

▼ Set Up

```
!nvidia-smi

Thu Feb 1 09:49:00 2024
+-----+
| NVIDIA-SMI 535.104.05      Driver Version: 535.104.05    CUDA Version: 12.2 |
| 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  67C   P8          11W / 70W |    0MiB / 15360MiB |     0%      Default |
|          |             |             |                |          | N/A |
+-----+
+-----+
| Processes:
| GPU  GI CI      PID  Type  Process name          GPU Memory |
| ID   ID          ID   ID               Usage
+-----+
| No running processes found
+-----+
```

```
import os
HOME = os.getcwd()
print(HOME)

/content
```

▼ Installing YOLOv8

```
!pip install ultralytics==8.0.196

from IPython import display
display.clear_output()

import ultralytics
ultralytics.checks()

Ultralytics YOLOv8.0.196 ✅ Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
Setup complete ✅ (2 CPUs, 12.7 GB RAM, 26.3/78.2 GB disk)

from ultralytics import YOLO

from IPython.display import display, Image
```

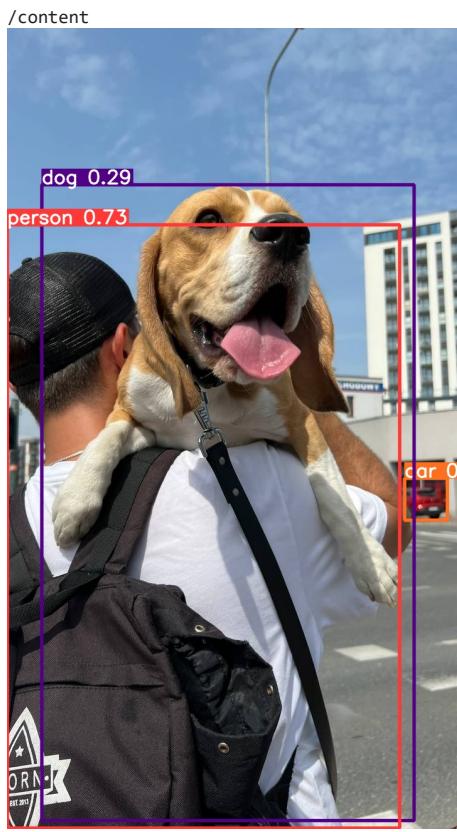
▼ Checking if everything is correct with pre-trained model

```
%cd {HOME}
!yolo task=detect mode=predict model=yolov8n.pt conf=0.25 source='https://media.roboflow.com/notebooks/examples/dog.jpeg' save=True

/content
Downloading https://github.com/ultralytics/assets/releases/download/v0.0.0/yolov8n.pt to 'yolov8n.pt'...
100% 6.23M/6.23M [00:00<00:00, 300MB/s]
Ultralytics YOLOv8.0.196 ✅ Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
YOLOv8n summary (fused): 168 layers, 3151904 parameters, 0 gradients, 8.7 GFLOPs

Downloading https://media.roboflow.com/notebooks/examples/dog.jpeg to 'dog.jpeg'...
100% 104k/104k [00:00<00:00, 102MB/s]
WARNING ⚠️ NMS time limit 0.550s exceeded
image 1/1 /content/dog.jpeg: 640x384 1 person, 1 car, 1 dog, 114.7ms
Speed: 15.9ms preprocess, 114.7ms inference, 703.6ms postprocess per image at shape (1, 3, 640, 384)
Results saved to runs/detect/predict
💡 Learn more at https://docs.ultralytics.com/modes/predict
```

```
%cd {HOME}  
Image(filename='runs/detect/predict/dog.jpeg', height=600)
```



▼ Downloading the dataset from Roboflow

```
!mkdir {HOME}/datasets  
%cd {HOME}/datasets  
  
!pip install roboflow  
  
from roboflow import Roboflow  
rf = Roboflow(api_key="r6085u5oVC5CYpNFCk77")  
project = rf.workspace("tracking-tg3ig").project("football-players-detection-gzhxj")  
dataset = project.version(1).download("yolov8")
```

```
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-packages (from r
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from r
Collecting supervision (from roboflow)
  Downloading supervision-0.18.0-py3-none-any.whl (86 kB)
                                             86.7/86.7 kB 12.8 MB/s eta 0:00:00
Requirement already satisfied: urllib3>=1.26.6 in /usr/local/lib/python3.10/dist-packages (from r
Requirement already satisfied: tqdm>=4.41.0 in /usr/local/lib/python3.10/dist-packages (from r
Requirement already satisfied: PyYAML>=5.3.1 in /usr/local/lib/python3.10/dist-packages (from r
Collecting requests-toolbelt (from roboflow)
  Downloading requests_toolbelt-1.0.0-py2.py3-none-any.whl (54 kB)
                                             54.5/54.5 kB 8.2 MB/s eta 0:00:00
Collecting python-magic (from roboflow)
  Downloading python_magic-0.4.27-py2.py3-none-any.whl (13 kB)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from r
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from r
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from r
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from r
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/
Requirement already satisfied: defusedxml<0.8.0,>=0.7.1 in /usr/local/lib/python3.10/
Requirement already satisfied: scipy<2.0.0,>=1.10.0 in /usr/local/lib/python3.10/dist-
Installing collected packages: python-magic, python-dotenv, opencv-python-headless, i
Attempting uninstall: opencv-python-headless
  Found existing installation: opencv-python-headless 4.9.0.80
  Uninstalling opencv-python-headless-4.9.0.80:
    Successfully uninstalled opencv-python-headless-4.9.0.80
Attempting uninstall: idna
  Found existing installation: idna 3.6
  Uninstalling idna-3.6:
    Successfully uninstalled idna-3.6
Attempting uninstall: cycler
  Found existing installation: cycler 0.12.1
  Uninstalling cycler-0.12.1:
    Successfully uninstalled cycler-0.12.1
Attempting uninstall: chardet
  Found existing installation: chardet 5.2.0
  Uninstalling chardet-5.2.0:
    Successfully uninstalled chardet-5.2.0
Attempting uninstall: certifi
  Found existing installation: certifi 2023.11.17
  Uninstalling certifi-2023.11.17:
    Successfully uninstalled certifi-2023.11.17
ERROR: pip's dependency resolver does not currently take into account all the package
lida 0.0.10 requires fastapi, which is not installed.
lida 0.0.10 requires kaleido, which is not installed.
lida 0.0.10 requires python-multipart, which is not installed.
lida 0.0.10 requires uvicorn, which is not installed.
Successfully installed certifi-2023.7.22 chardet-4.0.0 cycler-0.10.0 idna-2.10 opencv
WARNING: The following packages were previously imported in this runtime:
[certifi,chardet,cv2,cycler,idna]
You must restart the runtime in order to use newly installed versions.
```

[RESTART SESSION](#)

```
loading Roboflow workspace...
loading Roboflow project...
Downloading Dataset Version Zip in football-players-detection-1 to yolov8:: 100%|██████████|
```

Model Training

```
%cd {HOME}
```

```
!yolo task=detect mode=train model=yolov8s.pt data={dataset.location}/data.yaml epochs=25 imgsz=800 plots=True
    class      images  instances      box(r)      r      mAP@0   mAP@0.5-0.95: 100% 5/5 [00:00<00:00,  1.28it/s]
    all       136     1923      0.944      0.94      0.974      0.555
Closing dataloader mosaic
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,
```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
16/25	6.57G	1.359	0.6974	1.047	328	800: 100% 94/94 [01:06<00:00, 1.42it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:02<00:00, 1.85it/s]
	all	136	1923	0.951	0.936	0.971 0.56
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
17/25	6.33G	1.328	0.6813	1.038	274	800: 100% 94/94 [00:58<00:00, 1.61it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:02<00:00, 1.76it/s]
	all	136	1923	0.958	0.939	0.979 0.571
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
18/25	6.58G	1.291	0.6524	1.022	334	800: 100% 94/94 [00:59<00:00, 1.58it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:03<00:00, 1.51it/s]
	all	136	1923	0.959	0.947	0.98 0.588
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
19/25	6.58G	1.268	0.6344	1.015	272	800: 100% 94/94 [00:58<00:00, 1.62it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:03<00:00, 1.36it/s]
	all	136	1923	0.951	0.962	0.98 0.597
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
20/25	6.59G	1.232	0.6168	1.006	319	800: 100% 94/94 [00:58<00:00, 1.61it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:02<00:00, 1.73it/s]
	all	136	1923	0.95	0.963	0.981 0.611
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
21/25	6.47G	1.197	0.5953	0.9932	277	800: 100% 94/94 [00:58<00:00, 1.61it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:02<00:00, 1.91it/s]
	all	136	1923	0.962	0.962	0.982 0.621
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
22/25	6.55G	1.171	0.5796	0.9837	287	800: 100% 94/94 [01:00<00:00, 1.56it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:02<00:00, 1.69it/s]
	all	136	1923	0.966	0.967	0.986 0.631
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
23/25	6.6G	1.144	0.564	0.9762	241	800: 100% 94/94 [00:57<00:00, 1.63it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:03<00:00, 1.40it/s]
	all	136	1923	0.971	0.973	0.987 0.646
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
24/25	6.57G	1.112	0.5485	0.9687	254	800: 100% 94/94 [00:59<00:00, 1.59it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:03<00:00, 1.31it/s]
	all	136	1923	0.978	0.969	0.988 0.658
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
25/25	6.32G	1.097	0.5383	0.9605	253	800: 100% 94/94 [00:55<00:00, 1.68it/s]
	Class	Images	Instances	Box(P)	R	mAP50 mAP50-95): 100% 5/5 [00:02<00:00, 1.93it/s]
	all	136	1923	0.979	0.971	0.987 0.662

25 epochs completed in 0.467 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 22.5MB
Optimizer stripped from runs/detect/train/weights/best.pt, 22.5MB

Checking Results

```
!ls {HOME}/runs/detect/train/
```

args.yaml	R_curve.png	val_batch0_labels.jpg
confusion_matrix_normalized.png	results.csv	val_batch0_pred.jpg
confusion_matrix.png	results.png	val_batch1_labels.jpg
events.out.tfevents.1706782081.143e2acb1b12.4962.0	train_batch0.jpg	val_batch1_pred.jpg

01.02.2024, 17:11

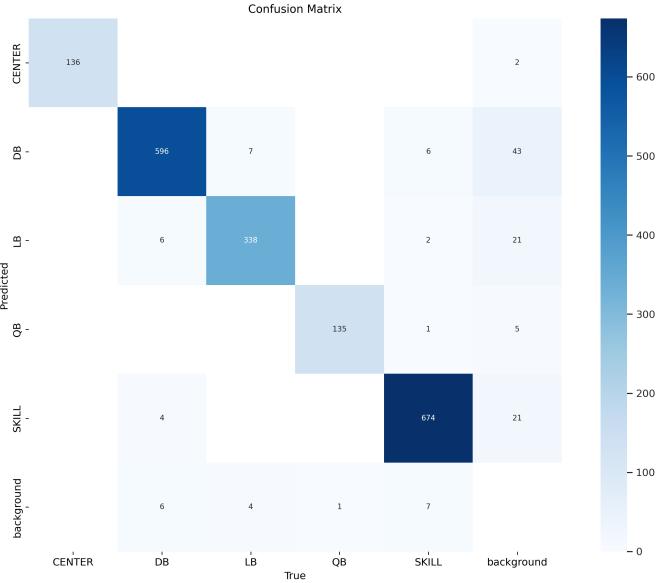
Assignment 5.ipynb - Colaboratory

F1_curve.png
labels_correlogram.jpg
labels.jpg
P_curve.png
PR_curve.png

train_batch1410.jpg val_batch2_labels.jpg
train_batch1411.jpg val_batch2_pred.jpg
train_batch1412.jpg weights
train_batch1.jpg
train_batch2.jpg

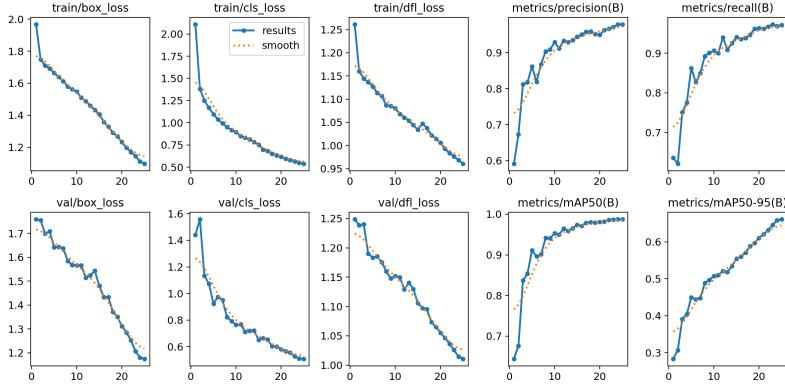
```
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train/confusion_matrix.png', width=600)
```

/content



```
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train/results.png', width=600)
```

/content



```
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train/val_batch0_pred.jpg', width=600)
```

/content



▼ Validating Model

%cd {HOME}

!yolo task=detect mode=val model={HOME}/runs/detect/train/weights/best.pt data={dataset.location}/data.yaml

/content

```
Ultralytics YOLOv8.0.196 🚀 Python-3.10.12 torch-2.1.0+cu121 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 168 layers, 11127519 parameters, 0 gradients, 28.4 GFLOPs
val: Scanning /content/datasets/football-players-detection-1/valid/labels.cache... 136 images, 0 backgrounds, 0 corrupt: 100% 136/136 [
  Class   Images  Instances      Box(P)      R      mAP50      mAP50-95):  0% 0/9 [00:00<?, ?it/s]WARNING ⚠ NMS time
  Class   Images  Instances      Box(P)      R      mAP50      mAP50-95): 100% 9/9 [00:14<00:00,  1.60s/it]
    all     136     1923     0.978     0.865     0.899     0.602
    CENTER   136      136     0.99     0.882     0.904     0.607
    DB      136      612     0.963     0.863     0.895     0.585
    LB      136      349     0.956     0.857     0.9     0.651
    QB      136      136     0.996     0.875     0.902     0.57
    SKILL   136      690     0.985     0.851     0.893     0.596
```

Speed: 5.1ms preprocess, 17.1ms inference, 0.0ms loss, 16.5ms postprocess per image

Results saved to runs/detect/val

💡 Learn more at <https://docs.ultralytics.com/modes/val>

▼ Inference with Model

%cd {HOME}

!yolo task=detect mode=predict model={HOME}/runs/detect/train/weights/best.pt conf=0.25 source={dataset.location}/test/images save=True

```
image 5/59 /content/datasets/football-players-detection-1/test/images/Capture154.PNG_rf.8719ac3d998dff8c1b681d38bb53822.jpg: 800 ▾
image 6/59 /content/datasets/football-players-detection-1/test/images/Capture159.PNG_rf.2498e3ee9c857afdef76be8491e2e76.jpg: 800
```

```
image 16/59 /content/datasets/football-players-detection-1/test/images/Capture20.PNG.jpg.rf.014c21100e12a0503840e8/cuebvt/59.jpg: 80
image 17/59 /content/datasets/football-players-detection-1/test/images/Capture210.PNG.jpg.rf.a0a0c72d1c146f164570aef58546818c.jpg: 80
image 18/59 /content/datasets/football-players-detection-1/test/images/Capture214.PNG.jpg.rf.2a8da68123dedf11dc4d58acddfb7cd.jpg: 80
image 19/59 /content/datasets/football-players-detection-1/test/images/Capture235.PNG.jpg.rf.cfd54dc4c32811da882e499088320e22.jpg: 80
image 20/59 /content/datasets/football-players-detection-1/test/images/Capture239.PNG.jpg.rf.96f71375d37b4f662948af16db6afe59.jpg: 80
image 21/59 /content/datasets/football-players-detection-1/test/images/Capture23.PNG.jpg.rf.a80732dd7c1b74b1fe6b21752956b5f2.jpg: 800
image 22/59 /content/datasets/football-players-detection-1/test/images/Capture25.PNG.jpg.rf.bad6077ddbe9437ee95fc18956c49261.jpg: 800
image 23/59 /content/datasets/football-players-detection-1/test/images/Capture38.PNG.jpg.rf.56459f1adabd5ef28f4062ed1169ec19.jpg: 800
image 24/59 /content/datasets/football-players-detection-1/test/images/Capture43.PNG.jpg.rf.rf.72632f24c44f0bbdf18f50757e210e274.jpg: 800
image 25/59 /content/datasets/football-players-detection-1/test/images/Capture4.PNG.jpg.rf.efa4b17f9205eb76c4c8050b7c0a16d0.jpg: 800x
image 26/59 /content/datasets/football-players-detection-1/test/images/Capture51.PNG.jpg.rf.75d741da8e7741d17765934ccb004f35.jpg: 800
image 27/59 /content/datasets/football-players-detection-1/test/images/Capture5.PNG.jpg.rf.e71ca22c264b7eaea918dea5199ce278c.jpg: 800x
image 28/59 /content/datasets/football-players-detection-1/test/images/Capture61.PNG.jpg.rf.0a8d36d68da6e5b914fb4060d7582d4d.jpg: 800
image 29/59 /content/datasets/football-players-detection-1/test/images/Capture62.PNG.jpg.rf.57300647acd2ae0ca8edfcc23149a81a.jpg: 800
image 30/59 /content/datasets/football-players-detection-1/test/images/Capture66.PNG.jpg.rf.rf.aafdf7238bafe5e1a5efdac0bc9bafa77.jpg: 800
image 31/59 /content/datasets/football-players-detection-1/test/images/Capture79.PNG.jpg.rf.6cf3879947830ec9cc398518c565004a.jpg: 800
image 32/59 /content/datasets/football-players-detection-1/test/images/Capture9.PNG.jpg.rf.673a1e065d2cc9c5b068f9a626e824a7.jpg: 800x
image 33/59 /content/datasets/football-players-detection-1/test/images/Capture.PNG.jpg.rf.9af65c247212a0bbd842f80eda838cad.jpg: 800x8
image 34/59 /content/datasets/football-players-detection-1/test/images/Oregon_0_vs_Colorado_2019_mp4-53.jpg.rf.84c5087c8d20f359cbfeb3
image 35/59 /content/datasets/football-players-detection-1/test/images/Oregon_0_vs_Colorado_2019_mp4-85.jpg.rf.rf.056b848375c58cdc8f9476
image 36/59 /content/datasets/football-players-detection-1/test/images/WashSt_vs_IowaSt2018_mp4-36.jpg.rf.44e43863e3dd35e5c7e7ad49789
image 37/59 /content/datasets/football-players-detection-1/test/images/WashSt_vs_IowaSt2018_mp4-38.jpg.rf.70e981cf58b5fec34924693f2c4
image 38/59 /content/datasets/football-players-detection-1/test/images/cap-1_.png.jpg.rf.2e513bb7f3a3c3307a43b2a9b1c8ed68.jpg: 800x80
image 39/59 /content/datasets/football-players-detection-1/test/images/videoplayback_mp4-107.jpg.rf.8af1ca8b84f1b55400e929ba0032cf03.
image 40/59 /content/datasets/football-players-detection-1/test/images/videoplayback_mp4-130.jpg.rf.711b7370cb386a421d5a19a8be2fdf30.
image 41/59 /content/datasets/football-players-detection-1/test/images/videoplayback_mp4-139.jpg.rf.76b4f47a1adb533625e66b233a9de41e.
image 42/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 43/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 44/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 45/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 46/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 47/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 48/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 49/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 50/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 51/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 52/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 53/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 54/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Detroit-Lions-vs-Dallas-Cowboys-2016-All-22-Film-360p
image 55/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Super-Bowl-LV-All-22-Coaches-Film-480p-_mp4-29.jpg.rf
image 56/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Super-Bowl-LV-All-22-Coaches-Film-480p-_mp4-32.jpg.rf
image 57/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Vikings-2017-3rd-Down-Defense-All-22-Cut-up-480p-_mp4
image 58/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Vikings-2017-3rd-Down-Defense-All-22-Cut-up-480p-_mp4
image 59/59 /content/datasets/football-players-detection-1/test/images/yt5s_com-Vikings-2017-3rd-Down-Defense-All-22-Cut-up-480p-_mp4
Speed: 4.2ms preprocess, 16.9ms inference, 17.7ms postprocess per image at shape (1, 3, 800, 800)
Results saved to runs/detect/predict2
```

Checking some of the results

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

for image_path in glob.glob(f'{HOME}/runs/detect/predict2/*.jpg')[::3]:
    display(Image(filename=image_path, width=600))
    print("\n")
```