Problem Definition

The goal is to detect **Person** and **Car** object in the image, video and live stream well

- **NOTE:** This notebook has trained using Kaggle Notebook. So, It is better to use kaggle notebook itself. Otherwise do the required changes.

Create virtual environment

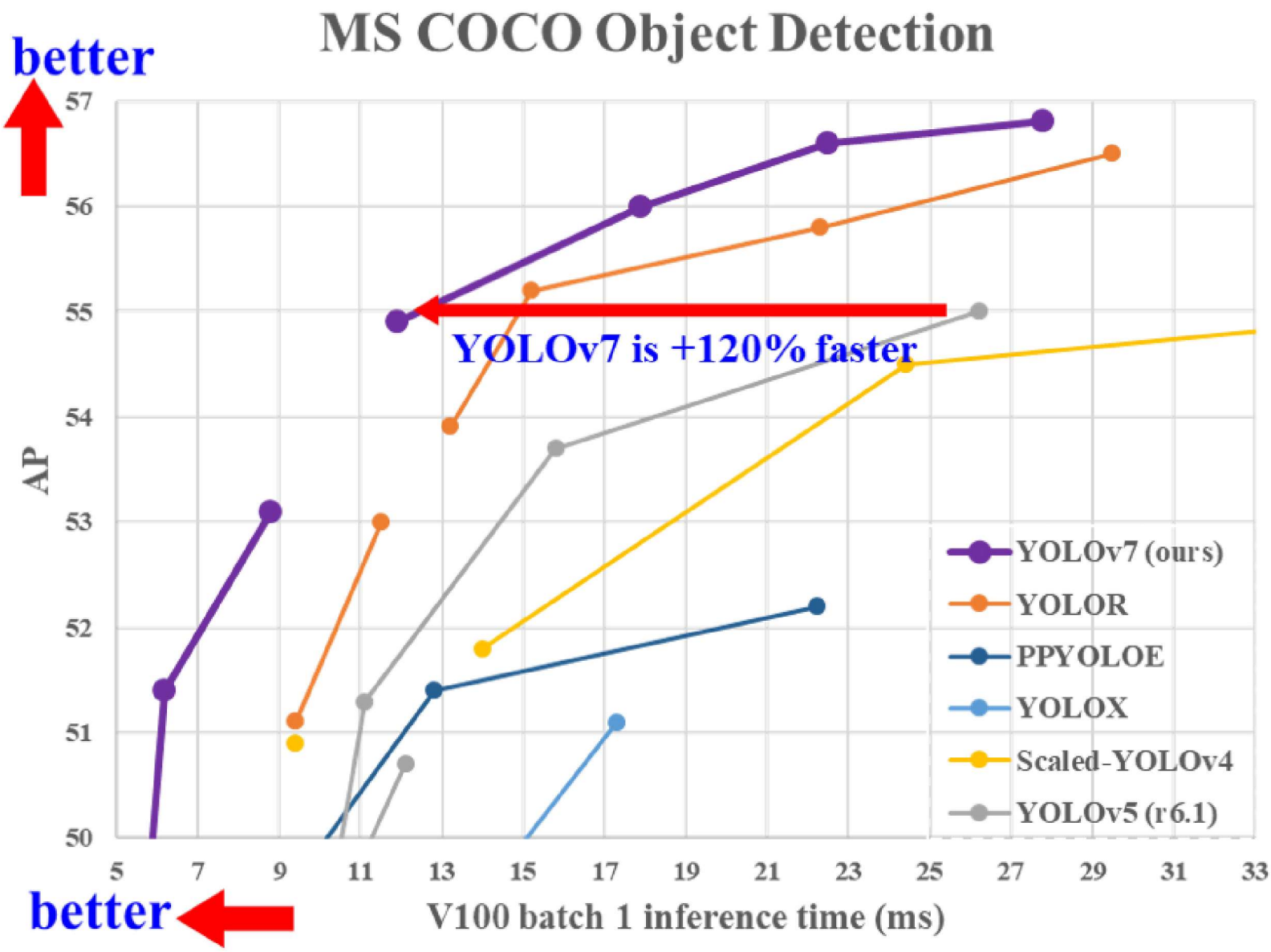
In [2]:
```
!python -m venv yolov7-env
!source yolov7-env/bin/activate
```

Training YOLOv7 on custom car-person-object-detection dataset

I have download the dataset for **Car** and **Person** object from the COCO using `fiftyone` library and create the dataset using python script (created split and format to YOLO).

In this notebook we will:

- Export the dataset to YOLOv7
- Train YOLOv7 to recognize the objects in our dataset
- Evaluate the model's performance
- Run test inference to view performance of YOLOv7 model on image, video and live stream



1. Install requirements

Downloading YOLOv7 repo and installing requirements

In [3]:
```
%%capture

!git clone https://github.com/WongKinYiu/yolov7 # Downloading YOLOv7 repository and installing requirements
%cd yolov7
!pip3 install -qr requirements.txt
```

Downloading YOLOv7 starting checkpoint

In [4]:
```
!wget "https://github.com/WongKinYiu/yolov7/releases/download/v0.1/yolov7-tiny.pt"
```

```
--2022-11-23 12:10:11--  https://github.com/WongKinYiu/yolov7/releases/download/v0.1/yolov7-tiny.pt
Resolving github.com (github.com)... 140.82.113.4
Connecting to github.com (github.com)|140.82.113.4|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://objects.githubusercontent.com/github-production-release-asset-2e65be/511187726/ba7d01ee-125a-4134-886
4-fa1abcbf94d5?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWNJYAX4CSVEH53A%2F20221123%2Fus-east-1%2Fs3%2Faws
4_request&X-Amz-Date=20221123T121011Z&X-Amz-Expires=300&X-Amz-Signature=7f75d2a75b8a1a0e4240acb5524a280c3b2329a017686f9
d31e8f1ff27aa9ed7&X-Amz-SignedHeaders=host&actor_id=0&key_id=0&repo_id=511187726&response-content-disposition=attachmen
t%3B%20filename%3Dyolov7-tiny.pt&response-content-type=application%2Foctet-stream [following]
--2022-11-23 12:10:11--  https://objects.githubusercontent.com/github-production-release-asset-2e65be/511187726/ba7d01e
e-125a-4134-8864-fa1abcbf94d5?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWNJYAX4CSVEH53A%2F20221123%2Fus-ea
st-1%2Fs3%2Faws4_request&X-Amz-Date=20221123T121011Z&X-Amz-Expires=300&X-Amz-Signature=7f75d2a75b8a1a0e4240acb5524a280c
3b2329a017686f9d31e8f1ff27aa9ed7&X-Amz-SignedHeaders=host&actor_id=0&key_id=0&repo_id=511187726&response-content-dispos
ition=attachment%3B%20filename%3Dyolov7-tiny.pt&response-content-type=application%2Foctet-stream
Resolving objects.githubusercontent.com (objects.githubusercontent.com)... 185.199.111.133, 185.199.110.133, 185.199.10
8.133, ...
Connecting to objects.githubusercontent.com (objects.githubusercontent.com)|185.199.111.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 12639769 (12M) [application/octet-stream]
Saving to: ‘yolov7-tiny.pt.1’

yolov7-tiny.pt.1    100%[===================>]  12.05M  --.-KB/s    in 0.1s

2022-11-23 12:10:11 (97.5 MB/s) - ‘yolov7-tiny.pt.1’ saved [12639769/12639769]
```

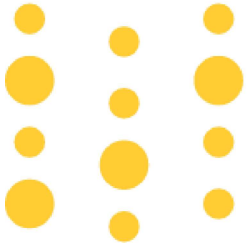
Imports

In [5]:
```
import os
import sys
import glob
import torch
import wandb
```

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

# version of torch
print(f"Setup complete. Using torch {torch.__version__} ({torch.cuda.get_device_properties(0).name if torch.cuda.is_ava
```

```
Setup complete. Using torch 1.11.0 (Tesla P100-PCIE-16GB)
```



Weights & Biases

I will be using Weights & Biases for visualizations and loggin artifacts and comparison of different models!

YOLOv7-car-person-object-detection

In [6]:
```
from kaggle_secrets import UserSecretsClient
try:
    user_secrets = UserSecretsClient()
    wandb_api_key = user_secrets.get_secret("wandb_api")
    wandb.login(key=wandb_api_key)
    anonymous = None
except:
    wandb.login(anonymous='must')
    print('To use your W&B account,\nGo to Add-ons -> Secrets and provide your W&B access token. Use the Label name as

# wandb.init(project="yolov7-tiny",name=f"run1")
wandb.init(project="car-person-object-detection", entity="mdiqbalbajmi", name="run1")
```

```
wandb: Currently logged in as: mdiqbalbajmi. Use `wandb login --relogin` to force relogin
wandb: WARNING If you're specifying your api key in code, ensure this code is not shared publicly.
wandb: WARNING Consider setting the WANDB_API_KEY environment variable, or running `wandb login` from the command line.
wandb: Appending key for api.wandb.ai to your netrc file: /root/.netrc
```

wandb version 0.13.5 is available! To upgrade, please run: $ pip install wandb --upgrade

Tracking run with wandb version 0.12.21

Run data is saved locally in /kaggle/working/yolov7/wandb/run-20221123_121013-94q6rgc8

Syncing run **run1** to Weights & Biases (docs)

Out[6]: Display W&B run

2. Assemble Our Dataset

Add the dataset to `/kaggle/input`

- dataset link: car-person-object-detection

In [7]:
```
!ls /kaggle/input/
```

```
car-person-object-detection-yolov7
```

3. Training the model

In [8]:
```
!ls
```

```
LICENSE.md  detect.py   models           tools        yolov7-tiny.pt
README.md   export.py   paper            train.py     yolov7-tiny.pt.1
cfg         figure      requirements.txt  train_aux.py
data        hubconf.py  scripts          utils
deploy      inference   test.py          wandb
```

In [9]:
```
cd /kaggle/working
```

```
/kaggle/working
```

In [10]:
```
!cp ../input/car-person-object-detection/data.yaml data.yaml
!cp -R ../input/car-person-object-detection-yolov7 car-person-object-detection-yolov7
```

```
cp: cannot stat '../input/car-person-object-detection/data.yaml': No such file or directory
```

In [11]:
```
dataset_dir="/kaggle/working/car-person-object-detection-yolov7"
```

In [13]:
```
from pathlib import Path
config_file_template = f'''
train: {Path(f"{dataset_dir}/images/train").absolute()}
val: {Path(f"{dataset_dir}/images/val").absolute()}
test: {Path(f"{dataset_dir}images/test").absolute()}

nc: 2
names: ['Person', 'Car']
'''

with open('data.yaml', 'w') as f:
    f.write(config_file_template)
```

In [14]:
```
!python yolov7/train.py --batch 64 --cfg ./yolov7/cfg/training/yolov7-tiny.yaml --epochs 60 --data ./data.yaml --weight
```

```
wandb: Currently logged in as: mdiqbalbajmi. Use `wandb login --relogin` to force relogin
wandb: wandb version 0.13.5 is available!  To upgrade, please run:
wandb:  $ pip install wandb --upgrade
wandb: Tracking run with wandb version 0.12.21
wandb: Run data is saved locally in /kaggle/working/wandb/run-20221123_121130-rm6nnzx3
wandb: Run `wandb offline` to turn off syncing.
wandb: Syncing run run1
wandb: ⭐ View project at https://wandb.ai/mdiqbalbajmi/car-person-object-detection
wandb: 🚀 View run at https://wandb.ai/mdiqbalbajmi/car-person-object-detection/runs/rm6nnzx3
/opt/conda/lib/python3.7/site-packages/torch/functional.py:568: UserWarning: torch.meshgrid: in an upcoming release, it will be required to pass the indexing argument. (Triggered internally at  /usr/local/src/pytorch/aten/src/ATen/native/TensorShape.cpp:2227.)
  return _VF.meshgrid(tensors, **kwargs)  # type: ignore[attr-defined]
train: Scanning '/kaggle/working/car-person-object-detection-yolov7/labels/train
val: Scanning '/kaggle/working/car-person-object-detection-yolov7/labels/val.cac

autoanchor: Analyzing anchors... anchors/target = 4.49, Best Possible Recall (BPR) = 0.9973
      0/59     6.73G   0.08004   0.02035   0.01271    0.1131       770       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.268       0.359       0.239      0.0635
      1/59     9.44G   0.06718   0.01758  0.006493   0.09126       949       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.483       0.465        0.41       0.141
      2/59     9.44G   0.06015   0.01825  0.004937   0.08333      1011       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980        0.65       0.519       0.546        0.23
      3/59     9.44G   0.05632   0.01831   0.00439   0.07902       924       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.617       0.532       0.547       0.248
      4/59     9.44G    0.0537   0.01839  0.004041   0.07614       881       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.705       0.538         0.6       0.292
      5/59     9.44G   0.05191   0.01885  0.003757   0.07452       866       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.745       0.554       0.627       0.318
      6/59     9.44G   0.05027    0.0187  0.003466   0.07244       674       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.695       0.586        0.63       0.328
      7/59     9.44G   0.04924   0.01889  0.003346   0.07147       642       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.718       0.577       0.633       0.334
      8/59     9.44G   0.04833   0.01924  0.003239   0.07081       699       640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.714       0.577       0.634       0.339
      9/59     9.44G   0.04769   0.01956   0.00311   0.07036       667       640
```

```
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.726       0.576       0.639       0.343
10/59     9.44G   0.04758   0.01999  0.003077   0.07065         798         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.705       0.582       0.631       0.339
11/59     9.44G    0.0468   0.02045  0.003067   0.07032         866         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980        0.73       0.558       0.632       0.341
12/59     10.1G    0.0454   0.02068  0.002716    0.0688         743         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.728       0.561       0.634       0.336
13/59     10.1G   0.04468   0.02126  0.002639   0.06857         900         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.737       0.556       0.634       0.343
14/59     10.1G   0.04373   0.02092   0.00251   0.06716         691         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.733       0.551       0.622       0.336
15/59     10.1G   0.04343    0.0216  0.002507   0.06754         823         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.682       0.574       0.622       0.331
16/59     10.1G   0.04296   0.02162  0.002364   0.06694         858         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.709       0.576       0.633       0.339
17/59     10.1G   0.04282   0.02203  0.002358    0.0672         922         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.722       0.555       0.618        0.33
18/59     10.9G    0.0425   0.02144  0.002332   0.06628         722         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.699       0.549       0.605       0.321
19/59     10.9G    0.0427   0.02121  0.002391    0.0663         750         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.731        0.52         0.6       0.318
20/59     10.9G   0.04246   0.02139  0.002333   0.06618         829         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.699       0.545       0.607       0.329
21/59     10.9G   0.04176   0.02124  0.002292    0.0653         846         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.729       0.563        0.63        0.34
22/59     10.9G   0.04151   0.02127  0.002166   0.06495         693         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.718       0.563       0.629       0.337
23/59     10.9G   0.04146   0.02123  0.002147   0.06483         788         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980        0.72       0.555       0.618        0.33
24/59     10.9G   0.04117    0.0213  0.002121   0.06459         841         640
```

```
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.732       0.558        0.63        0.34
25/59      10.9G   0.04125   0.02184  0.002111    0.0652       976       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.735       0.556       0.627       0.341
26/59      10.9G   0.04099   0.02097  0.002128   0.06409       703       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.712       0.576       0.636       0.348
27/59      10.9G   0.04078   0.02101  0.002034   0.06382       915       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.739       0.562       0.635       0.351
28/59      10.9G   0.04066   0.02077  0.001997   0.06343       781       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.732       0.563       0.638       0.352
29/59      10.9G   0.04063   0.02124  0.001996   0.06387       751       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.752       0.555       0.638       0.351
30/59      11.3G   0.04035   0.02092  0.001969   0.06324       911       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.714       0.575       0.638       0.353
31/59      11.3G   0.04034   0.02062  0.002001   0.06296       744       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.753       0.561       0.645       0.357
32/59      11.3G   0.03999   0.02085   0.00195   0.06279       866       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.708       0.586       0.641       0.356
33/59      11.3G   0.03994   0.02102  0.001937    0.0629      1037       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.722       0.577       0.639       0.358
34/59      11.3G    0.0401   0.02049  0.001889   0.06247       776       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.746       0.573       0.649       0.362
35/59      11.3G   0.03941   0.02045  0.001909   0.06177       887       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.723       0.583       0.649       0.363
36/59        12G   0.03958   0.02083  0.001869   0.06228       856       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.746       0.582       0.653       0.366
37/59        12G   0.03934   0.02104   0.00185   0.06224       662       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.751       0.574       0.652       0.367
38/59        12G   0.03968   0.02057  0.001865   0.06212       641       640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.746       0.579       0.653        0.37
39/59        12G   0.03908   0.02065  0.001775   0.06151       770       640
```

```
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.743        0.58       0.652       0.368
40/59        12G   0.03931   0.02071  0.001852   0.06188         834         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.711       0.606       0.655       0.373
41/59        12G   0.03895   0.02053  0.001784   0.06127         753         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.734       0.593       0.658       0.373
42/59      12.8G   0.03915   0.02096  0.001849   0.06196         855         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.753       0.581        0.66       0.375
43/59      12.8G   0.03867   0.02024  0.001756   0.06066         730         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.743       0.589       0.657       0.373
44/59      12.8G   0.03878   0.02056  0.001703   0.06105         924         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.737       0.596        0.66       0.377
45/59      12.8G   0.03876    0.0202  0.001749   0.06071         775         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.737       0.592       0.661       0.375
46/59      12.8G   0.03845   0.02033  0.001746   0.06053         661         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.734       0.599       0.664       0.379
47/59      12.8G   0.03855   0.02009  0.001747   0.06039         714         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.759       0.586       0.667       0.381
48/59      12.8G   0.03842   0.01983  0.001673   0.05992        1023         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.742         0.6       0.668       0.382
49/59      12.8G   0.03856   0.02075   0.00176   0.06107         913         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.744       0.597       0.671       0.383
50/59      12.8G   0.03833   0.02022  0.001724   0.06027         847         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980        0.74       0.602        0.67       0.384
51/59      13.5G   0.03823   0.02034  0.001662   0.06024         816         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980        0.74       0.603       0.668       0.384
52/59      13.5G   0.03796   0.02013  0.001654   0.05974         809         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.744       0.599       0.667       0.385
53/59      13.5G   0.03817    0.0205  0.001658   0.06033         995         640
           Class      Images      Labels           P           R      mAP@.5
             all        1000        8980       0.745       0.606       0.672       0.388
54/59      13.5G   0.03768   0.02018    0.0016   0.05946         698         640
```

```
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.743       0.601       0.671       0.387
       55/59     13.5G   0.03806   0.01988   0.00163   0.05957         745         640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.744       0.605       0.674       0.386
       56/59     13.5G   0.03785   0.02007  0.001647   0.05957         970         640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.758       0.602       0.676        0.39
       57/59     13.5G   0.03786   0.02007  0.001633   0.05956         686         640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.739       0.605       0.671       0.388
       58/59     13.5G   0.03767   0.01986  0.001597   0.05913         963         640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.751       0.602       0.675        0.39
       59/59     13.5G   0.03805   0.02038  0.001644   0.06007         928         640
               Class      Images      Labels           P           R      mAP@.5
                 all        1000        8980       0.741       0.605       0.672       0.387
              Person        1000        5292       0.738       0.614       0.679       0.384
                 Car        1000        3688       0.743       0.596       0.666       0.391
Optimizer stripped from car-person-object-detection/run1/weights/last.pt, 12.3MB
Optimizer stripped from car-person-object-detection/run1/weights/best.pt, 12.3MB
wandb: Waiting for W&B process to finish... (success).
wandb:
wandb:
wandb: Run history:
wandb:      metrics/mAP_0.5 _
wandb: metrics/mAP_0.5:0.95 _
wandb:    metrics/precision _
wandb:       metrics/recall _
wandb:       train/box_loss
wandb:       train/cls_loss
wandb:       train/obj_loss
wandb:         val/box_loss
wandb:         val/cls_loss
wandb:         val/obj_loss _
wandb:                x/lr0 _
wandb:                x/lr1 _
wandb:                x/lr2
wandb:
wandb: Run summary:
wandb:      metrics/mAP_0.5 0.67235
wandb: metrics/mAP_0.5:0.95 0.38738
wandb:    metrics/precision 0.74062
wandb:       metrics/recall 0.60514
wandb:       train/box_loss 0.03805
```

```
wandb:       train/cls_loss 0.00164
wandb:       train/obj_loss 0.02038
wandb:         val/box_loss 0.05923
wandb:         val/cls_loss 0.0065
wandb:         val/obj_loss 0.04648
wandb:                x/lr0 0.00102
wandb:                x/lr1 0.00102
wandb:                x/lr2 0.00102
wandb:
wandb: Synced run1: https://wandb.ai/mdiqbalbajmi/car-person-object-detection/runs/rm6nnzx3
wandb: Synced 6 W&B file(s), 342 media file(s), 1 artifact file(s) and 0 other file(s)
wandb: Find logs at: ./wandb/run-20221123_121130-rm6nnzx3/logs
```

Run Inference With Trained Weights

Testing inference with a pretrained checkpoint of contents of `./car-person-object-detection-yolov7` folder.

In [15]:
```
%%capture
!python yolov7/detect.py --weights ./car-person-object-detection/run1/weights/best.pt --conf 0.40 --source ./car-person
```

Display inference on ALL test images

In [16]:
```
for images in glob.glob('runs/detect/exp/*.jpg')[0:10]:
    display(Image(filename=images))
```

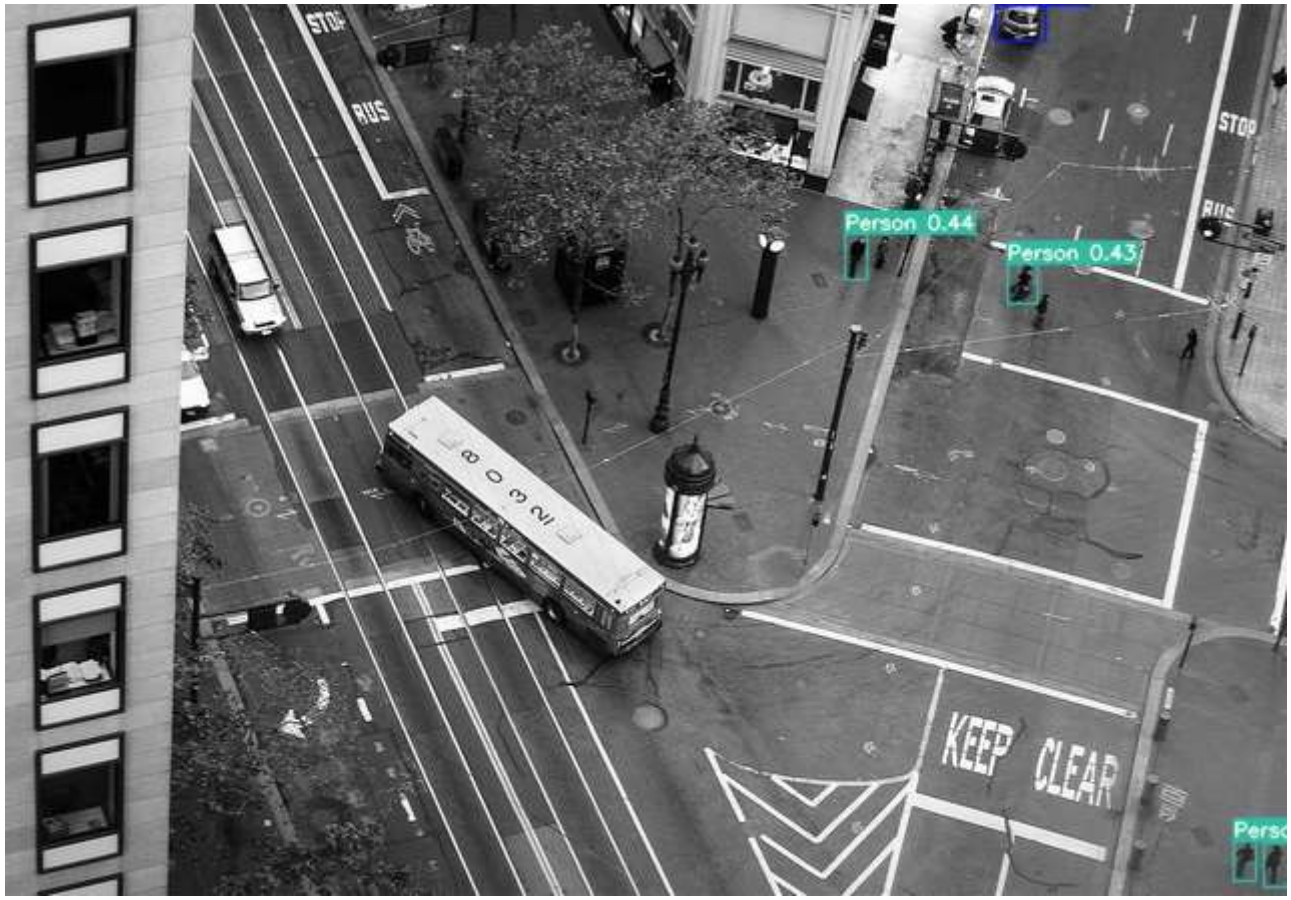

Person 0.54
Person 0.54
Car 0.57
Car 0.42
Car 0.76


Person 0.88
Person 0.79
0.78
Car 0.90
Person 0.89
Person 0.75
Michelle's
STARBUCKS COFFEE


HOTEL DE ANZA
HOTEL DE ANZA
Car 0.93
Car 0.67
Car Car 0.75


Car 0.45
Person 0.85
Person 0.76
0.51
SCHOOL BUS


Person 0.55
Person 0.78


Person 0.44
Person 0.43
KEEP CLEAR


Car 0.46
Car 0.46
Person 0.49
Car 0.57
Car 0.88


Person 0.89
Car 0.45
Car 0


Car 0.56
Person 0.51
Person 0.61
Car 0.83
PIZZA

Inference on video file

In [24]:
```
%%capture
!python yolov7/detect.py --weights ./car-person-object-detection/run1/weights/best.pt --conf 0.25 --img-size 640 --sour
```

In [29]:
```
!ls runs/detect/exp2
```

```
car_person_video.mp4
```

In [30]:
```
sys.path.insert(0, './yolov7')
sys.path.insert(0, './car-person-object-detection')
```

In [31]:
```
model = torch.load('car-person-object-detection/run1/weights/best.pt')
!zip -r best_Model.zip car-person-object-detection/run1/weights/best.pt
```

```
updating: car-person-object-detection/run1/weights/best.pt (deflated 8%)
```

In [32]:
```
%%capture
!zip -r output.zip /kaggle/working/
```

Summary

- We are getting fair performance.
- To improve the model performance we can increase no.of images and train for more no.of epochs.

In [ ]: