# NAME - SANTRAM

## ROLL NO. -231030050

## Image Extraction and Traffic Data Analysis

```
import pandas as pd
import numpy as np
import cv2
import matplotlib.pyplot as plt
from PIL import Image
import os
```

## Read the annotation CSV file and find the number of unique object classes in the images

```
#reading of annotation file
annotation_file=pd.read_csv('ques1_annotation.csv')
annotation_file
```

| | filename | class | x | y | width | height |
|---|---|---|---|---|---|---|
| **0** | car_tent.jpg | tent | 0 | 392 | 198 | 148 |
| **1** | car_tent.jpg | car | 294 | 372 | 375 | 151 |
| **2** | dog.jpg | truck | 473 | 71 | 216 | 101 |
| **3** | dog.jpg | dog | 134 | 219 | 179 | 324 |
| **4** | dog.jpg | bicycle | 125 | 129 | 446 | 293 |

```
# finding of no. of unique objects class in two images
unique_object=annotation_file['class'].unique()
print('unique objects are:-\n',unique_object)
no_of_objects=len(unique_object)
print('no of unique objects are:-\n',no_of_objects)
```

```
unique objects are:-
 ['tent' 'car' 'truck' 'dog' 'bicycle']
no of unique objects are:-
 5
```

## Extract and save all objects from the images based on their positions

```
images='/content'
#iterating through annotation row-wise
for index,row in annotation_file.iterrows():
  #storing filenames in image_id
  image_id=row['filename']
  #storing class data in objects
  object=row['class']

  x,y,width,height=row['x'],row['y'],row['width'],row['height']
  x_min,x_max=x,x+width
  y_min,y_max=y,y+height
  #joining image path
  image_path=os.path.join(images,image_id)
  image=Image.open(image_path)
  #function to crop image
  object_image=image.crop((x_min,y_min,x_max,y_max))
  #function image.save to combine each cropped image present in object_image with a unique index number and then save it as png extensi
  # f here denotes formatted string
  object_image.save(f'{object_image}_{index}.png')

print('objects extracted and saved')
```

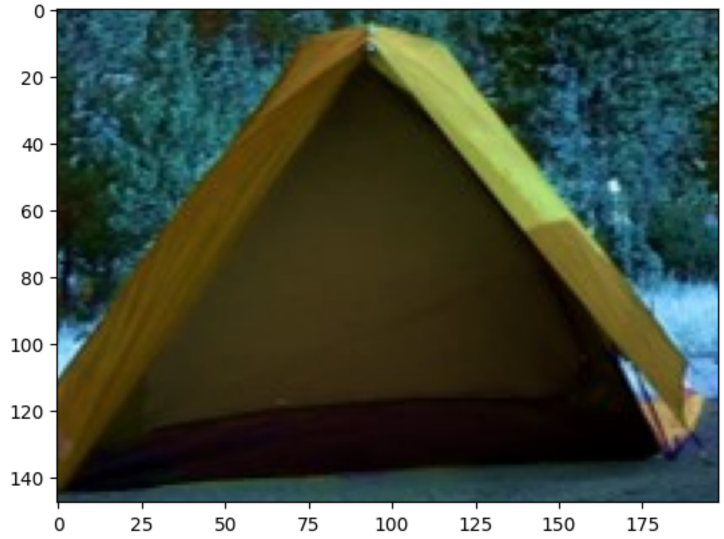
```
objects extracted and saved
```

## Display the "tent" object from "car_tent.jpg" and the "bicycle" object from "dog.jpg".

```
# reading of car_tent.jpg image
image1=cv2.imread('car_tent.jpg')

# croping of tent from car_tent.jpg image
tent=image1[392:540,0:198]
print('tent object is \n',plt.imshow(tent))
```

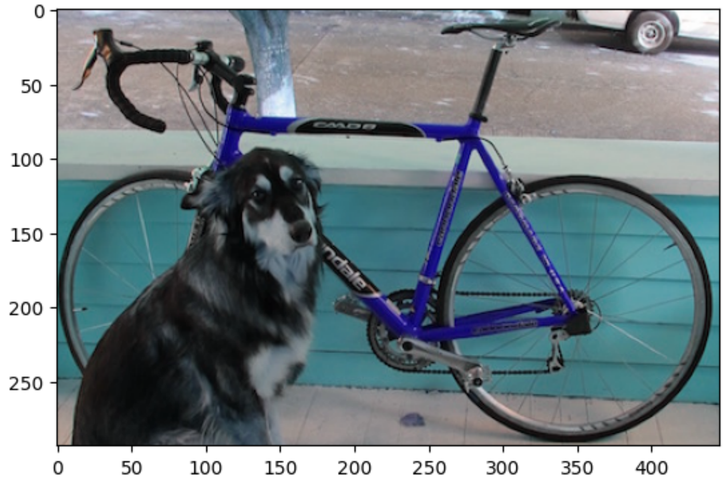
```
tent object is
 AxesImage(size=(148, 198))
```



```
# reading of dog.jpg image
image2=cv2.imread('dog.jpg')

# croping bycycle from dog.jpg image
bycycle=image2[129:422,125:571]
print('bycycle object is \n',plt.imshow(bycycle))
```

```
bycycle object is
 AxesImage(size=(293, 446))
```



## Read and merge the data files "threshold_data.csv" and "segment_data.csv".n

```
import pandas as pd

# Read the two CSV files into dataframes
data1 = pd.read_csv('threshold_data.csv')
data2 = pd.read_csv('segment_data.csv')

# Merge the dataframes based on the "Code" column
dframe= pd.merge(data1, data2, on='Code')
dframe
```

| | Code | Time | Speed | Road | Direction | Mileage |
|---|---|---|---|---|---|---|
| **0** | 5032426 | 0 | 55.00 | I-235 | EB | 12.937880 |
| **1** | 5032426 | 1 | 43.00 | I-235 | EB | 12.937880 |
| **2** | 5032426 | 2 | 42.75 | I-235 | EB | 12.937880 |
| **3** | 5032426 | 3 | 53.00 | I-235 | EB | 12.937880 |
| **4** | 5032426 | 100 | 46.00 | I-235 | EB | 12.937880 |
| **...** | ... | ... | ... | ... | ... | ... |
| **6809** | 5033376 | 2203 | 59.00 | I-235 | EB | 1.277982 |
| **6810** | 5033376 | 2300 | 55.75 | I-235 | EB | 1.277982 |
| **6811** | 5033376 | 2301 | 57.00 | I-235 | EB | 1.277982 |
| **6812** | 5033376 | 2302 | 44.00 | I-235 | EB | 1.277982 |
| **6813** | 5033376 | 2303 | 49.00 | I-235 | EB | 1.277982 |

6814 rows × 6 columns

## Modify threshold speed values in the merged dataframe.

```
# Clip the "Threshold Speed" column to a minimum value of 0 and a maximum value of 45
dframe['Speed'] = dframe['Speed'].clip(lower=0, upper=45)

# Display the modified merged dataframe
dframe
```

| | Code | Time | Speed | Road | Direction | Mileage |
|---|---|---|---|---|---|---|
| **0** | 5032426 | 0 | 45.00 | I-235 | EB | 12.937880 |
| **1** | 5032426 | 1 | 43.00 | I-235 | EB | 12.937880 |
| **2** | 5032426 | 2 | 42.75 | I-235 | EB | 12.937880 |
| **3** | 5032426 | 3 | 45.00 | I-235 | EB | 12.937880 |
| **4** | 5032426 | 100 | 45.00 | I-235 | EB | 12.937880 |
| **...** | ... | ... | ... | ... | ... | ... |
| **6809** | 5033376 | 2203 | 45.00 | I-235 | EB | 1.277982 |
| **6810** | 5033376 | 2300 | 45.00 | I-235 | EB | 1.277982 |
| **6811** | 5033376 | 2301 | 45.00 | I-235 | EB | 1.277982 |
| **6812** | 5033376 | 2302 | 44.00 | I-235 | EB | 1.277982 |
| **6813** | 5033376 | 2303 | 45.00 | I-235 | EB | 1.277982 |

6814 rows × 6 columns

## Filter the merged dataframe for Road = ‘I-235’ and Direction = ‘WB’.

```
# Filter the dataframe for Road = 'I-235' and Direction = 'WB'
dataframe= dframe[(dframe['Road'] == 'I-235') & (dframe['Direction'] == 'WB')]
dataframe
```

| | Code | Time | Speed | Road | Direction | Mileage |
|---|---|---|---|---|---|---|
| **96** | 5032428 | 0 | 45.0 | I-235 | WB | 0.676521 |
| **97** | 5032428 | 1 | 45.0 | I-235 | WB | 0.676521 |
| **98** | 5032428 | 2 | 45.0 | I-235 | WB | 0.676521 |
| **99** | 5032428 | 3 | 45.0 | I-235 | WB | 0.676521 |
| **100** | 5032428 | 100 | 45.0 | I-235 | WB | 0.676521 |
| **...** | ... | ... | ... | ... | ... | ... |
| **6617** | 5033373 | 2203 | 45.0 | I-235 | WB | 12.491597 |
| **6618** | 5033373 | 2300 | 35.5 | I-235 | WB | 12.491597 |
| **6619** | 5033373 | 2301 | 45.0 | I-235 | WB | 12.491597 |
| **6620** | 5033373 | 2302 | 45.0 | I-235 | WB | 12.491597 |
| **6621** | 5033373 | 2303 | 45.0 | I-235 | WB | 12.491597 |

3359 rows × 6 columns

## Pivot the filtered dataframe

```
# inserting of Distance column on dataframe by the help of multiplying  Time and Threshold_speed
pivoted = dframe.pivot_table(index='Mileage', columns='Time', values='Speed')

# Sort the pivot table based on the distance (index)
pivoted = pivoted.sort_index()

# Display the sorted pivot table
pivoted
```

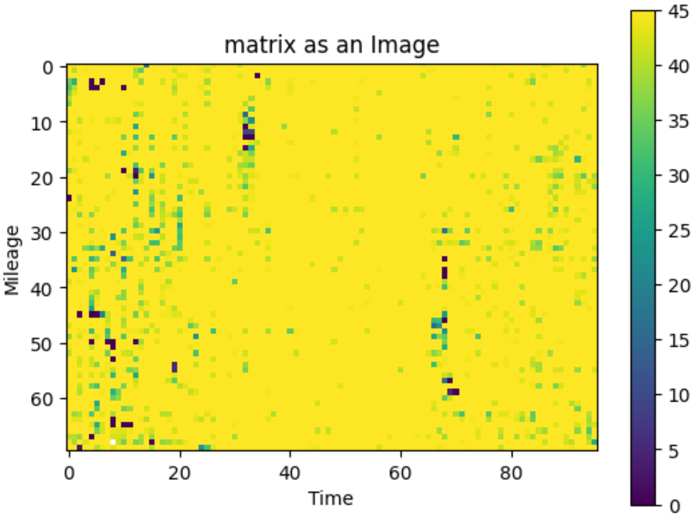
| Time | 0 | 1 | 2 | 3 | 100 | 101 | 102 | 103 | 200 | 201 | ... | 2102 | 2103 | 2200 | 2201 | 2202 | 2203 | 2300 | 2301 | 2302 | 2303 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mileage** | | | | | | | | | | | | | | | | | | | | | |
| **0.000000** | 44.375 | 44.0 | 45.0 | 45.00 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | ... | 42.5 | 44.0 | 45.00 | 45.0 | 45.0 | 45.0 | 45.0 | 38.5 | 45.0 | 45.0 |
| **0.509586** | 45.000 | 40.0 | 45.0 | 44.25 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | ... | 45.0 | 45.0 | 45.00 | 45.0 | 42.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 |
| **0.676521** | 45.000 | 45.0 | 45.0 | 45.00 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | ... | 43.0 | 45.0 | 45.00 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 |
| **0.891268** | 35.000 | 29.0 | 45.0 | 45.00 | 0.0 | 45.0 | 0.0 | 45.0 | 45.0 | 45.0 | ... | 45.0 | 45.0 | 45.00 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 42.0 | 45.0 |
| **1.277982** | 33.000 | 40.0 | 45.0 | 45.00 | 0.0 | 0.0 | 45.0 | 45.0 | 45.0 | 45.0 | ... | 45.0 | 45.0 | 45.00 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 44.0 | 45.0 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **13.112941** | 45.000 | 45.0 | 45.0 | 45.00 | 42.5 | 28.0 | 42.0 | 45.0 | 0.0 | 45.0 | ... | 45.0 | 45.0 | 42.75 | 45.0 | 45.0 | 45.0 | 42.5 | 45.0 | 40.0 | 42.0 |
| **13.456991** | 45.000 | 45.0 | 45.0 | 45.00 | 45.0 | 36.0 | 42.0 | 45.0 | 43.5 | 43.0 | ... | 38.5 | 45.0 | 45.00 | 45.0 | 45.0 | 45.0 | 37.0 | 45.0 | 33.0 | 45.0 |
| **13.656730** | 40.000 | 40.0 | 38.0 | 45.00 | 0.0 | 45.0 | 45.0 | 45.0 | 42.0 | 42.0 | ... | 45.0 | 45.0 | 45.00 | 45.0 | 42.0 | 45.0 | 45.0 | 45.0 | 39.0 | 45.0 |
| **13.960500** | 45.000 | 39.0 | 45.0 | 42.50 | 45.0 | 45.0 | 45.0 | 45.0 | NaN | 41.0 | ... | 41.0 | 45.0 | 45.00 | 45.0 | 42.0 | 40.0 | 45.0 | 45.0 | 41.0 | 28.0 |
| **14.152948** | 45.000 | 45.0 | 2.0 | 45.00 | 45.0 | 40.0 | 44.0 | 45.0 | 43.0 | 45.0 | ... | 45.0 | 45.0 | 45.00 | 45.0 | 45.0 | 44.0 | 45.0 | 45.0 | 45.0 | 45.0 |

70 rows × 96 columns

## Convert the pivoted dataframe into a matrix and plot it as an image.

```
# Convert pivot DataFrame to a matrix
matrix = pivoted.values

# Plot the matrix as an image
plt.imshow(matrix, cmap='viridis', interpolation='nearest')
plt.colorbar()
plt.title('matrix as an Image')
plt.xlabel('Time')
plt.ylabel('Mileage')
plt.show()
```



```
### Apply medianBlur filter and plot the denoised image
```

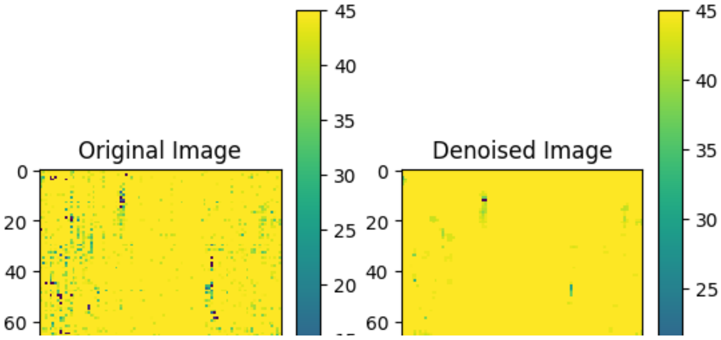
### Apply medianBlur filter and plot the denoised image

```
# Convert pivot DataFrame to a matrix of float32 type
matrix = pivoted.values.astype(np.float32)

# Apply medianBlur filter with kernel window size 3
denoised_matrix = cv2.medianBlur(matrix, 3)

# Plot the denoised matrix as an image
plt.subplot(121)
plt.imshow(matrix, cmap='viridis', interpolation='nearest')
plt.colorbar()
plt.title('Original Image')

plt.subplot(122)
plt.imshow(denoised_matrix, cmap='viridis', interpolation='nearest')
plt.colorbar()
plt.title('Denoised Image')
plt.show()
```


Original Image
Denoised Image