In [ ]:
```
!pip3 install torch torchvision torchaudio pandas pyYAML tqdm seaborn opencv-python
```

```
Requirement already satisfied: torch in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (1.12.0)
Requirement already satisfied: torchvision in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (0.13.0)
Requirement already satisfied: torchaudio in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (0.12.0)
Requirement already satisfied: pandas in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (1.4.3)
Requirement already satisfied: pyYAML in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (6.0)
Requirement already satisfied: tqdm in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (4.64.0)
Requirement already satisfied: seaborn in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (0.11.2)
Requirement already satisfied: opencv-python in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (4.6.0.66)
Requirement already satisfied: numpy in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (1.23.1)
Requirement already satisfied: typing-extensions in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from torch) (4.3.0)
Requirement already satisfied: pillow!=8.3.*,>=5.3.0 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from torchvision) (9.2.0)
Requirement already satisfied: requests in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from torchvision) (2.28.1)
Requirement already satisfied: pytz>=2020.1 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from pandas) (2022.1)
Requirement already satisfied: python-dateutil>=2.8.1 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from pandas) (2.8.2)
Requirement already satisfied: colorama in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from tqdm) (0.4.5)
Requirement already satisfied: matplotlib>=2.2 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from seaborn) (3.5.2)
Requirement already satisfied: scipy>=1.0 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from seaborn) (1.8.1)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from matplotlib>=2.2->seaborn) (1.4.4)
Requirement already satisfied: pyparsing>=2.2.1 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from matplotlib>=2.2->seaborn) (3.0.9)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from matplotlib>=2.2->seaborn) (4.34.4)
Requirement already satisfied: cycler>=0.10 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from matplotlib>=2.2->seaborn) (0.11.0)
Requirement already satisfied: packaging>=20.0 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from matplotlib>=2.2->seaborn) (21.3)
Requirement already satisfied: six>=1.5 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from python-dateutil>=2.8.1->pandas) (1.16.0)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from requests->torchvision) (1.26.10)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from requests->torchvision) (2022.6.15)
Requirement already satisfied: idna<4,>=2.5 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from requests->torchvision) (3.3)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\jmess\appdata\local\programs\python\python39\lib\site-packages (from requests->torchvision) (2.1.0)
```

In [ ]:
```
%matplotlib inline
```

In [ ]:
```
import torch
import cv2
from matplotlib import pyplot as plt
```

In [ ]:
```
model = torch.hub.load('ultralytics/yolov5', 'yolov5s')
```

```
Using cache found in C:\Users\jmess/.cache\torch\hub\ultralytics_yolov5_master
YOLOv5  2022-7-18 Python-3.9.13 torch-1.12.0+cpu CPU

Fusing layers...
YOLOv5s summary: 213 layers, 7225885 parameters, 0 gradients
Adding AutoShape...
```

In [ ]:
```
def load_image(path):
    return cv2.imread(path)[:, :, ::-1]
```

In [ ]:
```
def process_image(img):
    result = model([img], size=640)

    print(result.pandas().xyxy[0])

    return result
```

In [ ]:
```
IMGS_PATH = ['imgs/all.png', 'imgs/people_1.png', 'imgs/people_2.png']
```

In [ ]:
```
IMGS = []

for i in IMGS_PATH:
    IMGS.append(load_image(i))
```

a)

In [ ]:
```
def draw_result(frame, results):
    frame = frame.copy()
    for box in results.xyxy[0]:
        if int(box[5]) == 0:
            xB = int(box[2])
            xA = int(box[0])
            yB = int(box[3])
            yA = int(box[1])

            cv2.rectangle(frame, (xA, yA), (xB, yB), (255, 0, 0), 2)

    return frame
```

In [ ]:
```
def process(img):
    plt.imshow(img)
    plt.show()

    result = process_image(img)

    print(result)

    plt.imshow(draw_result(img, result))
    plt.show()
```

In [ ]:
```
process(IMGS[0])
```

	xmin	ymin	xmax	ymax	confidence	class
0	726.216492	870.891785	967.580078	1088.871460	0.846512	2
1	1104.301514	841.032959	1196.471558	923.366333	0.829974	2
2	393.870117	922.003052	694.894958	1192.261230	0.800172	2
3	1.707250	910.309021	84.191330	1184.690308	0.776526	0
4	636.185120	826.378418	760.100464	929.397766	0.770256	2
5	1045.868408	804.348999	1140.609253	883.489014	0.762862	2
6	1600.351807	493.414764	1672.191406	587.836914	0.680482	9
7	256.838928	852.810669	328.951660	1052.742432	0.631074	0
8	447.830383	725.431458	625.831116	910.149231	0.628749	5
9	1189.572998	697.095337	1907.240234	1186.575684	0.597191	7
10	1206.703735	593.303833	1252.806030	651.825256	0.585567	9
11	878.548706	793.447327	911.642090	870.598999	0.522277	0
12	971.822571	797.682190	1003.063477	869.149353	0.472607	0
13	718.716797	753.658752	812.098267	850.487915	0.451698	2
14	396.205566	838.769409	441.134613	986.398010	0.450832	0
15	507.221191	523.475037	573.016846	602.472778	0.437403	9
16	1020.958191	670.210266	1041.742432	708.367859	0.422663	9
17	392.386963	924.273560	691.774841	1186.112305	0.386347	7
18	1196.590454	700.699097	1843.417358	1188.745605	0.296920	5
19	964.837463	767.659180	1010.002258	861.787720	0.285839	0

	name
0	car
1	car
2	car
3	person
4	car
5	car
6	traffic light
7	person
8	bus
9	truck
10	traffic light
11	person
12	person
13	car
14	person
15	traffic light
16	traffic light
17	truck
18	bus
19	person

```
image 1/1: 1235x1920 6 persons, 6 cars, 2 buss, 2 trucks, 4 traffic lights
Speed: 14.9ms pre-process, 116.6ms inference, 16.9ms NMS per image at shape (1, 3,
416, 640)
```

Como podemos ver, já que existem varios elementos na foto boa parte das pessoas foi encontrada pelo modelo. Mas dá para ver que quanto mais profundo na foto o elemento está menor a confiança na classificação temos. Provavelmente devido menor informação de pixels para representá-lo dentro da foto. A rede identificou todas as pessoas na foto sem nenhuma falha.

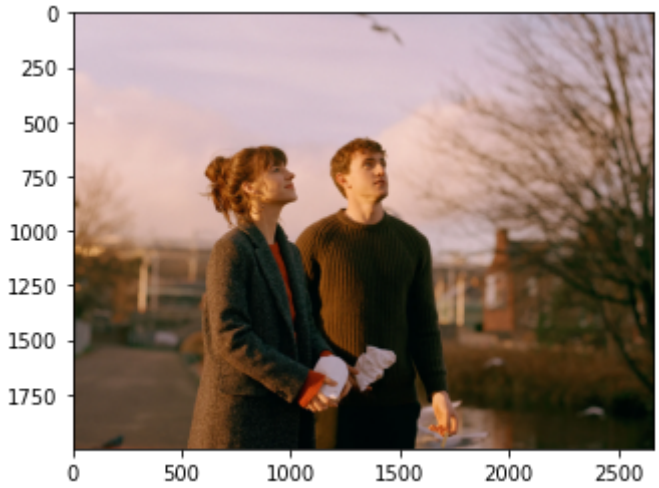
In [ ]:
```
process(IMGS[1])
```

```
          xmin        ymin        xmax        ymax  confidence  class  \
0   528.242798  213.827530  608.271057  445.049377    0.859260      0
1   369.474243  211.207169  384.192078  257.956268    0.816155      0
2   392.125702  212.672897  405.924194  254.231247    0.733099      0
3    99.137474  249.691849  149.096802  408.160004    0.711861      0
4   519.139893  276.049927  558.115784  353.744110    0.657766     26
5    48.602715  255.429077  111.330231  410.260864    0.655491      0
6   445.193054  199.727753  473.608276  257.162567    0.448671     58
7   582.135010  246.941681  621.685974  377.284088    0.395870     58
8   416.761749  210.722229  428.724884  239.429962    0.371667      0
9    34.038357  305.115082   92.542786  430.863617    0.362988     56
10  582.520630  325.183167  617.694824  377.309143    0.335677     58
11  659.666870  109.544678  700.000000  153.703491    0.307373     58
12  521.921143  209.655411  605.688599  448.508728    0.261612     26
13   36.373814  298.593567   98.360062  431.164307    0.258987      0

           name
0        person
1        person
2        person
3        person
4       handbag
5        person
6   potted plant
7   potted plant
8        person
9         chair
10  potted plant
11  potted plant
12      handbag
13       person
image 1/1: 525x700 7 persons, 2 handbags, 1 chair, 4 potted plants
Speed: 4.0ms pre-process, 121.6ms inference, 1.0ms NMS per image at shape (1, 3, 4
80, 640)
```

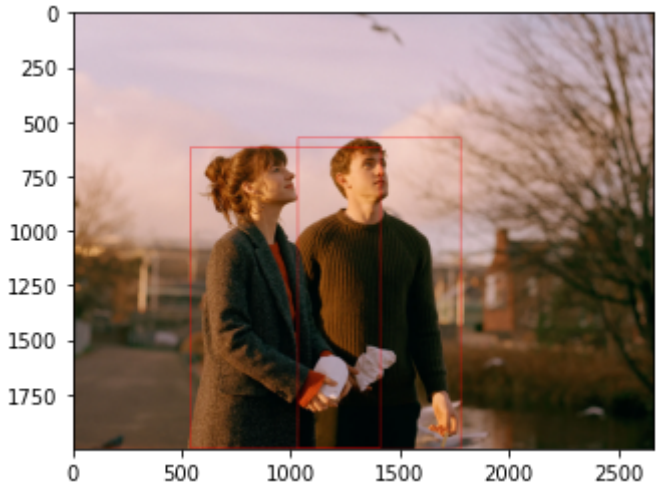
Uma rua com uma quantidade relativa de objetos podemos ver que todas as pessoas foram identificadas, contudo o modelo acabou errado e identificado uma pessoa duas vezes.

In [ ]:
```
process(IMGS[2])
```




```
          xmin         ymin         xmax         ymax  confidence  class  \
0  1028.121338   574.823120  1774.388672  1998.000000    0.915181      0
1   537.640442   618.084961  1406.829224  1992.961426    0.865246      0

     name
0  person
1  person
image 1/1: 1998x2664 2 persons
Speed: 24.9ms pre-process, 111.6ms inference, 1.0ms NMS per image at shape (1, 3,
480, 640)
```



Os dois unico elementos da foto propositalmente são duas pessoas e podemos ver que o modelo o identifica, com um nivel consideravel de confiança as duas pessoas.

b)

In [ ]:

```python
# Transforma o video em imagens para ser usado no modelo

def get_frames(path):
    vidcap = cv2.VideoCapture(path)
    vidcap.set(cv2.CAP_PROP_FRAME_WIDTH, 1280)
    vidcap.set(cv2.CAP_PROP_FRAME_HEIGHT, 720)
    lista_results = []

    success,image = vidcap.read()
    while success:
        image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
        lista_results.append(image)
```

```
        success,image = vidcap.read()

    return lista_results
```

In [ ]:
```
# Pega todos os frames
results = get_frames('videos/cross.mp4')
```

In [ ]:
```
# Executa os frames no modelo

t = model(results)
pd = t.pandas().xyxy
```

In [ ]:
```
# Verifica e calcula os centros dos quadrados demarcadores
def get_path(pd):
    path = []

    for j in pd:
        i = j[j['class'] == 0]

        if len(i) > 0:
            i = i.iloc[0]
            x = (i['xmax'] + i['xmin']) // 2
            y = (i['ymax'] + i['ymin']) // 2
            path.append((int(x), int(y)))

    return path
```

In [ ]:
```
# Pinta aréa a partir dos centros dos quadrados demarcadores calculado
def print_area(img, point, w):
    for i in range(point[0] - w, point[0] + w):
        for j in range(point[1] - w, point[1] + w):
            try:
                img[j][i] = (255, 0, 0)
            except IndexError:
                pass
```

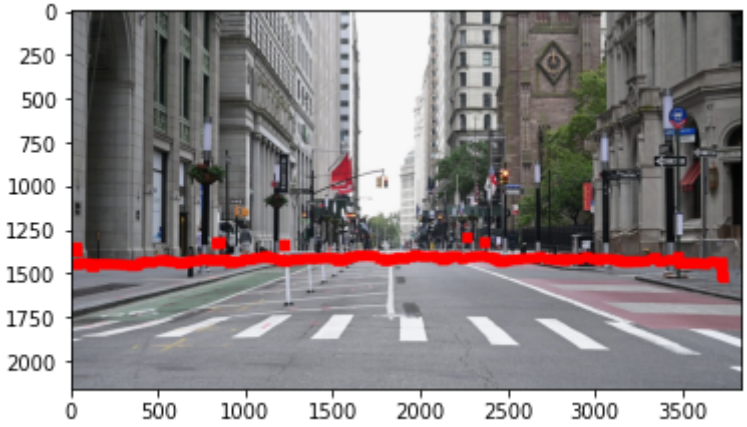
In [ ]:
```
# Angraria os centros
a = get_path(pd)
```

In [ ]:
```
# Pinta o caminho na imagem

img = results[0].copy()
for i in a:
    print_area(img, i, 30)
```

In [ ]:
```
# Exibe a imagem

plt.imshow(img)
plt.show()
```


0
250
500
750
1000
1250
1500
1750
2000
0
500
1000
1500
2000
2500
3000
3500