Attempted to push results to github but it resulted in filesize being too big (>100MB). Therefore, will try to save to drive instead, as downloading the file is ineffective. Github Credential Helper is likely redundant.

Idea: zip everything but the weights, as they are the only thing really using storage. The rest can quickly be downloaded and evaluated, independently. Weights also need to be obtained, so drive is still wanted.

```
import os
HOME = '/content'
```

```
from google.colab import drive
DRIVE = HOME+'/drive'
drive.mount(DRIVE)
DRIVE = DRIVE+'/MyDrive'
```

```
Mounted at /content/drive
```

```
drive.mount("/content/drive", force_remount=True)
```

```
Mounted at /content/drive
```

```
!nvidia-smi
```

```
Thu May 30 12:13:11 2024
+---------------------------------------------------------------------------------------+
| NVIDIA-SMI 535.104.05             Driver Version: 535.104.05   CUDA Version: 12.2     |
|-----------------------------------------+----------------------+----------------------+
| GPU  Name                 Persistence-M | Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf          Pwr:Usage/Cap |         Memory-Usage | GPU-Util  Compute M. |
|                                         |                      |               MIG M. |
|=========================================+======================+======================|
|   0  Tesla T4                       Off | 00000000:00:04.0 Off |                    0 |
| N/A   54C    P8              10W /  70W |      0MiB / 15360MiB |      0%      Default |
|                                         |                      |                  N/A |
+-----------------------------------------+----------------------+----------------------+

+---------------------------------------------------------------------------------------+
| Processes:                                                                            |
|  GPU   GI   CI        PID   Type   Process name                            GPU Memory |
|        ID   ID                                                             Usage      |
|=======================================================================================|
|  No running processes found                                                           |
+---------------------------------------------------------------------------------------+
```

Install yolov9 and pretrained weights

```
!git clone https://github.com/Hallvaeb/yolov9-masterthesis.git
```

```
Cloning into 'yolov9-masterthesis'...
remote: Enumerating objects: 163, done.
remote: Counting objects: 100% (163/163), done.
remote: Compressing objects: 100% (117/117), done.
remote: Total 163 (delta 50), reused 148 (delta 39), pack-reused 0
Receiving objects: 100% (163/163), 581.46 KiB | 15.30 MiB/s, done.
Resolving deltas: 100% (50/50), done.
```

```
%cd yolov9-masterthesis
!pip install -r requirements.txt -q
```

```
/content/yolov9-masterthesis
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 207.3/207.3 kB 5.0 MB/s eta 0:00:00
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 62.7/62.7 kB 7.5 MB/s eta 0:00:00
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.6/1.6 MB 17.2 MB/s eta 0:00:00
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 21.3/21.3 MB 72.3 MB/s eta 0:00:00
```

Download and prepare the dataset for training

```
!mkdir -p {HOME}/dataset
```

```
!unzip -n -q {DRIVE}/datasets/football-players-yolo.zip -d {HOME}/dataset
```

```
import os
import random

labels_path = '/content/dataset/football-players-yolo/labels'
output_path = '/content/dataset/football-players-yolo'

# Ratios for splitting the datasets
train_ratio = 1
val_ratio = 0

# test_ratio is implicitly determined

# Get all file names without their extensions
filenames = [os.path.splitext(file)[0] for file in os.listdir(labels_path) if os.path.isfile(os.path.join(labels_path, file)

# Shuffle the list of filenames to ensure random distribution
random.shuffle(filenames)

# Calculate split indices
no_total_files = len(filenames)
train_end = int(no_total_files * train_ratio)
print(train_end)
print(no_total_files)

if(no_total_files == train_end):
  train_end-=1

val_end = train_end + int(no_total_files * val_ratio) +1

# Split the filenames
train_filenames = filenames[:train_end]
val_filenames = filenames[train_end:val_end]
test_filenames = filenames[val_end:]
print(val_filenames)

# Function to write filenames to a file
def write_filenames_to_file(filenames, file_path):
    with open(file_path, 'w') as file:
        for name in filenames:
            file.write(f'./images/{name}.jpg\n')

# Write the splits to their respective files
write_filenames_to_file(train_filenames, os.path.join(output_path, 'train.txt'))
write_filenames_to_file(val_filenames, os.path.join(output_path, 'val.txt'))
write_filenames_to_file(test_filenames, os.path.join(output_path, 'test.txt'))

print("Files have been split and saved successfully.")
```

```
663
663
['538438_1_10_png.rf.394f8e55b797bda34d8c5600bc236474']
Files have been split and saved successfully.
```

Now ensure yolov9-masterthesis/data.yaml is pointing to the right train and val txt files.

Train the model

Prior to running this, /models/detect/yolov9-e.yaml was modified to have nc: 1. This file is responsible for the detector architecture. We freeze the backbone, to shorten training time.

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch -1 \
--epochs 5 \
--img 640 \
--min-items 0 \
--data /content/dataset/football-players-yolo/data.yaml \
--cfg yolov9-e.yaml \
--project . \
--single-cls \
--noval \
--weights /content/weights/yolov9-e.pt \
--freeze 28

# --device cpu \
# --close-mosaic 15 \
```

```
/content
2024-05-29 06:17:54.891639: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
```

```
2024-05-29 06:17:54.891687: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
2024-05-29 06:17:54.893105: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-29 06:17:54.900365: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler
2024-05-29 06:17:56.089820: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/weights/yolov9-e.pt, cfg=yolov9-e.yaml, data=/content/dataset/football-players-yolo/data.
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir .', view at http://localhost:6006/
Downloading https://ultralytics.com/assets/Arial.ttf to /root/.config/Ultralytics/Arial.ttf...
100% 755k/755k [00:00<00:00, 15.1MB/s]

                 from  n    params  module                                       arguments
  0                -1  1         0  models.common.Silence                        []
  1                -1  1      1856  models.common.Conv                           [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                           [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4                   [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                          [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4                   [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                          [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4                   [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                          [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4                   [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                       [64, [64]]
 11                 3  1     49344  models.common.CBLinear                       [256, [64, 128]]
 12                 5  1    229824  models.common.CBLinear                       [512, [64, 128, 256]]
 13                 7  1    984000  models.common.CBLinear                       [1024, [64, 128, 256, 512]]
 14                 9  1   2033600  models.common.CBLinear                       [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                           [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                        [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                           [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                        [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4                   [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                          [256, 256]
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                         [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4                   [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                          [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                         [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4                   [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                          [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                         [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4                   [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                        [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                         [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4                   [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                         [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4                   [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                        [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                         [1]
```

```
results_saved_to = "exp"
!zip -r {DRIVE}/football-5e.zip {HOME}/$results_saved_to
```

```
  adding: content/exp/ (stored 0%)
  adding: content/exp/train_batch0.jpg (deflated 7%)
  adding: content/exp/F1_curve.png (deflated 16%)
  adding: content/exp/labels.jpg (deflated 29%)
  adding: content/exp/weights/ (stored 0%)
  adding: content/exp/weights/last.pt (deflated 8%)
  adding: content/exp/weights/best.pt (deflated 8%)
  adding: content/exp/R_curve.png (deflated 17%)
  adding: content/exp/events.out.tfevents.1716963477.faccc4e149c6.2768.0 (deflated 19%)
  adding: content/exp/confusion_matrix.png (deflated 41%)
  adding: content/exp/labels_correlogram.jpg (deflated 30%)
  adding: content/exp/P_curve.png (deflated 23%)
  adding: content/exp/PR_curve.png (deflated 29%)
  adding: content/exp/hyp.yaml (deflated 43%)
  adding: content/exp/train_batch1.jpg (deflated 16%)
  adding: content/exp/train_batch2.jpg (deflated 11%)
  adding: content/exp/results.csv (deflated 84%)
  adding: content/exp/val_batch0_labels.jpg (deflated 7%)
  adding: content/exp/val_batch0_pred.jpg (deflated 7%)
  adding: content/exp/opt.yaml (deflated 49%)
  adding: content/exp/results.png (deflated 13%)
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 5 \
--img 640 \
--min-items 0 \
--data /content/dataset/football-players-yolo/data.yaml \
--cfg yolov9-e.yaml \
--project . \
--single-cls \
--noval \
--weights /content/exp/weights/best.pt \
--freeze 28

# --weights /content/weights/yolov9-e.pt \
# --device cpu \
# --close-mosaic 15 \
```

```
/content
2024-05-29 06:26:51.313090: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
2024-05-29 06:26:51.313141: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
2024-05-29 06:26:51.314446: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-29 06:26:51.321842: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler
2024-05-29 06:26:52.483608: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/exp/weights/best.pt, cfg=yolov9-e.yaml, data=/content/dataset/football-players-yolo/data.
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir .', view at http://localhost:6006/

                 from  n    params  module                                  arguments
  0                -1  1         0  models.common.Silence                   []
  1                -1  1      1856  models.common.Conv                      [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                     [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                     [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                     [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                  [64, [64]]
 11                 3  1     49344  models.common.CBLinear                  [256, [64, 128]]
 12                 5  1    229824  models.common.CBLinear                  [512, [64, 128, 256]]
 13                 7  1    984000  models.common.CBLinear                  [1024, [64, 128, 256, 512]]
 14                 9  1   2033600  models.common.CBLinear                  [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                      [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                     [256, 256]
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                    [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                     [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                    [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                     [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                    [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                    [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                    [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4              [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                    [1]
 39                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 40                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
```

```
results_saved_to = "exp3"
!zip -r {DRIVE}/football-10e.zip {HOME}/$results_saved_to
```

```
  adding: content/exp3/ (stored 0%)
  adding: content/exp3/train_batch0.jpg (deflated 7%)
  adding: content/exp3/F1_curve.png (deflated 17%)
  adding: content/exp3/labels.jpg (deflated 29%)
  adding: content/exp3/weights/ (stored 0%)
  adding: content/exp3/weights/last.pt (deflated 8%)
  adding: content/exp3/weights/best.pt (deflated 8%)
  adding: content/exp3/R_curve.png (deflated 17%)
```

```
        adding: content/exp3/events.out.tfevents.1716964013.faccc4e149c6.5438.0 (deflated 19%)
        adding: content/exp3/confusion_matrix.png (deflated 41%)
        adding: content/exp3/labels_correlogram.jpg (deflated 30%)
        adding: content/exp3/P_curve.png (deflated 24%)
        adding: content/exp3/PR_curve.png (deflated 30%)
        adding: content/exp3/hyp.yaml (deflated 43%)
        adding: content/exp3/train_batch1.jpg (deflated 16%)
        adding: content/exp3/train_batch2.jpg (deflated 11%)
        adding: content/exp3/results.csv (deflated 83%)
        adding: content/exp3/val_batch0_labels.jpg (deflated 7%)
        adding: content/exp3/val_batch0_pred.jpg (deflated 7%)
        adding: content/exp3/opt.yaml (deflated 49%)
        adding: content/exp3/results.png (deflated 13%)
```

PRW

```
!unzip -n -q {DRIVE}/datasets/PRW-yolo.zip -d {HOME}/dataset
```

```
import os
import random

labels_path = '/content/dataset/PRW-yolo/labels'
output_path = '/content/dataset/PRW-yolo'

# Ratios for splitting the datasets
train_ratio = 1
val_ratio = 0

# test_ratio is implicitly determined

# Get all file names without their extensions
filenames = [os.path.splitext(file)[0] for file in os.listdir(labels_path) if os.path.isfile(os.path.join(labels_path, file)

# Shuffle the list of filenames to ensure random distribution
random.shuffle(filenames)

# Calculate split indices
no_total_files = len(filenames)
train_end = int(no_total_files * train_ratio)
print(train_end)
print(no_total_files)

if(no_total_files == train_end):
  train_end-=1

val_end = train_end + int(no_total_files * val_ratio) +1

# Split the filenames
train_filenames = filenames[:train_end]
val_filenames = filenames[train_end:val_end]
test_filenames = filenames[val_end:]
print(val_filenames)

# Function to write filenames to a file
def write_filenames_to_file(filenames, file_path):
    with open(file_path, 'w') as file:
        for name in filenames:
            file.write(f'./images/{name}.jpg\n')

# Write the splits to their respective files
write_filenames_to_file(train_filenames, os.path.join(output_path, 'train.txt'))
write_filenames_to_file(val_filenames, os.path.join(output_path, 'val.txt'))
write_filenames_to_file(test_filenames, os.path.join(output_path, 'test.txt'))

print("Files have been split and saved successfully.")
```

```
11816
11816
['c3s1_117783']
Files have been split and saved successfully.
```

```
!cp /content/drive/MyDrive/datasets/PRW-5e.pt /content/weights/PRW-5e.pt
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch -1 \
--epochs 5 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data.yaml \
--cfg yolov9-e.yaml \
--project . \
--single-cls \
--noval \
--weights /content/weights/PRW-5e.pt \
--freeze 28

# --device cpu \
# --close-mosaic 15 \
```

```
/content
2024-05-29 06:39:30.465371: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
2024-05-29 06:39:30.465427: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
2024-05-29 06:39:30.466927: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-29 06:39:30.474190: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler
2024-05-29 06:39:31.639946: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/weights/PRW-5e.pt, cfg=yolov9-e.yaml, data=/content/yolov9-masterthesis/data.yaml, hyp=yo
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir .', view at http://localhost:6006/

                 from  n    params  module                                  arguments
  0                -1  1         0  models.common.Silence                   []
  1                -1  1      1856  models.common.Conv                      [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                     [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                     [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                     [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                  [64, [64]]
 11                 3  1     49344  models.common.CBLinear                  [256, [64, 128]]
 12                 5  1    229824  models.common.CBLinear                  [512, [64, 128, 256]]
 13                 7  1    984000  models.common.CBLinear                  [1024, [64, 128, 256, 512]]
 14                 9  1   2033600  models.common.CBLinear                  [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                      [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                     [256, 256]
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                    [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                     [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                    [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                     [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                    [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                    [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                    [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4              [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                    [1]
 39                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 40                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
```

```
results_saved_to = "exp4"
!zip -r {DRIVE}/PRW-5e.zip {HOME}/$results_saved_to
```

```
  adding: content/exp4/ (stored 0%)
  adding: content/exp4/train_batch0.jpg (deflated 7%)
  adding: content/exp4/events.out.tfevents.1716964772.faccc4e149c6.8833.0 (deflated 18%)
  adding: content/exp4/F1_curve.png (deflated 17%)
  adding: content/exp4/labels.jpg (deflated 35%)
  adding: content/exp4/weights/ (stored 0%)
  adding: content/exp4/weights/last.pt (deflated 8%)
  adding: content/exp4/weights/best.pt (deflated 8%)
  adding: content/exp4/R_curve.png (deflated 19%)
```

```
adding: content/exp4/confusion_matrix.png (deflated 43%)
adding: content/exp4/labels_correlogram.jpg (deflated 33%)
adding: content/exp4/P_curve.png (deflated 21%)
adding: content/exp4/PR_curve.png (deflated 29%)
adding: content/exp4/hyp.yaml (deflated 43%)
adding: content/exp4/train_batch1.jpg (deflated 17%)
adding: content/exp4/train_batch2.jpg (deflated 11%)
adding: content/exp4/results.csv (deflated 83%)
adding: content/exp4/val_batch0_labels.jpg (deflated 7%)
adding: content/exp4/val_batch0_pred.jpg (deflated 7%)
adding: content/exp4/opt.yaml (deflated 49%)
adding: content/exp4/results.png (deflated 12%)
```

FIMUS resume training until 50 and 100 epochs

```
!unzip -n -q {DRIVE}/FIMUSDataset/Inconsistent.zip -d {HOME}/dataset
```

```
import os
import random

labels_path = '/content/dataset/Inconsistent/labels'
output_path = '/content/dataset/Inconsistent'

# Ratios for splitting the datasets
train_ratio = 1
val_ratio = 0

# test_ratio is implicitly determined

# Get all file names without their extensions
filenames = [os.path.splitext(file)[0] for file in os.listdir(labels_path) if os.path.isfile(os.path.join(labels_path, file)

# Shuffle the list of filenames to ensure random distribution
random.shuffle(filenames)

# Calculate split indices
no_total_files = len(filenames)
train_end = int(no_total_files * train_ratio)
print(train_end)
print(no_total_files)

if(no_total_files == train_end):
  train_end-=1

val_end = train_end + int(no_total_files * val_ratio) +1

# Split the filenames
train_filenames = filenames[:train_end]
val_filenames = filenames[train_end:val_end]
test_filenames = filenames[val_end:]
print(val_filenames)

# Function to write filenames to a file
def write_filenames_to_file(filenames, file_path):
    with open(file_path, 'w') as file:
        for name in filenames:
            file.write(f'./images/{name}.jpg\n')

# Write the splits to their respective files
write_filenames_to_file(train_filenames, os.path.join(output_path, 'train.txt'))
write_filenames_to_file(val_filenames, os.path.join(output_path, 'val.txt'))
write_filenames_to_file(test_filenames, os.path.join(output_path, 'test.txt'))

print("Files have been split and saved successfully.")
```

```
2637
2637
['120324-164120-right']
Files have been split and saved successfully.
```

```
!cp /content/drive/MyDrive/FIMUSDataset/Inconsistent-50e.pt /content/weights/Inconsistent-50e.pt
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 10 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data.yaml \
--cfg yolov9-e.yaml \
--project /content/80e \
--single-cls \
--noval \
--weights /content/70e/exp/weights/best.pt \
--freeze 28

# --device cpu \
# --close-mosaic 15 \
```

```
/content
2024-05-30 14:26:33.523083: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
2024-05-30 14:26:33.523155: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
2024-05-30 14:26:33.524729: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-30 14:26:33.532259: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 AVX512F FMA, in other operations, rebuild TensorFlow with the appropriate c
2024-05-30 14:26:34.709876: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/70e/exp/weights/best.pt, cfg=yolov9-e.yaml, data=/content/yolov9-masterthesis/data.yaml,
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir /content/80e', view at http://localhost:6006/

                 from  n    params  module                                  arguments
  0                -1  1         0  models.common.Silence                   []
  1                -1  1      1856  models.common.Conv                      [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                     [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                     [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                     [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                  [64, [64]]
 11                 3  1     49344  models.common.CBLinear                  [256, [64, 128]]
 12                 5  1    229824  models.common.CBLinear                  [512, [64, 128, 256]]
 13                 7  1    984000  models.common.CBLinear                  [1024, [64, 128, 256, 512]]
 14                 9  1   2033600  models.common.CBLinear                  [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                      [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                     [256, 256]
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                    [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                     [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                    [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                     [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                    [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                    [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                    [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4              [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                    [1]
 39                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 40                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
```

```
results_saved_to = "80e/exp"
!zip -r {DRIVE}/80e.zip {HOME}/$results_saved_to
```

```
  adding: content/80e/exp/ (stored 0%)
  adding: content/80e/exp/confusion_matrix.png (deflated 43%)
  adding: content/80e/exp/train_batch1.jpg (deflated 25%)
  adding: content/80e/exp/labels_correlogram.jpg (deflated 41%)
  adding: content/80e/exp/R_curve.png (deflated 24%)
  adding: content/80e/exp/PR_curve.png (deflated 29%)
  adding: content/80e/exp/weights/ (stored 0%)
  adding: content/80e/exp/weights/best.pt (deflated 8%)
  adding: content/80e/exp/weights/last.pt (deflated 8%)
```

```
adding: content/80e/exp/val_batch0_pred.jpg (deflated 22%)
adding: content/80e/exp/hyp.yaml (deflated 43%)
adding: content/80e/exp/train_batch0.jpg (deflated 14%)
adding: content/80e/exp/labels.jpg (deflated 33%)
adding: content/80e/exp/P_curve.png (deflated 24%)
adding: content/80e/exp/opt.yaml (deflated 50%)
adding: content/80e/exp/results.csv (deflated 87%)
adding: content/80e/exp/train_batch2.jpg (deflated 21%)
adding: content/80e/exp/F1_curve.png (deflated 20%)
adding: content/80e/exp/val_batch0_labels.jpg (deflated 22%)
adding: content/80e/exp/events.out.tfevents.1717079195.68b1c5c90573.34903.0 (deflated 20%)
adding: content/80e/exp/results.png (deflated 12%)
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 10 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data.yaml \
--cfg yolov9-e.yaml \
--project /content/90e \
--single-cls \
--noval \
--weights /content/80e/exp/weights/best.pt \
--freeze 28

# --device cpu \
# --close-mosaic 15 \
```

```
/content
2024-05-30 15:15:29.183726: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
2024-05-30 15:15:29.183779: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
2024-05-30 15:15:29.185115: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-30 15:15:29.192802: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 AVX512F FMA, in other operations, rebuild TensorFlow with the appropriate c
2024-05-30 15:15:30.448814: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/80e/exp/weights/best.pt, cfg=yolov9-e.yaml, data=/content/yolov9-masterthesis/data.yaml,
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir /content/90e', view at http://localhost:6006/

                 from  n    params  module                                  arguments
  0                -1  1         0  models.common.Silence                   []
  1                -1  1      1856  models.common.Conv                      [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                     [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                     [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                     [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                  [64, [64]]
 11                 3  1     49344  models.common.CBLinear                  [256, [64, 128]]
 12                 5  1    229824  models.common.CBLinear                  [512, [64, 128, 256]]
 13                 7  1    984000  models.common.CBLinear                  [1024, [64, 128, 256, 512]]
 14                 9  1   2033600  models.common.CBLinear                  [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                      [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                     [256, 256]
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                    [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                     [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                    [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                     [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                    [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                    [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                    [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4              [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                    [1]
 39                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 40                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
```

```
results_saved_to = "90e/exp"
!zip -r {DRIVE}/90e.zip {HOME}/$results_saved_to
```

```
  adding: content/90e/exp/ (stored 0%)
  adding: content/90e/exp/confusion_matrix.png (deflated 43%)
  adding: content/90e/exp/train_batch1.jpg (deflated 25%)
  adding: content/90e/exp/labels_correlogram.jpg (deflated 41%)
  adding: content/90e/exp/R_curve.png (deflated 22%)
  adding: content/90e/exp/PR_curve.png (deflated 30%)
  adding: content/90e/exp/weights/ (stored 0%)
  adding: content/90e/exp/weights/best.pt (deflated 8%)
  adding: content/90e/exp/weights/last.pt (deflated 8%)
  adding: content/90e/exp/val_batch0_pred.jpg (deflated 22%)
  adding: content/90e/exp/hyp.yaml (deflated 43%)
  adding: content/90e/exp/events.out.tfevents.1717082131.68b1c5c90573.47525.0 (deflated 20%)
  adding: content/90e/exp/train_batch0.jpg (deflated 14%)
  adding: content/90e/exp/labels.jpg (deflated 33%)
  adding: content/90e/exp/P_curve.png (deflated 22%)
  adding: content/90e/exp/opt.yaml (deflated 50%)
  adding: content/90e/exp/results.csv (deflated 87%)
  adding: content/90e/exp/train_batch2.jpg (deflated 21%)
  adding: content/90e/exp/F1_curve.png (deflated 18%)
  adding: content/90e/exp/val_batch0_labels.jpg (deflated 22%)
  adding: content/90e/exp/results.png (deflated 12%)
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 10 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data.yaml \
--cfg yolov9-e.yaml \
--project /content/100e \
--single-cls \
--noval \
--weights /content/90e/exp/weights/best.pt \
--freeze 28
```

```
10 epochs completed in 0.??? hours.
Optimizer stripped from /content/100e/exp/weights/last.pt, 139.9MB
Optimizer stripped from /content/100e/exp/weights/best.pt, 139.9MB

Validating /content/100e/exp/weights/best.pt...
Fusing layers...
yolov9-e summary: 839 layers, 68547814 parameters, 0 gradients, 240.7 GFLOPs
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 1/1 [00:00<00:00,  4.56
                   all          1          1      0.972          1      0.995      0.895
Results saved to /content/100e/exp
```

```
results_saved_to = "100e/exp"
!zip -r {DRIVE}/100e.zip {HOME}/$results_saved_to
```

```
  adding: content/100e/exp/ (stored 0%)
  adding: content/100e/exp/confusion_matrix.png (deflated 43%)
  adding: content/100e/exp/events.out.tfevents.1717084996.68b1c5c90573.59839.0 (deflated 20%)
  adding: content/100e/exp/train_batch1.jpg (deflated 25%)
  adding: content/100e/exp/labels_correlogram.jpg (deflated 41%)
  adding: content/100e/exp/R_curve.png (deflated 23%)
  adding: content/100e/exp/PR_curve.png (deflated 27%)
  adding: content/100e/exp/weights/ (stored 0%)
  adding: content/100e/exp/weights/best.pt (deflated 8%)
  adding: content/100e/exp/weights/last.pt (deflated 8%)
  adding: content/100e/exp/val_batch0_pred.jpg (deflated 22%)
  adding: content/100e/exp/hyp.yaml (deflated 43%)
  adding: content/100e/exp/train_batch0.jpg (deflated 14%)
  adding: content/100e/exp/labels.jpg (deflated 33%)
  adding: content/100e/exp/P_curve.png (deflated 21%)
  adding: content/100e/exp/opt.yaml (deflated 50%)
  adding: content/100e/exp/results.csv (deflated 87%)
  adding: content/100e/exp/train_batch2.jpg (deflated 21%)
  adding: content/100e/exp/F1_curve.png (deflated 19%)
  adding: content/100e/exp/val_batch0_labels.jpg (deflated 22%)
  adding: content/100e/exp/results.png (deflated 12%)
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 25 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data.yaml \
--cfg yolov9-e.yaml \
--project /content/125e \
--single-cls \
--noval \
--weights /content/100e/exp/weights/best.pt \
--freeze 28
```

```
/content
2024-05-30 16:50:34.260224: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
2024-05-30 16:50:34.260274: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
2024-05-30 16:50:34.261611: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-30 16:50:34.270221: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 AVX512F FMA, in other operations, rebuild TensorFlow with the appropriate c
2024-05-30 16:50:35.554702: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/100e/exp/weights/best.pt, cfg=yolov9-e.yaml, data=/content/yolov9-masterthesis/data.yaml,
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir /content/125e', view at http://localhost:6006/

                 from  n    params  module                                  arguments
  0                -1  1         0  models.common.Silence                   []
  1                -1  1      1856  models.common.Conv                      [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                     [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                     [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                     [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                  [64, [64]]
 11                 3  1     49344  models.common.CBLinear                  [256, [64, 128]]
 12                 5  1    229824  models.common.CBLinear                  [512, [64, 128, 256]]
 13                 7  1    984000  models.common.CBLinear                  [1024, [64, 128, 256, 512]]
 14                 9  1   2033600  models.common.CBLinear                  [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                      [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                     [256, 256]
```

```
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                    [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4               [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                      [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                    [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4               [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                      [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                    [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4               [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                    [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample     [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                     [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4               [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample     [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                     [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4               [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                    [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample     [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                     [1]
 39                -1  1   4005888  models.common.RepNCSPELAN4               [1536, 512, 512, 256, 2]
 40                -1  1         0  torch.nn.modules.upsampling.Upsample     [None, 2, 'nearest']
```

```
results_saved_to = "125e/exp"
!zip -r {DRIVE}/125e.zip {HOME}/$results_saved_to
```

```
  adding: content/125e/exp/ (stored 0%)
  adding: content/125e/exp/confusion_matrix.png (deflated 43%)
  adding: content/125e/exp/train_batch1.jpg (deflated 25%)
  adding: content/125e/exp/labels_correlogram.jpg (deflated 41%)
  adding: content/125e/exp/R_curve.png (deflated 23%)
  adding: content/125e/exp/PR_curve.png (deflated 27%)
  adding: content/125e/exp/weights/ (stored 0%)
  adding: content/125e/exp/weights/best.pt (deflated 8%)
  adding: content/125e/exp/weights/last.pt (deflated 8%)
  adding: content/125e/exp/val_batch0_pred.jpg (deflated 22%)
  adding: content/125e/exp/hyp.yaml (deflated 43%)
  adding: content/125e/exp/events.out.tfevents.1717087836.68b1c5c90573.72056.0 (deflated 21%)
  adding: content/125e/exp/train_batch0.jpg (deflated 14%)
  adding: content/125e/exp/labels.jpg (deflated 33%)
  adding: content/125e/exp/P_curve.png (deflated 22%)
  adding: content/125e/exp/opt.yaml (deflated 50%)
  adding: content/125e/exp/results.csv (deflated 90%)
  adding: content/125e/exp/train_batch2.jpg (deflated 21%)
  adding: content/125e/exp/F1_curve.png (deflated 19%)
  adding: content/125e/exp/val_batch0_labels.jpg (deflated 22%)
  adding: content/125e/exp/results.png (deflated 13%)
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 25 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data.yaml \
--cfg yolov9-e.yaml \
--project /content/150e \
--single-cls \
--noval \
--weights /content/125e/exp/weights/best.pt \
--freeze 28
```

```
/content
2024-05-30 18:48:08.338077: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
2024-05-30 18:48:08.338129: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
2024-05-30 18:48:08.339569: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-30 18:48:08.347273: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 AVX512F FMA, in other operations, rebuild TensorFlow with the appropriate c
2024-05-30 18:48:09.527928: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/125e/exp/weights/best.pt, cfg=yolov9-e.yaml, data=/content/yolov9-masterthesis/data.yaml,
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir /content/150e', view at http://localhost:6006/

                 from  n    params  module                                  arguments
  0                -1  1         0  models.common.Silence                   []
  1                -1  1      1856  models.common.Conv                      [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                     [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                     [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                     [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                  [64, [64]]
```

```
 11                -1  1     49344  models.common.CBLinear                [256, [64, 128]]
 12                -1  1    229824  models.common.CBLinear                [512, [64, 128, 256]]
 13                -1  1    984000  models.common.CBLinear                [1024, [64, 128, 256, 512]]
 14                -1  1   2033600  models.common.CBLinear                [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                    [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                    [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4            [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                   [256, 256]
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                  [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4            [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                   [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                  [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4            [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                   [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                  [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4            [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                 [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample  [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                  [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4            [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample  [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                  [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4            [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                 [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample  [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                  [1]
 39                -1  1   4005888  models.common.RepNCSPELAN4            [1536, 512, 512, 256, 2]
 40                -1  1         0  torch.nn.modules.upsampling.Upsample  [None, 2, 'nearest']
```

```
results_saved_to = "150e/exp"
!zip -r {DRIVE}/150e.zip {HOME}/$results_saved_to
```

```
  adding: content/150e/exp/ (stored 0%)
  adding: content/150e/exp/confusion_matrix.png (deflated 43%)
  adding: content/150e/exp/train_batch1.jpg (deflated 25%)
  adding: content/150e/exp/events.out.tfevents.1717094890.68b1c5c90573.102163.0 (deflated 21%)
  adding: content/150e/exp/labels_correlogram.jpg (deflated 41%)
  adding: content/150e/exp/R_curve.png (deflated 23%)
  adding: content/150e/exp/PR_curve.png (deflated 30%)
  adding: content/150e/exp/weights/ (stored 0%)
  adding: content/150e/exp/weights/best.pt (deflated 8%)
  adding: content/150e/exp/weights/last.pt (deflated 8%)
  adding: content/150e/exp/val_batch0_pred.jpg (deflated 22%)
  adding: content/150e/exp/hyp.yaml (deflated 43%)
  adding: content/150e/exp/train_batch0.jpg (deflated 14%)
  adding: content/150e/exp/labels.jpg (deflated 33%)
  adding: content/150e/exp/P_curve.png (deflated 22%)
  adding: content/150e/exp/opt.yaml (deflated 50%)
  adding: content/150e/exp/results.csv (deflated 90%)
  adding: content/150e/exp/train_batch2.jpg (deflated 21%)
  adding: content/150e/exp/F1_curve.png (deflated 19%)
  adding: content/150e/exp/val_batch0_labels.jpg (deflated 22%)
  adding: content/150e/exp/results.png (deflated 13%)
```

```
!cp /content/drive/MyDrive/FIMUSDataset/Inconsistent-20e.pt /content/weights/Inconsistent-20e.pt
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 10 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data.yaml \
--cfg yolov9-e.yaml \
--project /content/30e \
--single-cls \
--noval \
--weights /content/weights/Inconsistent-20e.pt \
--freeze 28
```

```
/content
2024-05-30 20:45:44.849381: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
2024-05-30 20:45:44.849440: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
2024-05-30 20:45:44.851001: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-30 20:45:44.859048: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 AVX512F FMA, in other operations, rebuild TensorFlow with the appropriate c
2024-05-30 20:45:45.977668: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/weights/Inconsistent-20e.pt, cfg=yolov9-e.yaml, data=/content/yolov9-masterthesis/data.ya
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir /content/30e', view at http://localhost:6006/
```

```
                 from  n    params  module                                  arguments
  0                -1  1         0  models.common.Silence                   []
  1                -1  1      1856  models.common.Conv                      [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                     [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                     [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                     [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                  [64, [64]]
 11                 3  1     49344  models.common.CBLinear                  [256, [64, 128]]
 12                 5  1    229824  models.common.CBLinear                  [512, [64, 128, 256]]
 13                 7  1    984000  models.common.CBLinear                  [1024, [64, 128, 256, 512]]
 14                 9  1   2033600  models.common.CBLinear                  [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                      [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                     [256, 256]
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                    [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                     [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                    [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                     [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                    [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                    [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                    [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4              [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                    [1]
 39                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 40                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 41          [-1, 22]  1         0  models.common.Concat                    [1]
```

```
results_saved_to = "30e/exp"
!zip -r {DRIVE}/30e.zip {HOME}/$results_saved_to
```

```
  adding: content/30e/exp/ (stored 0%)
  adding: content/30e/exp/confusion_matrix.png (deflated 43%)
  adding: content/30e/exp/train_batch1.jpg (deflated 25%)
  adding: content/30e/exp/labels_correlogram.jpg (deflated 41%)
  adding: content/30e/exp/R_curve.png (deflated 23%)
  adding: content/30e/exp/PR_curve.png (deflated 29%)
  adding: content/30e/exp/weights/ (stored 0%)
  adding: content/30e/exp/weights/best.pt (deflated 8%)
  adding: content/30e/exp/weights/last.pt (deflated 8%)
  adding: content/30e/exp/val_batch0_pred.jpg (deflated 22%)
  adding: content/30e/exp/events.out.tfevents.1717101946.68b1c5c90573.132286.0 (deflated 20%)
  adding: content/30e/exp/hyp.yaml (deflated 43%)
  adding: content/30e/exp/train_batch0.jpg (deflated 14%)
  adding: content/30e/exp/labels.jpg (deflated 33%)
  adding: content/30e/exp/P_curve.png (deflated 22%)
  adding: content/30e/exp/opt.yaml (deflated 50%)
  adding: content/30e/exp/results.csv (deflated 87%)
  adding: content/30e/exp/train_batch2.jpg (deflated 21%)
  adding: content/30e/exp/F1_curve.png (deflated 20%)
  adding: content/30e/exp/val_batch0_labels.jpg (deflated 22%)
  adding: content/30e/exp/results.png (deflated 13%)
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 10 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data.yaml \
--cfg yolov9-e.yaml \
--project /content/40e \
--single-cls \
--noval \
--weights /content/30e/exp/weights/best.pt \
--freeze 28
```

```
/content
2024-05-30 21:35:07.957411: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register cuDNN f
2024-05-30 21:35:07.957466: E external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register cuFFT fa
```

```
2024-05-30 21:35:07.958832: E external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to register cuBLAS
2024-05-30 21:35:07.966215: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized t
To enable the following instructions: AVX2 AVX512F FMA, in other operations, rebuild TensorFlow with the appropriate c
2024-05-30 21:35:09.163787: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find Ten
train_dual: weights=/content/30e/exp/weights/best.pt, cfg=yolov9-e.yaml, data=/content/yolov9-masterthesis/data.yaml,
YOLOv5 🚀 v3.0-4-g3c5307c Python-3.10.12 torch-2.3.0+cu121 CUDA:0 (Tesla T4, 15102MiB)

hyperparameters: lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warm
ClearML: run 'pip install clearml' to automatically track, visualize and remotely train YOLO 🚀 in ClearML
Comet: run 'pip install comet_ml' to automatically track and visualize YOLO 🚀 runs in Comet
TensorBoard: Start with 'tensorboard --logdir /content/40e', view at http://localhost:6006/

                 from  n    params  module                                  arguments
  0                -1  1         0  models.common.Silence                   []
  1                -1  1      1856  models.common.Conv                      [3, 64, 3, 2]
  2                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
  3                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
  4                -1  1    164352  models.common.ADown                     [256, 256]
  5                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
  6                -1  1    656384  models.common.ADown                     [512, 512]
  7                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
  8                -1  1   2623488  models.common.ADown                     [1024, 1024]
  9                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 10                 1  1      4160  models.common.CBLinear                  [64, [64]]
 11                 3  1     49344  models.common.CBLinear                  [256, [64, 128]]
 12                 5  1    229824  models.common.CBLinear                  [512, [64, 128, 256]]
 13                 7  1    984000  models.common.CBLinear                  [1024, [64, 128, 256, 512]]
 14                 9  1   2033600  models.common.CBLinear                  [1024, [64, 128, 256, 512, 1024]]
 15                 0  1      1856  models.common.Conv                      [3, 64, 3, 2]
 16[10, 11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[0, 0, 0, 0, 0]]
 17                -1  1     73984  models.common.Conv                      [64, 128, 3, 2]
 18[11, 12, 13, 14, -1]  1         0  models.common.CBFuse                    [[1, 1, 1, 1]]
 19                -1  1    252160  models.common.RepNCSPELAN4              [128, 256, 128, 64, 2]
 20                -1  1    164352  models.common.ADown                     [256, 256]
 21  [12, 13, 14, -1]  1         0  models.common.CBFuse                    [[2, 2, 2]]
 22                -1  1   1004032  models.common.RepNCSPELAN4              [256, 512, 256, 128, 2]
 23                -1  1    656384  models.common.ADown                     [512, 512]
 24      [13, 14, -1]  1         0  models.common.CBFuse                    [[3, 3]]
 25                -1  1   4006912  models.common.RepNCSPELAN4              [512, 1024, 512, 256, 2]
 26                -1  1   2623488  models.common.ADown                     [1024, 1024]
 27          [14, -1]  1         0  models.common.CBFuse                    [[4]]
 28                -1  1   4269056  models.common.RepNCSPELAN4              [1024, 1024, 512, 256, 2]
 29                 9  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 30                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 31           [-1, 7]  1         0  models.common.Concat                    [1]
 32                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 33                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 34           [-1, 5]  1         0  models.common.Concat                    [1]
 35                -1  1   1069056  models.common.RepNCSPELAN4              [1024, 256, 256, 128, 2]
 36                28  1    787968  models.common.SPPELAN                   [1024, 512, 256]
 37                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
 38          [-1, 25]  1         0  models.common.Concat                    [1]
 39                -1  1   4005888  models.common.RepNCSPELAN4              [1536, 512, 512, 256, 2]
 40                -1  1         0  torch.nn.modules.upsampling.Upsample    [None, 2, 'nearest']
```

```
results_saved_to = "40e/exp"
!zip -r {DRIVE}/40e.zip {HOME}/$results_saved_to
```

```
  adding: content/40e/exp/ (stored 0%)
  adding: content/40e/exp/confusion_matrix.png (deflated 43%)
  adding: content/40e/exp/train_batch1.jpg (deflated 25%)
  adding: content/40e/exp/labels_correlogram.jpg (deflated 41%)
  adding: content/40e/exp/R_curve.png (deflated 24%)
  adding: content/40e/exp/PR_curve.png (deflated 29%)
  adding: content/40e/exp/events.out.tfevents.1717104910.68b1c5c90573.145018.0 (deflated 20%)
  adding: content/40e/exp/weights/ (stored 0%)
  adding: content/40e/exp/weights/best.pt (deflated 8%)
  adding: content/40e/exp/weights/last.pt (deflated 8%)
  adding: content/40e/exp/val_batch0_pred.jpg (deflated 22%)
  adding: content/40e/exp/hyp.yaml (deflated 43%)
  adding: content/40e/exp/train_batch0.jpg (deflated 14%)
  adding: content/40e/exp/labels.jpg (deflated 33%)
  adding: content/40e/exp/P_curve.png (deflated 22%)
  adding: content/40e/exp/opt.yaml (deflated 50%)
  adding: content/40e/exp/results.csv (deflated 87%)
  adding: content/40e/exp/train_batch2.jpg (deflated 21%)
  adding: content/40e/exp/F1_curve.png (deflated 19%)
  adding: content/40e/exp/val_batch0_labels.jpg (deflated 22%)
  adding: content/40e/exp/results.png (deflated 13%)
```

FIMUS Consistent-2 training for Consistent-1 Evaluation, more epochs

```
!unzip -n -q {DRIVE}/FIMUSDataset/Consistent-2.zip -d {HOME}/dataset
```

```
import os
import random

labels_path = '/content/dataset/Consistent-2/labels'
output_path = '/content/dataset/Consistent-2'

# Ratios for splitting the datasets
train_ratio = 1
val_ratio = 0

# test_ratio is implicitly determined

# Get all file names without their extensions
filenames = [os.path.splitext(file)[0] for file in os.listdir(labels_path) if os.path.isfile(os.path.join(labels_path, file)

# Shuffle the list of filenames to ensure random distribution
random.shuffle(filenames)

# Calculate split indices
no_total_files = len(filenames)
train_end = int(no_total_files * train_ratio)
print(train_end)
print(no_total_files)

if(no_total_files == train_end):
  train_end-=1

val_end = train_end + int(no_total_files * val_ratio) +1

# Split the filenames
train_filenames = filenames[:train_end]
val_filenames = filenames[train_end:val_end]
test_filenames = filenames[val_end:]
print(val_filenames)

# Function to write filenames to a file
def write_filenames_to_file(filenames, file_path):
    with open(file_path, 'w') as file:
        for name in filenames:
            file.write(f'./images/{name}.jpg\n')

# Write the splits to their respective files
write_filenames_to_file(train_filenames, os.path.join(output_path, 'train.txt'))
write_filenames_to_file(val_filenames, os.path.join(output_path, 'val.txt'))
write_filenames_to_file(test_filenames, os.path.join(output_path, 'test.txt'))

print("Files have been split and saved successfully.")


!cp /content/drive/MyDrive/FIMUSDataset/Consistent-2-20e.pt /content/weights/Consistent-2-20e.pt


%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 30 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data-Consistent-2.yaml \
--cfg yolov9-e.yaml \
--project /content/Consistent-2-50e \
--single-cls \
--noval \
--weights /content/weights/Consistent-2-20e.pt \
--freeze 28


results_saved_to = "Consistent-2-50e/exp"
!zip -r {DRIVE}/Consistent-2-50e.zip {HOME}/$results_saved_to
```

```
%cd {HOME}
```

```
results_saved_to = "Consistent-2-75e/exp"
!zip -r {DRIVE}/Consistent-2-75e.zip {HOME}/$results_saved_to
```

```
--img 640 \
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 25 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data-Consistent-2.yaml \
--cfg yolov9-e.yaml \
--project /content/Consistent-2-100e \
--single-cls \
--noval \
--weights /content/Consistent-2-75e/exp/weights/best.pt \
--freeze 28
```

```
results_saved_to = "Consistent-2-100e/exp"
!zip -r {DRIVE}/Consistent-2-100e.zip {HOME}/$results_saved_to
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 25 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data-Consistent-2.yaml \
--cfg yolov9-e.yaml \
--project /content/Consistent-2-125e \
--single-cls \
--noval \
--weights /content/Consistent-2-100e/exp/weights/best.pt \
--freeze 28
```

```
results_saved_to = "Consistent-2-125e/exp"
!zip -r {DRIVE}/Consistent-2-125e.zip {HOME}/$results_saved_to
```

```
%cd {HOME}
!python yolov9-masterthesis/train_dual.py \
--batch 10 \
--epochs 25 \
--img 640 \
--min-items 0 \
--data /content/yolov9-masterthesis/data-Consistent-2.yaml \
--cfg yolov9-e.yaml \
--project /content/Consistent-2-150e \
--single-cls \
--noval \
--weights /content/Consistent-2-125e/exp/weights/best.pt \
--freeze 28
```

```
results_saved_to = "Consistent-2-150e/exp"
!zip -r {DRIVE}/Consistent-2-150e.zip {HOME}/$results_saved_to
```