```
# importing car object detection dataset from Kaggle Library

import kagglehub
sshikamaru_car_object_detection_path = kagglehub.dataset_download('sshikamaru/car-object-detection')

print('Data source import complete.')
```

```
Downloading from https://www.kaggle.com/api/v1/datasets/download/sshikamaru/car-object-detection?dataset_version_number=2...
100%|██████████| 112M/112M [00:00<00:00, 129MB/s] Extracting files...

Data source import complete.
```

```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# using OS level directory traversing to display the list of images from training and test directories of the dataset
import os
for dirname, _, filenames in os.walk('/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/'):
    for filename in filenames:
        print(os.path.join(dirname, filename))
```

```
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_4580.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_1780.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_6440.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_12300.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_19340.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_22260.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_16740.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_13740.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_5840.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_14680.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_1740.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_10240.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_10840.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_1020.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_20280.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_7180.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_16720.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_4640.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_980.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_6180.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_17200.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_11000.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_23400.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_24900.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_13940.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_9060.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_4540.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_27100.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_14140.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_27180.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_19580.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_6540.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_7260.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_11780.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_9820.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_14440.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_2000.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_7480.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_17360.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_19140.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_12780.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_2160.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_19200.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_9000.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_17380.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_19920.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_22600.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_7500.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_19900.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_19840.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_18760.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_12400.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_23480.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_9260.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_21860.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_10540.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_26180.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_3360.jpg
/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images/vid_4_12320.jpg
```

```
!pip install ultralytics
```

Show hidden output

```
# Install and import python libraries

!pip install -U ipywidgets
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt # pyplot for plotting
import seaborn as sns   # seaborn for plotting
from sklearn.model_selection import train_test_split
from glob import glob
import cv2
from PIL import Image
from ultralytics import YOLO
import os
```

Show hidden output

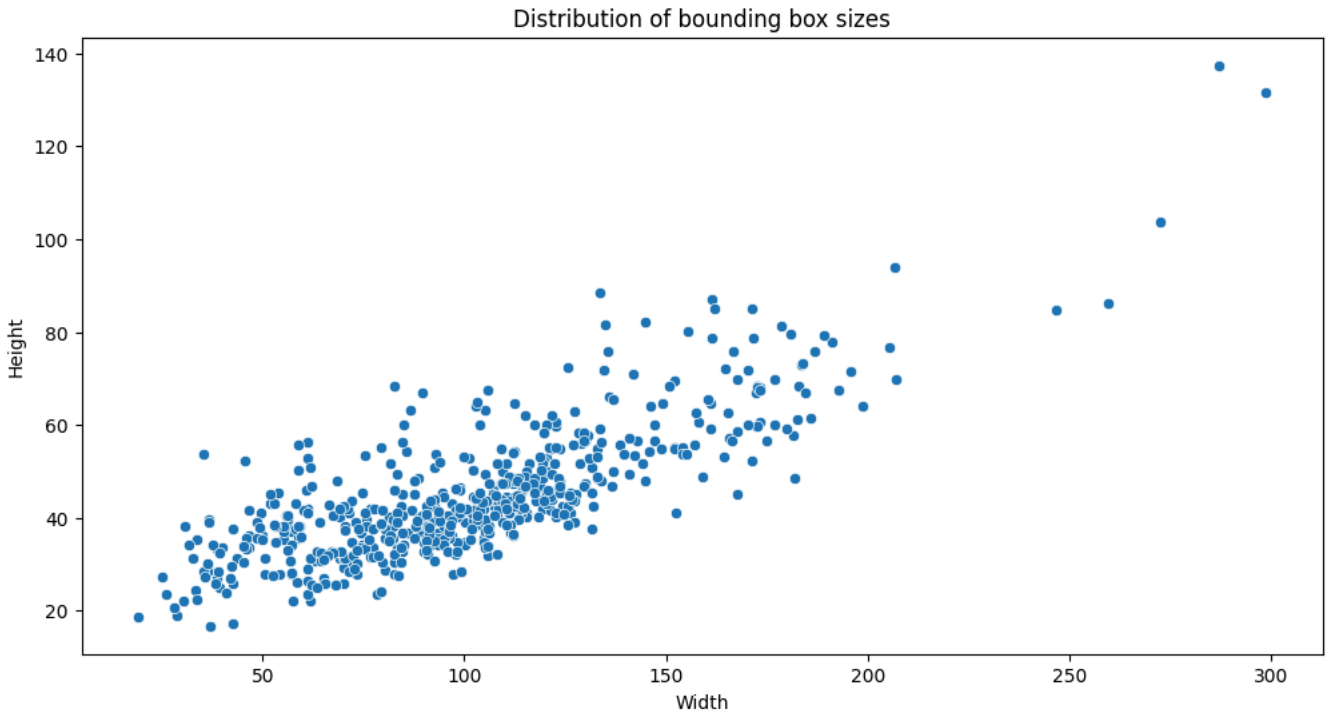
```
# creating directories for working session and training model

!mkdir -p "/content/working/data"
!mkdir -p "/content/working/data/images"
!mkdir -p "/content/working/data/images/train"
!mkdir -p "/content/working/data/images/val"
!mkdir -p "/content/working/data/labels"
!mkdir -p "/content/working/data/labels/train"
!mkdir -p "/content/working/data/labels/val"

root_dir = "/content/working/data"
labels_dir = "/content/working/data/labels"
images_dir = "/content/working/data/images"
```

```
train_data = "/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/training_images"
csv_data = "/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/train_solution_bounding_boxes (1).cs
test_data = "/root/.cache/kagglehub/datasets/sshikamaru/car-object-detection/versions/2/data/testing_images"
```

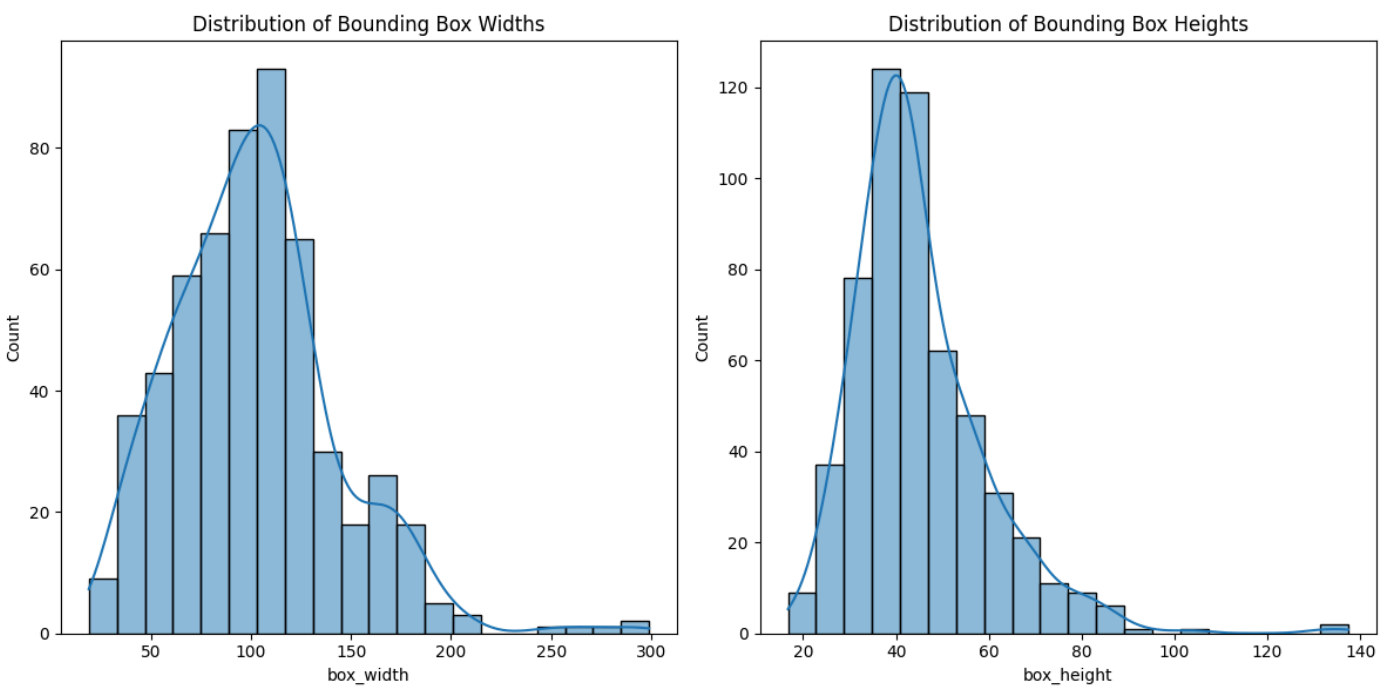
```
# Read the input dataset and display first few records

df = pd.read_csv(csv_data)
df.head()
```

	image	xmin	ymin	xmax	ymax
0	vid_4_1000.jpg	281.259045	187.035071	327.727931	223.225547
1	vid_4_10000.jpg	15.163531	187.035071	120.329957	236.430180
2	vid_4_10040.jpg	239.192475	176.764801	361.968162	236.430180
3	vid_4_10020.jpg	496.483358	172.363256	630.020260	231.539575
4	vid_4_10060.jpg	16.630970	186.546010	132.558611	238.386422

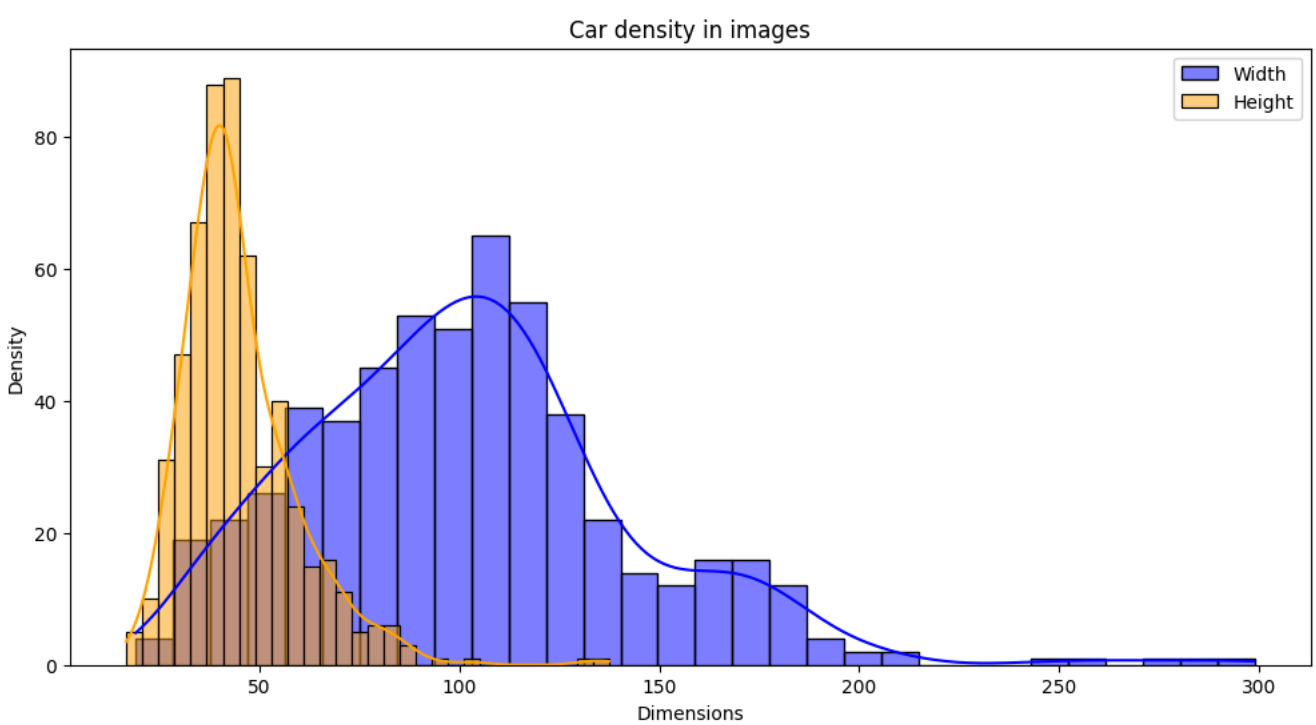
```
# Plotting for distribution of height and width of cars in the input dataset

plt.figure(figsize=(12, 6))
df['width'] = df['xmax'] - df['xmin']
df['height'] = df['ymax'] - df['ymin']
sns.scatterplot(x='width', y='height', data=df)
plt.title('Distribution of bounding box sizes')
plt.xlabel('Width')
plt.ylabel('Height')
plt.show()
```




```
#Plotting for bounding box width and height of the cars

df['box_width'] = df['xmax'] - df['xmin']
df['box_height'] = df['ymax'] - df['ymin']

plt.figure(figsize=(12, 6))
plt.subplot(1, 2, 1)
sns.histplot(df['box_width'], bins=20, kde=True)
plt.title('Distribution of Bounding Box Widths')

plt.subplot(1, 2, 2)
sns.histplot(df['box_height'], bins=20, kde=True)
plt.title('Distribution of Bounding Box Heights')

plt.tight_layout();
plt.show();
```




```
#Plotting density of cars found in the images

plt.figure(figsize=(12, 6))
sns.histplot(df['width'], bins=30, kde=True, color='blue', label='Width')
sns.histplot(df['height'], bins=30, kde=True, color='orange', label='Height')
plt.title('Car density in images')
plt.xlabel('Dimensions')
plt.ylabel('Density')
plt.legend()
plt.show()
```



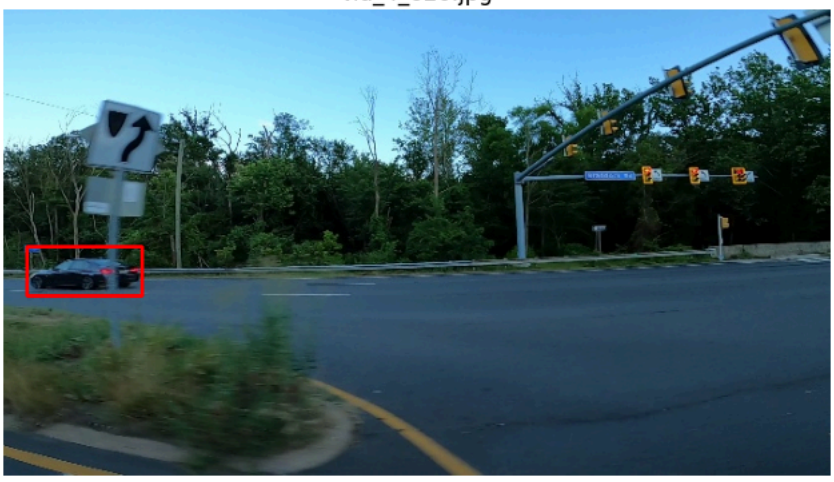

```
#Identifying and displaying cars in the input dataset
#The images are in RGB format.
```

```
def plot_images_with_boxes(image_path, df, n=12):
    images = glob(f'{image_path}/*.jpg')[:n]
    for img_path in images:
        img = cv2.imread(img_path)
        img_name = os.path.basename(img_path)
        boxes = df[df['image'] == img_name]

        for _, box in boxes.iterrows():
            cv2.rectangle(img,
                          (int(box['xmin']), int(box['ymin'])),
                          (int(box['xmax']), int(box['ymax'])),
                          (0,0,255),2)

        plt.figure(figsize=(8, 8))
        plt.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
        plt.title(img_name)
        plt.axis('off')
        plt.show()
plot_images_with_boxes(train_data, df)
```

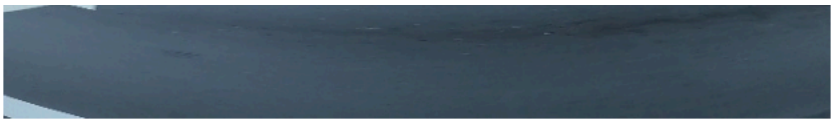
vid_4_11280.jpg

vid_4_23140.jpg

vid_4_620.jpg

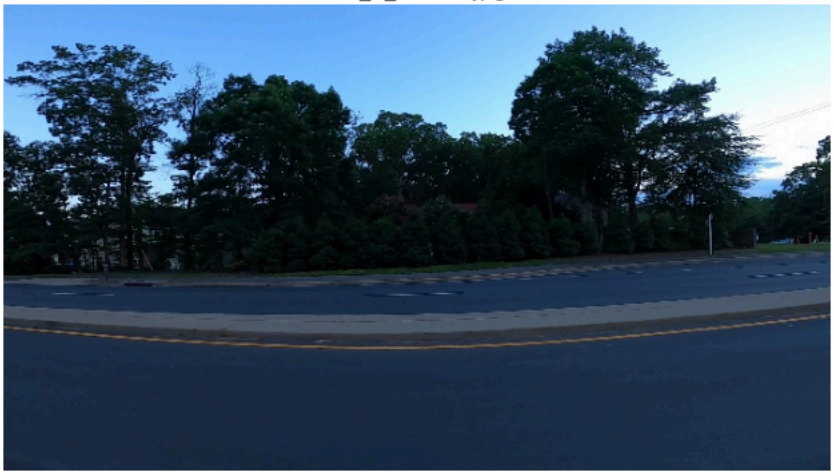


vid_4_5760.jpg



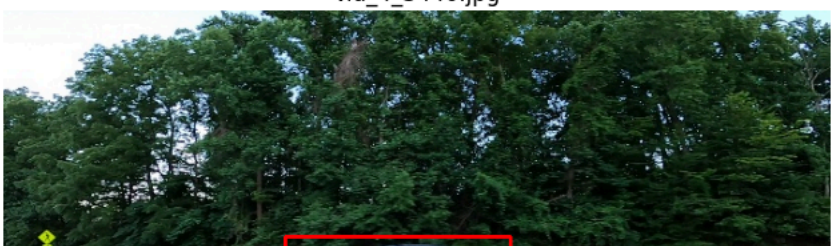
vid_4_14460.jpg

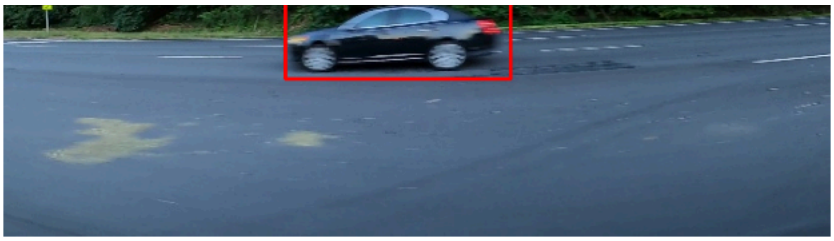
vid_4_19680.jpg



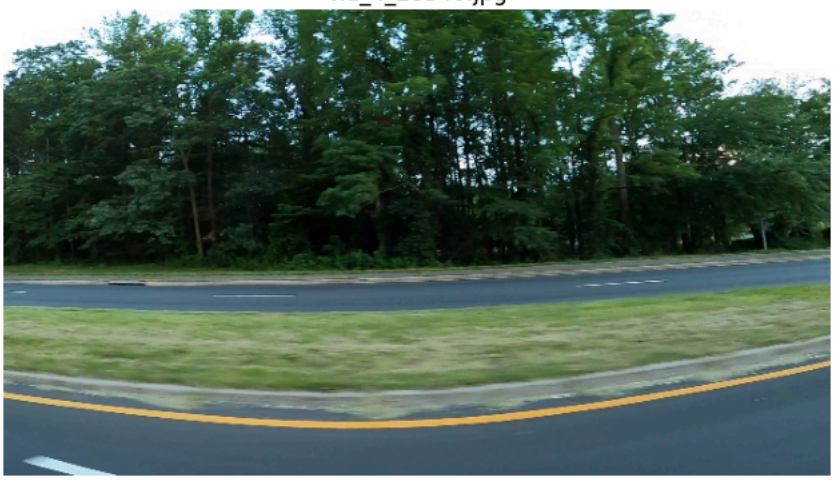
vid_4_11060.jpg

vid_4_3440.jpg





vid_4_20940.jpg



vid_4_18180.jpg

vid_4_21320.jpg

vid_4_3520.jpg