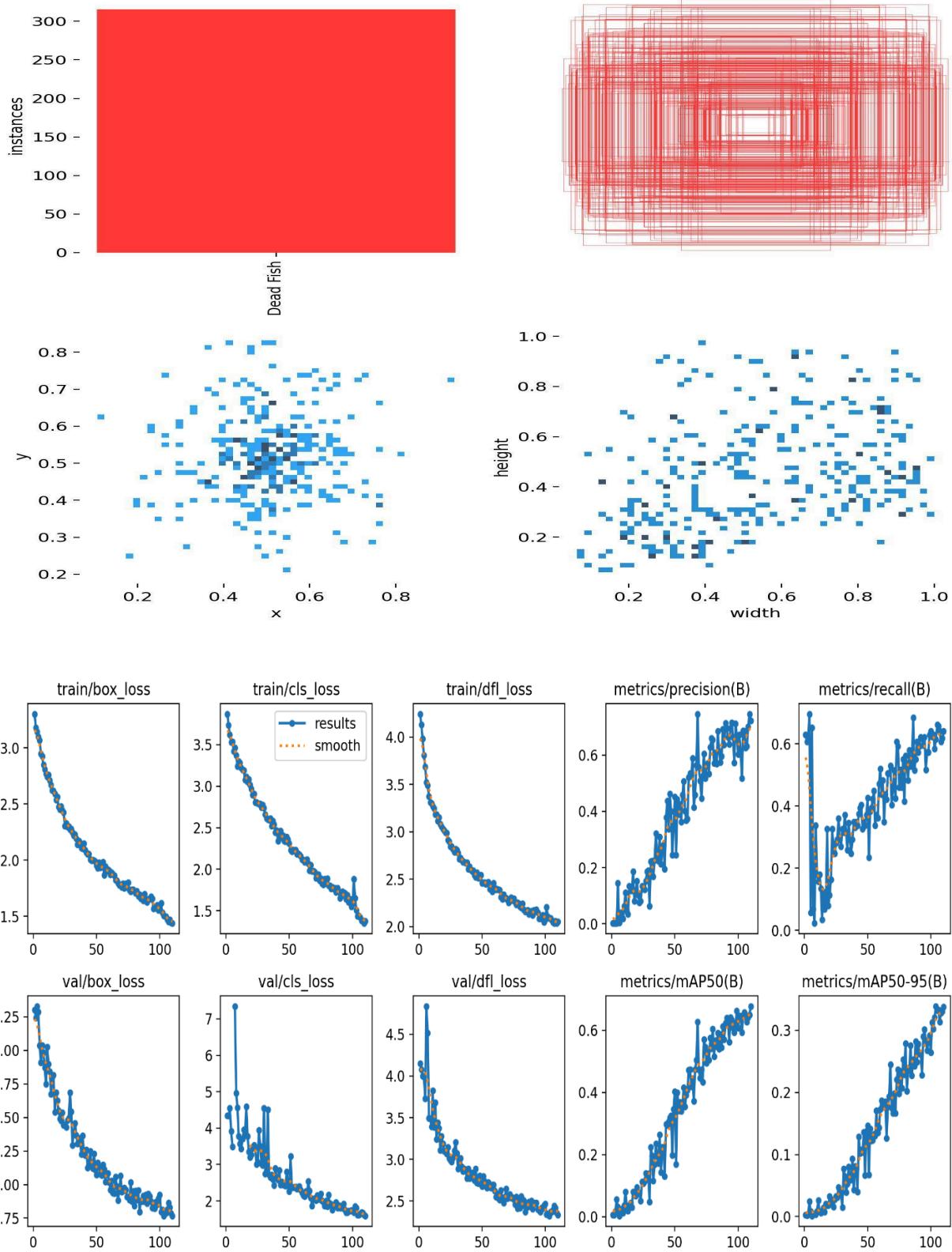


PR_curve:



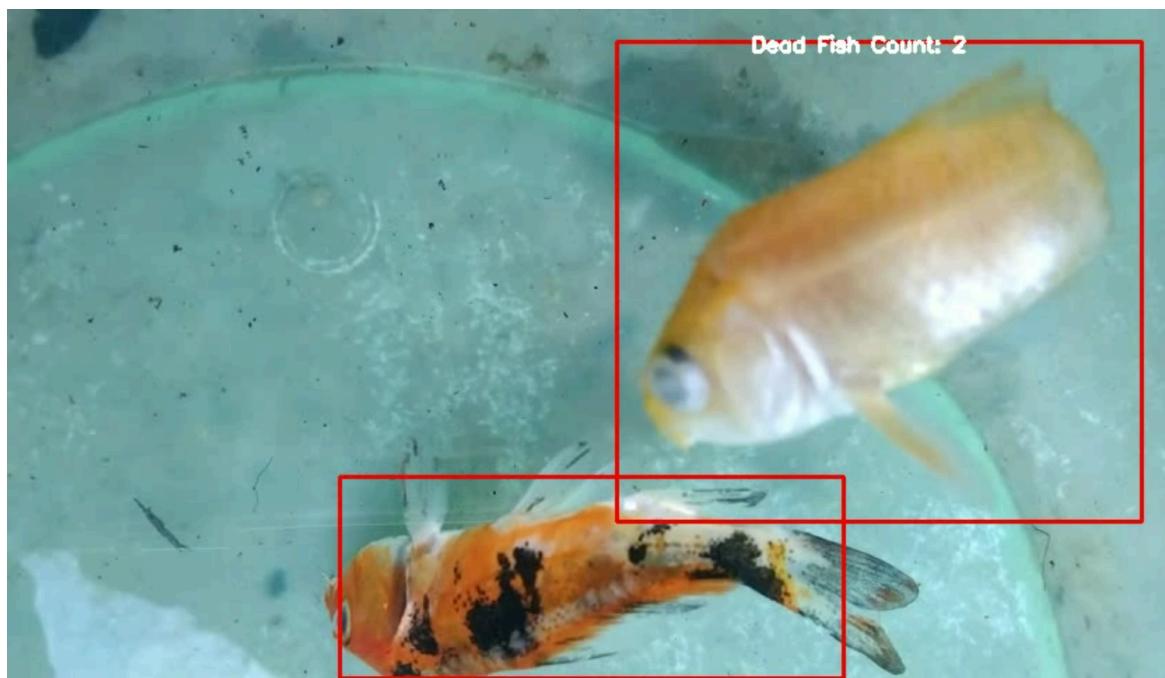
R_curve:





Inferencing...





Function 3 Task-1(Identify The Type of Fish and Count)

We used YOLO to detect fish species, and after fine-tuning parameters, we found the best model. Identifying fish species helps keep the underwater environment healthy and balanced.

Model_1

```
✓  import os

from ultralytics import YOLO

model = YOLO('yolov8n.yaml')

results = model.train(data=os.path.join(ROOT_DIR, 'data_config.yaml'), optimizer='Adam', epochs=50, batch=16, lr0=0.01)

[?] Ultralytics YOLOv8.1.8 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
engine/trainer: task=detect, mode=train, model=yolov8n.yaml, data=/content/drive/MyDrive/TrainYOLOv8/data_config.yaml, epochs=50, time=None, p...
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf'...
100%|██████████| 755k/755k [00:00<00:00, 26.6MB/s]
Overriding model.yaml nc=80 with nc=3
```

```
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01, clip_limit=(1, 4.0), tile_size=16)
val: Scanning /content/drive/MyDrive/TrainYOLOv8/data1/labels/val.cache... 44 images, 0 backgrounds, 0 corrupt: 100%|██████████| 44/44 [00:00<00:00, 1.16it/s]
Plotting labels to runs/detect/train/labels.jpg...
optimizer: Adam(lr=0.01, momentum=0.937) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 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 50 epochs...

Epoch    GPU mem   box loss   cls loss   dfl loss   Instances      Size
1/50     2.36       3.093     3.925     3.996       11          640: 100%|██████████| 19/19 [00:16<00:00,  1.16it/s]
          Class   Images   Instances   Box(P       R           mAP50   mAP50-95): 100%|██████████| 2/2 [00:03<00:00,  1.51s/it]
          all        44        52        0.00175    0.632      0.0153   0.00555

Epoch    GPU mem   box_loss   cls_loss   dfl_loss   Instances      Size
2/50     2.32G      3.265     3.339     3.556       8          640: 100%|██████████| 19/19 [00:07<00:00,  2.60it/s]
          Class   Images   Instances   Box(P       R           mAP50   mAP50-95): 100%|██████████| 2/2 [00:01<00:00,  1.48it/s]
          all        44        52        0.00368    0.827      0.00515  0.00166

Epoch    GPU mem   box_loss   cls_loss   dfl_loss   Instances      Size
3/50     2.29G      3.171     3.301     3.439       7          640: 100%|██████████| 19/19 [00:07<00:00,  2.53it/s]
          Class   Images   Instances   Box(P       R           mAP50   mAP50-95): 100%|██████████| 2/2 [00:00<00:00,  2.60it/s]
          all        44        52        3.01e-05  0.0145     1.6e-05  1.6e-06
```

```
Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.1.8 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3006233 parameters, 0 gradients, 8.1 GFLOPs
          Class   Images   Instances   Box(P       R           mAP50   mAP50-95): 100%|██████████| 2/2 [00:00<00:00,  4.53it/s]
          all        44        52        0.427    0.496      0.541   0.281
          Goldfish   44        10        0.67    0.407      0.713   0.392
          Guppy     44        19        0.318    0.614      0.666   0.332
          Angel     44        23        0.292    0.466      0.304   0.12
Speed: 0.2ms preprocess, 2.4ms inference, 0.0ms loss, 1.5ms postprocess per image
Results saved to runs/detect/train
```

-
- Map@50 ->54.1%
 - Map@50-95 ->28.1%
 - Epochs ->50
 - Optimizer ->Adam
 - Momentum ->0.937
 - Batch_Size ->16
 - Learning_Rate ->0.01

Model_2

```
▶ import os

from ultralytics import YOLO

model = YOLO('yolov8n.yaml')

results = model.train(data=os.path.join(ROOT_DIR,'data_config.yaml'),optimizer='Adam', epochs=100,batch=32,lr0=0.01)
```

```
val: Scanning /content/drive/MyDrive/TrainYOLOv8/data1/labels/val.cache... 44 images, 0 backgrounds, 0 corrupt: 100%|██████████| 44/44 [00:00<
Plotting labels to runs/detect/train2/labels.jpg...
optimizer: Adam(lr=0.01, momentum=0.937) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
TensorBoard: model graph visualization added ✓
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train2
Starting training for 100 epochs...
```

Epoch	GPU mem	box_loss	cls_loss	dfl_loss	Instances	Size
98/100	4.45G	1.304	1.316	1.843	3	640: 100% [██████] 10/10 [00:04<00:00, 2.39it/s] mAP50 mAP50-95): 100% [██████] 1/1 [00:00<00:00, 1.07it/s]
	Class	Images	Instances	Box(P R)		
	all	44	52	0.713	0.714	0.75 0.438
Epoch	GPU mem	box_loss	cls_loss	dfl_loss	Instances	Size
99/100	4.5G	1.291	1.363	1.851	3	640: 100% [██████] 10/10 [00:04<00:00, 2.39it/s] mAP50 mAP50-95): 100% [██████] 1/1 [00:00<00:00, 1.78it/s]
	Class	Images	Instances	Box(P R)		
	all	44	52	0.748	0.705	0.772 0.482
Epoch	GPU mem	box_loss	cls_loss	dfl_loss	Instances	Size
100/100	4.51G	1.352	1.426	1.923	4	640: 100% [██████] 10/10 [00:04<00:00, 2.40it/s] mAP50 mAP50-95): 100% [██████] 1/1 [00:00<00:00, 1.03it/s]
	Class	Images	Instances	Box(P R)		
	all	44	52	0.766	0.704	0.768 0.487

- Map@50 -> 76.8%
 - Map@50-95 -> 48.7%
 - Epochs -> 100
 - Optimizer -> Adam
 - Momentum -> 0.937
 - Batch_Size -> 32
 - Learning Rate -> 0.01

Model_3

Model 3

```
import os

from ultralytics import YOLO

model = YOLO('yolov8n.yaml')

results = model.train(data=os.path.join(ROOT_DIR, 'data_config.yaml'), optimizer='AdamW', epochs=100, batch=32, lr0=0.01)
```

```

val: Scanning /content/drive/MyDrive/TrainYOLOv8/data1/labels/val.cache... 44 images, 0 backgrounds, 0 corrupt: 100%|██████████| 44/44 [00:00<
Plotting labels to runs/detect/train3/labels.jpg...
optimizer: AdamW(lr=0.01, momentum=0.937) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
TensorBoard: model graph visualization added ✅
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train3
Starting training for 100 epochs...

Epoch      GPU mem    box loss    cls loss    dfl loss    Instances    Size
1/100      4.89G      3.123     4.03       4.195      12          640: 100%|██████████| 10/10 [00:07<00:00,  1.36it/s]
Class      Images     Instances   Box(P      R          mAP50      mAP50-95): 100%|██████████| 1/1 [00:01<00:00,  1.49s/it]
all        44          52         0.00149    0.581      0.00477    0.00173

Epoch      GPU mem    box loss    cls loss    dfl loss    Instances    Size
99/100     4.49G      1.295     1.324     1.832       3          640: 100%|██████████| 10/10 [00:04<00:00,  2.27it/s]
Class      Images     Instances   Box(P      R          mAP50      mAP50-95): 100%|██████████| 1/1 [00:00<00:00,  1.33it/s]
all        44          52         0.691      0.689      0.791      0.502

Epoch      GPU mem    box loss    cls loss    dfl loss    Instances    Size
100/100    4.49G      1.446     1.511     1.978       4          640: 100%|██████████| 10/10 [00:03<00:00,  2.62it/s]
Class      Images     Instances   Box(P      R          mAP50      mAP50-95): 100%|██████████| 1/1 [00:00<00:00,  2.03it/s]
all        44          52         0.758      0.65       0.794      0.505

100 epochs completed in 0.220 hours.
Optimizer stripped from runs/detect/train3/weights/last.pt, 6.3MB
Optimizer stripped from runs/detect/train3/weights/best.pt, 6.3MB

Validating runs/detect/train3/weights/best.pt...
Ultralytics YOLOv8.1.8 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3006233 parameters, 0 gradients, 8.1 GFLOPs
Class      Images     Instances   Box(P      R          mAP50      mAP50-95): 100%|██████████| 1/1 [00:00<00:00,  2.87it/s]
all        44          52         0.758      0.65       0.794      0.503
Goldfish   44          10         0.876      0.71       0.917      0.601
Guppy     44          19         0.707      0.763      0.828      0.555
Angel     44          23         0.691      0.478      0.636      0.354

Speed: 0.2ms preprocess, 2.2ms inference, 0.0ms loss, 1.1ms postprocess per image

```

- Map@50 ->79.4%
- Map@50-95 ->50.3%
- Epochs ->100
- Optimizer ->AdamW
- Momentum ->0.937
- Batch_Size ->32
- Learning_Rate ->0.01

Model_4(Best)

▼ Model 4

```
✓ 18m ⏴ import os

from ultralytics import YOLO

model = YOLO('yolov8n.yaml')

results = model.train(data=os.path.join(ROOT_DIR, 'data_config.yaml'), optimizer='AdamW', epochs=150, batch=32, lr0=0.001)

⚡ Ultralytics YOLOv8.1.8 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
engine/trainer: task=detect, mode=train, model=yolov8n.yaml, data=/content/drive/MyDrive/TrainYOLOv8/data_config.yaml, epochs=150, time=None,
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf'...
100%|██████████| 755k/755k [00:00<00:00, 19.6MB/s]
Overriding model.yaml nc=80 with nc=3
```

```
TensorBoard: Start with 'tensorboard --logdir runs/detect/train', view at http://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
Downloading https://github.com/ultralytics/assets/releases/download/v8.1.0/yolov8n.pt to 'yolov8n.pt'...
100%|██████████| 6.23M/6.23M [00:00<00:00, 83.9MB/s]
AMP: checks passed ✅
train: Scanning /content/drive/MyDrive/TrainYOLOv8/data1/labels/train.cache... 291 images, 1 backgrounds, 0 corrupt: 100%|██████████| 291/291

albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01, clip_limit=(1, 4.0)), tilde_val: Scanning /content/drive/MyDrive/TrainYOLOv8/data1/labels/val.cache... 44 images, 0 backgrounds, 0 corrupt: 100%|██████████| 44/44 [00:00<00:00, 1.00MB/s]
Plotting labels to runs/detect/train/labels.jpg...
optimizer: AdamW(lr=0.001, momentum=0.937) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 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 150 epochs...
```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/150	4.476	3.117	4.041	4.226	12	640: 100% ██████████ 10/10 [00:22<00:00, 2.25s/it]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95: 100% ██████████ 1/1 [00:03<00:00, 3.80s/it]
	all	44	52	0.000956	0.335	0.00135 0.000718
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
2/150	4.496	3.181	3.87	3.778	6	640: 100% ██████████ 10/10 [00:05<00:00, 1.99it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95: 100% ██████████ 1/1 [00:00<00:00, 2.36it/s]
	all	44	52	0.00148	0.332	0.00624 0.00236
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
3/150	4.496	3.22	3.501	3.594	7	640: 100% ██████████ 10/10 [00:06<00:00, 1.64it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95: 100% ██████████ 1/1 [00:01<00:00, 1.37s/it]
	all	44	52	0.00343	0.83	0.00972 0.00309

```

 1m 0s
Epoch GPU mem box_loss cls_loss dfl_loss Instances Size
148/150 4.44G 0.882 0.7079 1.45 3 640: 100% [██████] 10/10 [00:04<00:00, 2.46it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████] 1/1 [00:00<00:00, 2.06it/s]
          all 44 52 0.93 0.775 0.893 0.66

Epoch GPU mem box_loss cls_loss dfl_loss Instances Size
149/150 4.41G 0.9382 0.7381 1.515 8 640: 100% [██████] 10/10 [00:04<00:00, 2.26it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████] 1/1 [00:00<00:00, 1.56it/s]
          all 44 52 0.888 0.815 0.903 0.664

Epoch GPU mem box_loss cls_loss dfl_loss Instances Size
150/150 4.44G 0.9183 0.7812 1.443 3 640: 100% [██████] 10/10 [00:04<00:00, 2.43it/s]
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████] 1/1 [00:00<00:00, 2.09it/s]
          all 44 52 0.937 0.77 0.899 0.662

150 epochs completed in 0.297 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 6.3MB
Optimizer stripped from runs/detect/train/weights/best.pt, 6.3MB

Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.1.8 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3006233 parameters, 0 gradients, 8.1 GFLOPs
          Class Images Instances Box(P R mAP50 mAP50-95): 100% [██████] 1/1 [00:00<00:00, 3.06it/s]
          all 44 52 0.955 0.781 0.913 0.684
          Goldfish 44 10 1 0.945 0.995 0.771
          Guppy 44 19 0.929 0.789 0.949 0.762
          Angel 44 23 0.935 0.699 0.794 0.52

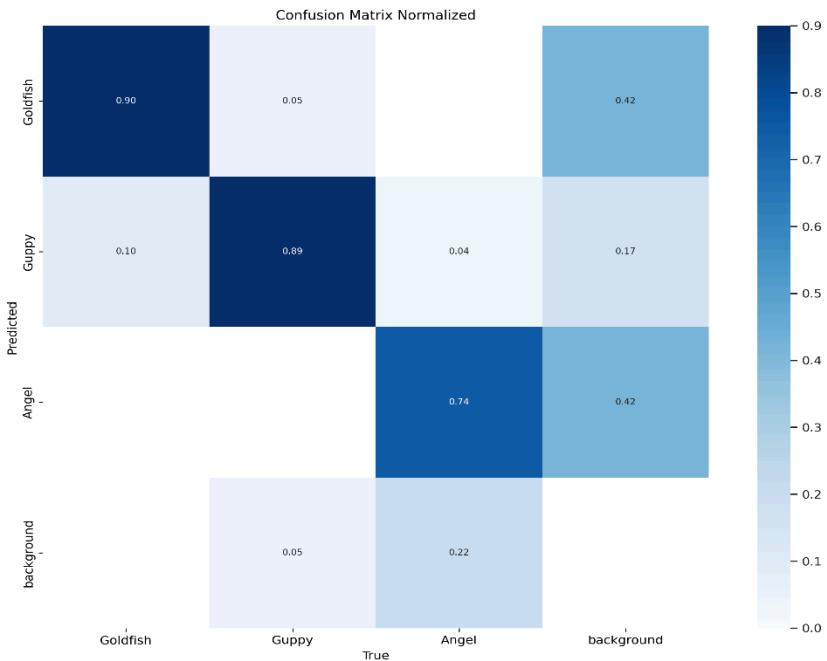
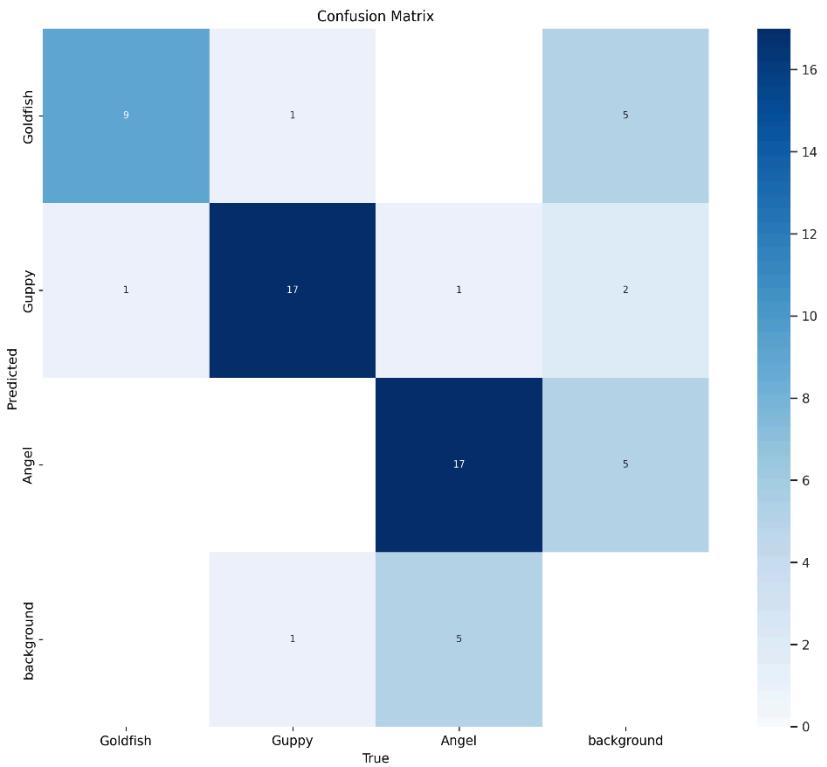
Speed: 0.2ms preprocess, 2.4ms inference, 0.0ms loss, 1.1ms postprocess per image
Results saved to runs/detect/train

```

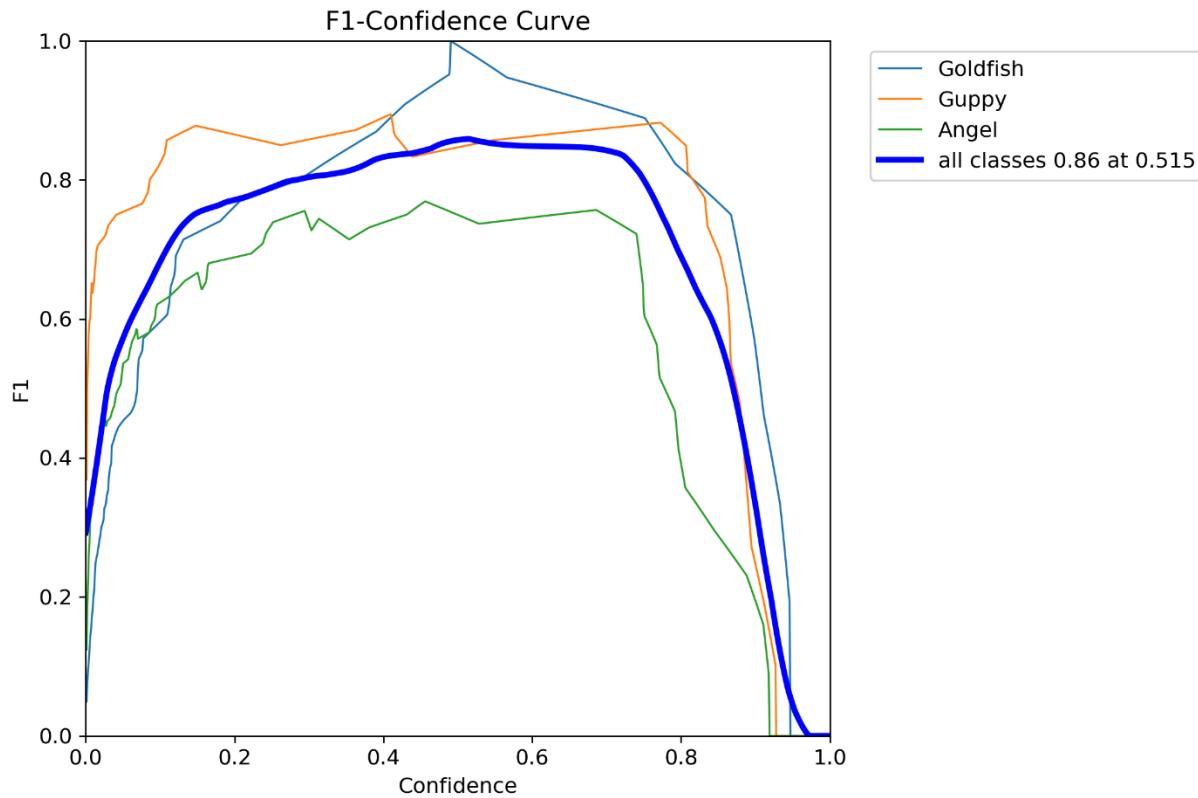
- Map@50 ->91.3%
- Map@50-95 ->68.4%
- Epochs ->150
- Optimizer ->AdamW
- Momentum ->0.937
- Batch_Size ->32
- Learning_Rate ->0.001

Best Model Evaluation

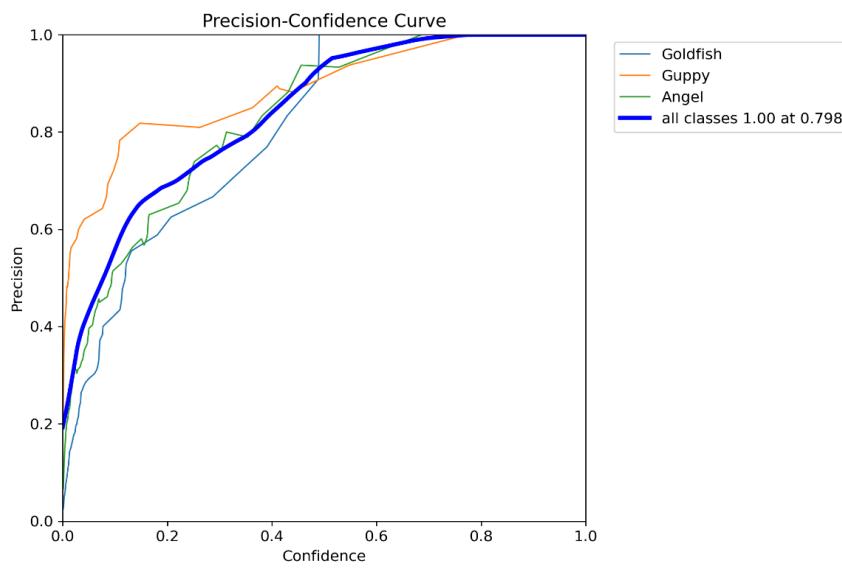
Confusion Matrix:



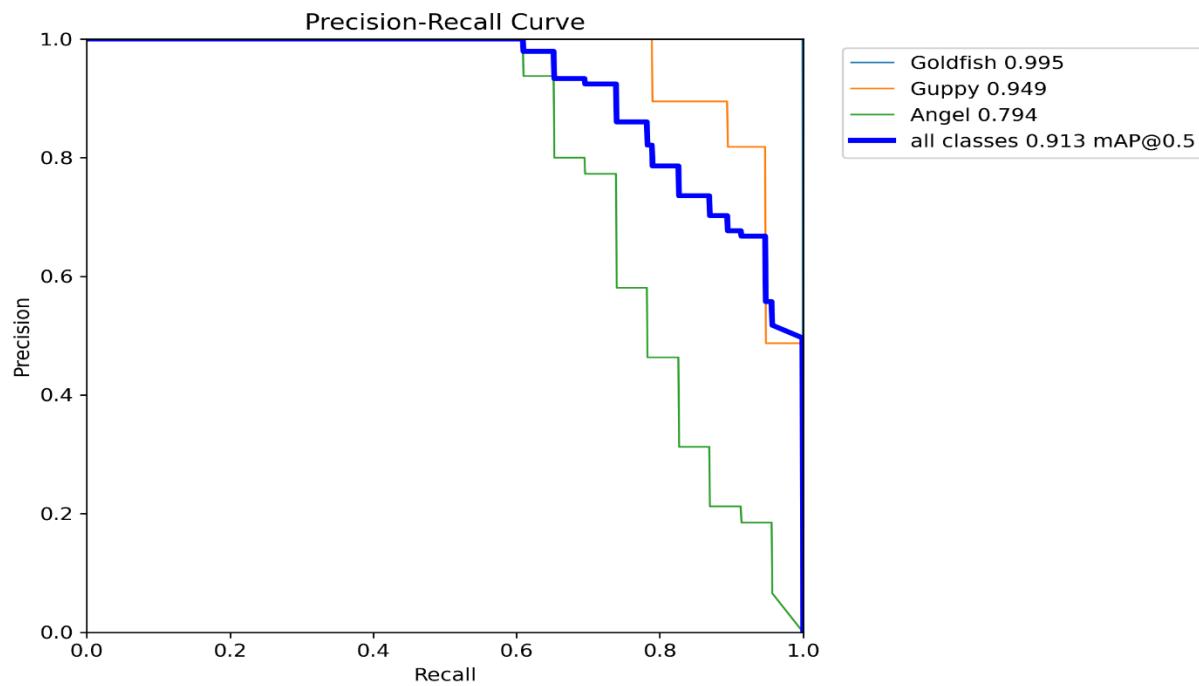
F1_curve:



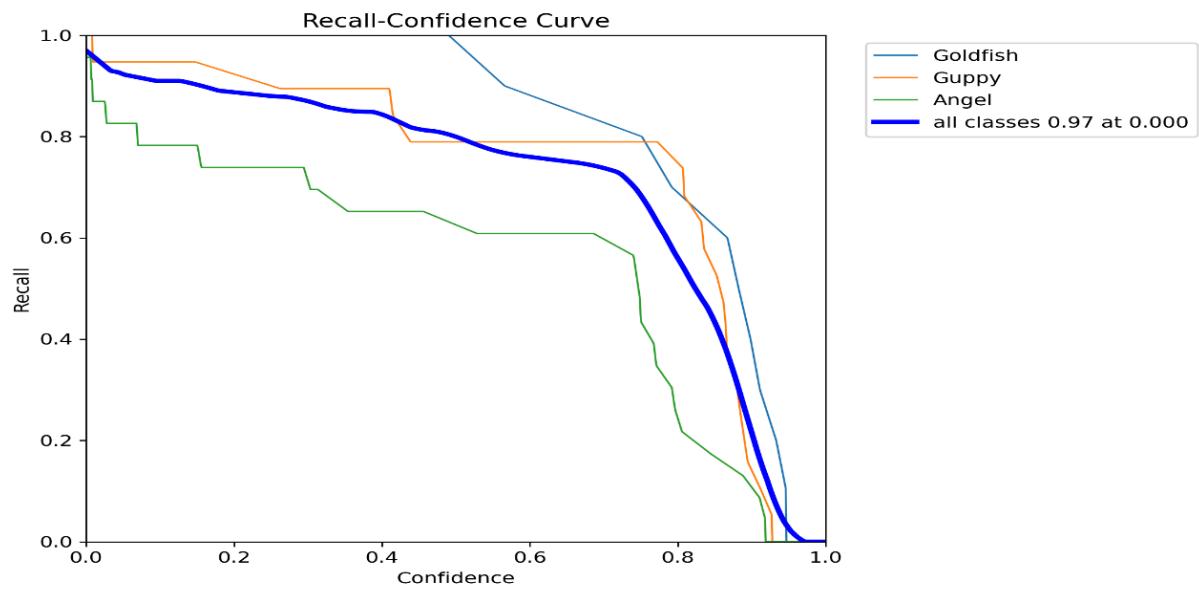
P_curve:

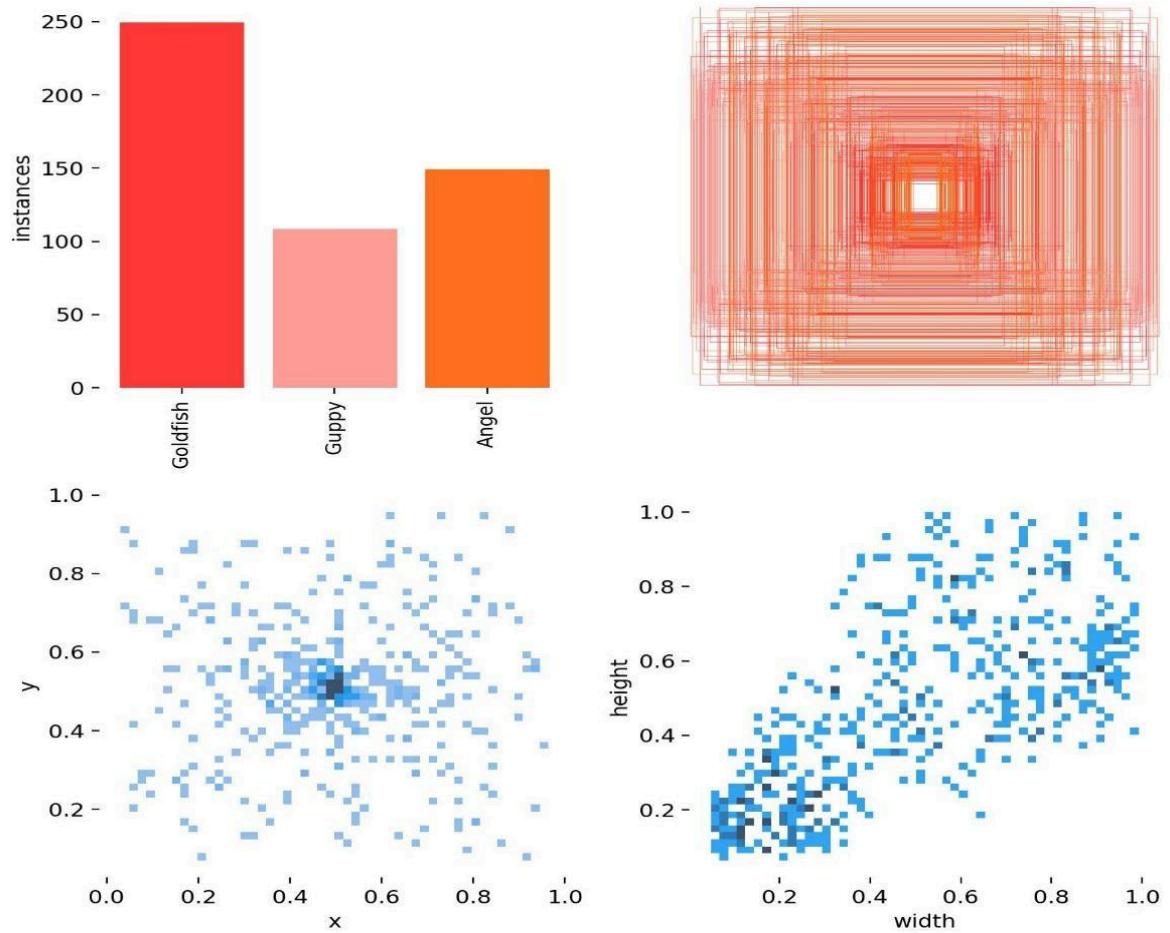


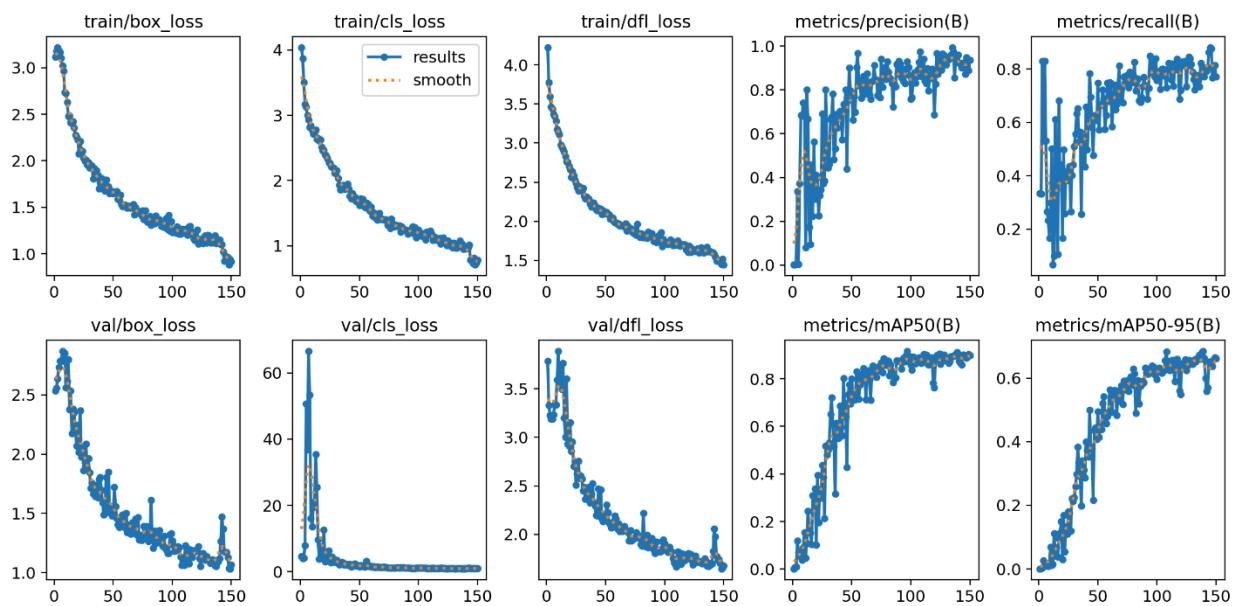
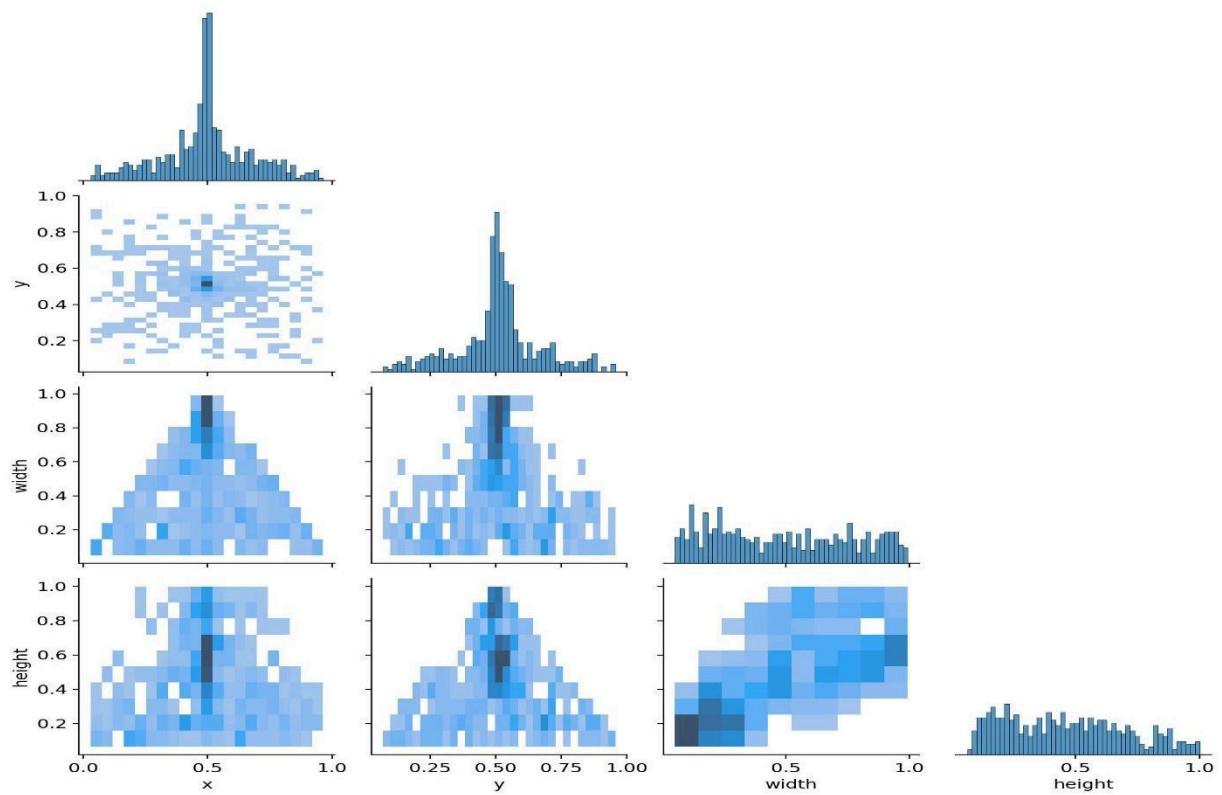
PR_curve:



R_curve:







Inferencing...

