Task 4 P: Computer Vision

Introduction

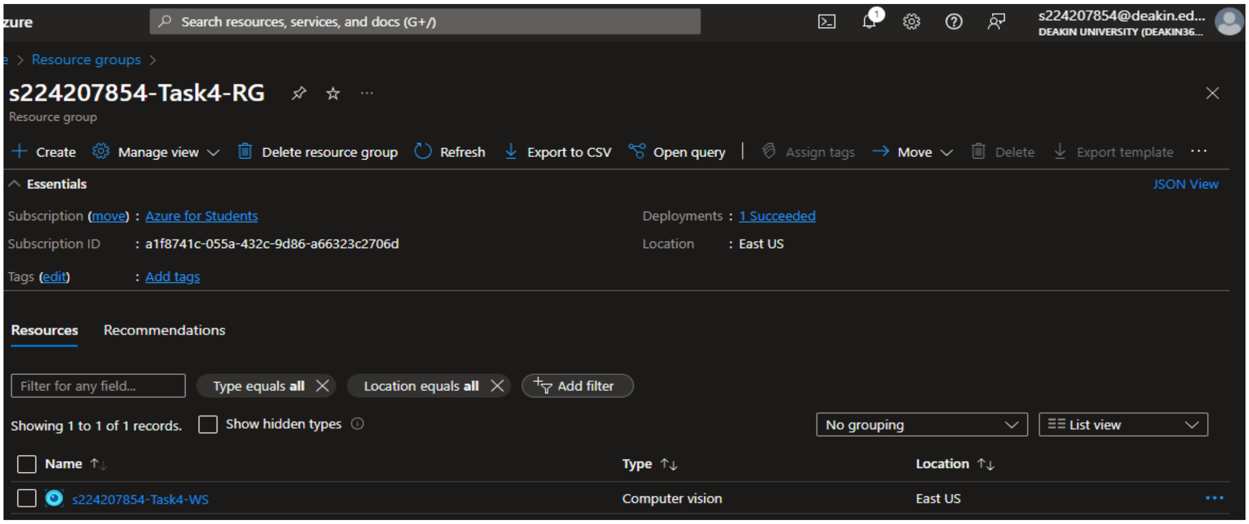
Computer vision is a field of computer science and AI that teaches computers to identify and comprehend objects and people in images and videos. It uses artificial intelligence (AI) and machine learning (ML) to process data from devices like smartphones, security systems, and traffic cameras to identify objects, classify, recommend, monitor, and detect. Some technique computer vision includes:

- Image processing and transformation
- Feature extraction and description
- Deep learning for computer vision
- Image segmentation
- 3D reconstruction
- Objects detection and recognition

Pre-requisites

In this case study we will be using Azure computer vision service using Azure Cognitive Services SDK. Before start coding will be doing some set-ups:

1. Resource Group set-up:



s224207854-Task4-RG

Resource group

Subscription (move) : Azure for Students

Subscription ID : a1f8741c-055a-432c-9d86-a66323c2706d

Tags (edit) : Add tags

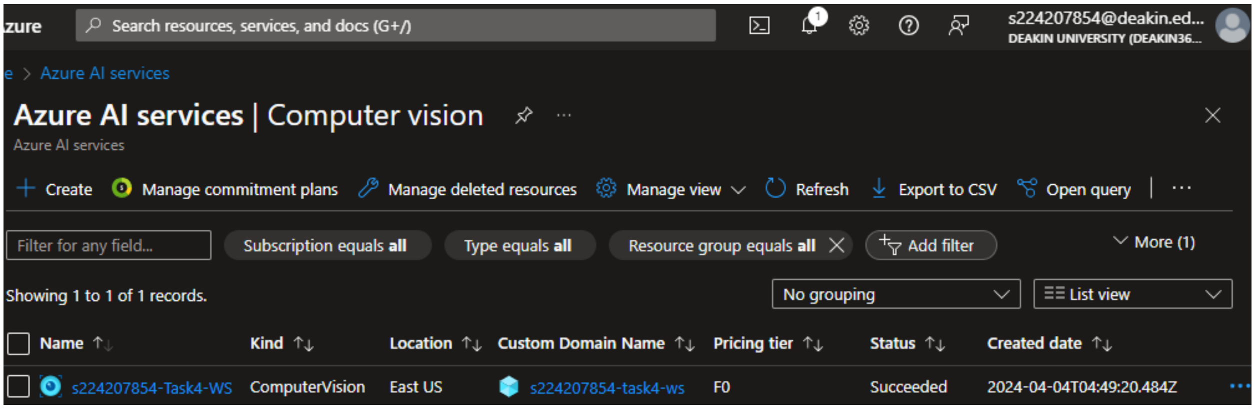
Deployments : 1 Succeeded

Location : East US

Showing 1 to 1 of 1 records.

Name	Type	Location
s224207854-Task4-WS	Computer vision	East US

2. Creating computer vision service in Azure AI services



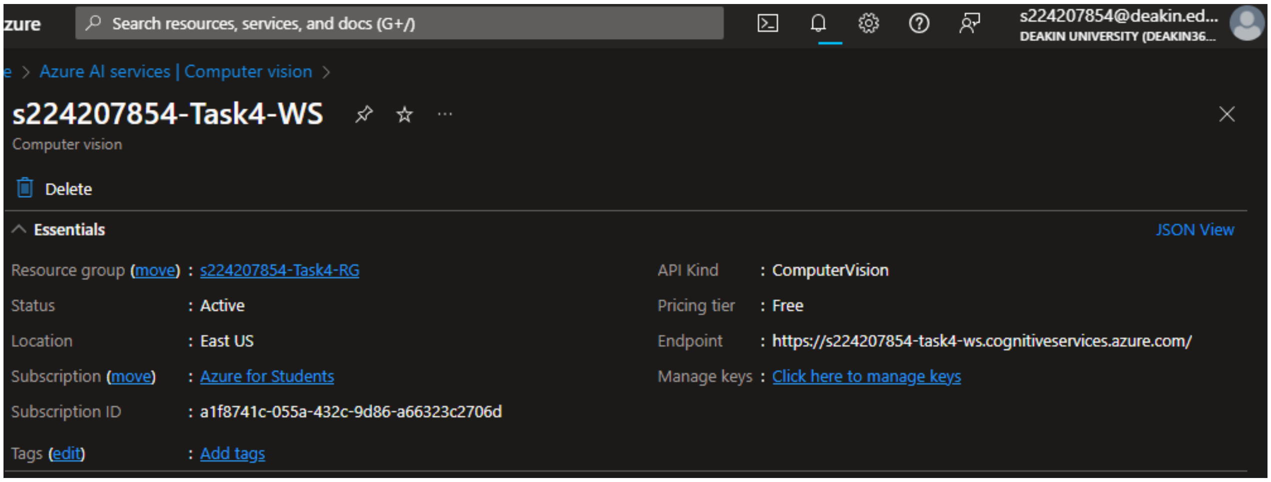
Azure AI services | Computer vision

Azure AI services

Showing 1 to 1 of 1 records.

Name	Kind	Location	Custom Domain Name	Pricing tier	Status	Created date
s224207854-Task4-WS	ComputerVision	East US	s224207854-task4-ws	F0	Succeeded	2024-04-04T04:49:20.484Z

3. In Azure AI service we can visit our Computer Vision


zure
Search resources, services, and docs (G+/)
s224207854@deakin.ed...
DEAKIN UNIVERSITY (DEAKIN36...
e > Azure AI services | Computer vision >
Delete
Essentials
JSON View

s224207854-Task4-WS

Computer vision

Resource group (move) : s224207854-Task4-RG

Status : Active

Location : East US

Subscription (move) : Azure for Students

Subscription ID : a1f8741c-055a-432c-9d86-a66323c2706d

Tags (edit) : Add tags

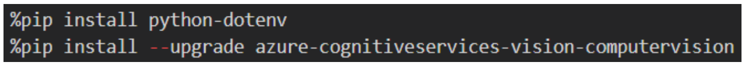
API Kind : ComputerVision

Pricing tier : Free

Endpoint : https://s224207854-task4-ws.cognitiveservices.azure.com/

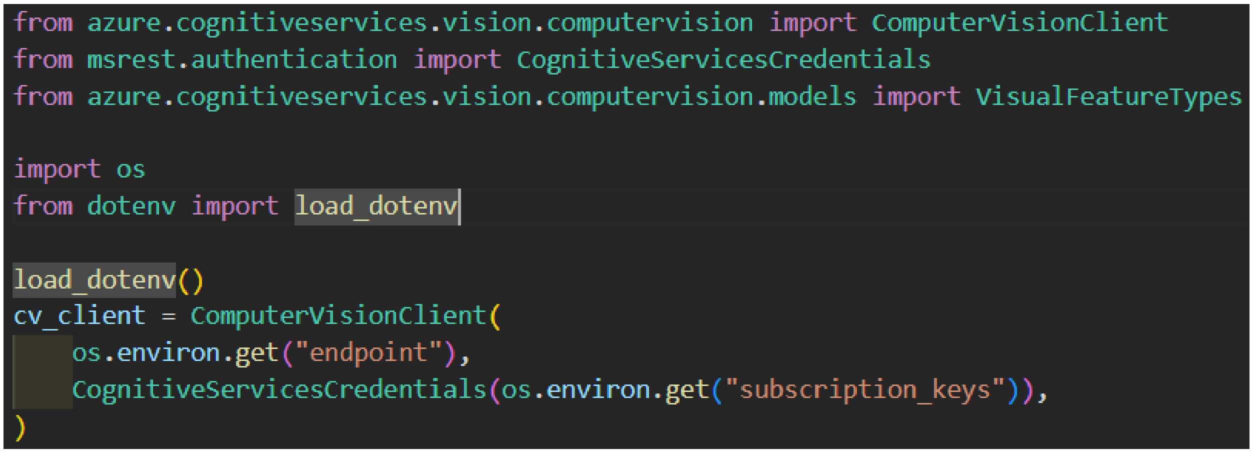
Manage keys : Click here to manage keys

4. Installing Azure SDK using pip



```
%pip install python-dotenv
%pip install --upgrade azure-cognitiveservices-vision-computervision
```

5. Setting up Azure Computer Vision service client using subscription key and endpoint



```
from azure.cognitiveservices.vision.computervision import ComputerVisionClient
from msrest.authentication import CognitiveServicesCredentials
from azure.cognitiveservices.vision.computervision.models import VisualFeatureTypes

import os
from dotenv import load_dotenv

load_dotenv()
cv_client = ComputerVisionClient(
    os.environ.get("endpoint"),
    CognitiveServicesCredentials(os.environ.get("subscription_keys")),
)
```

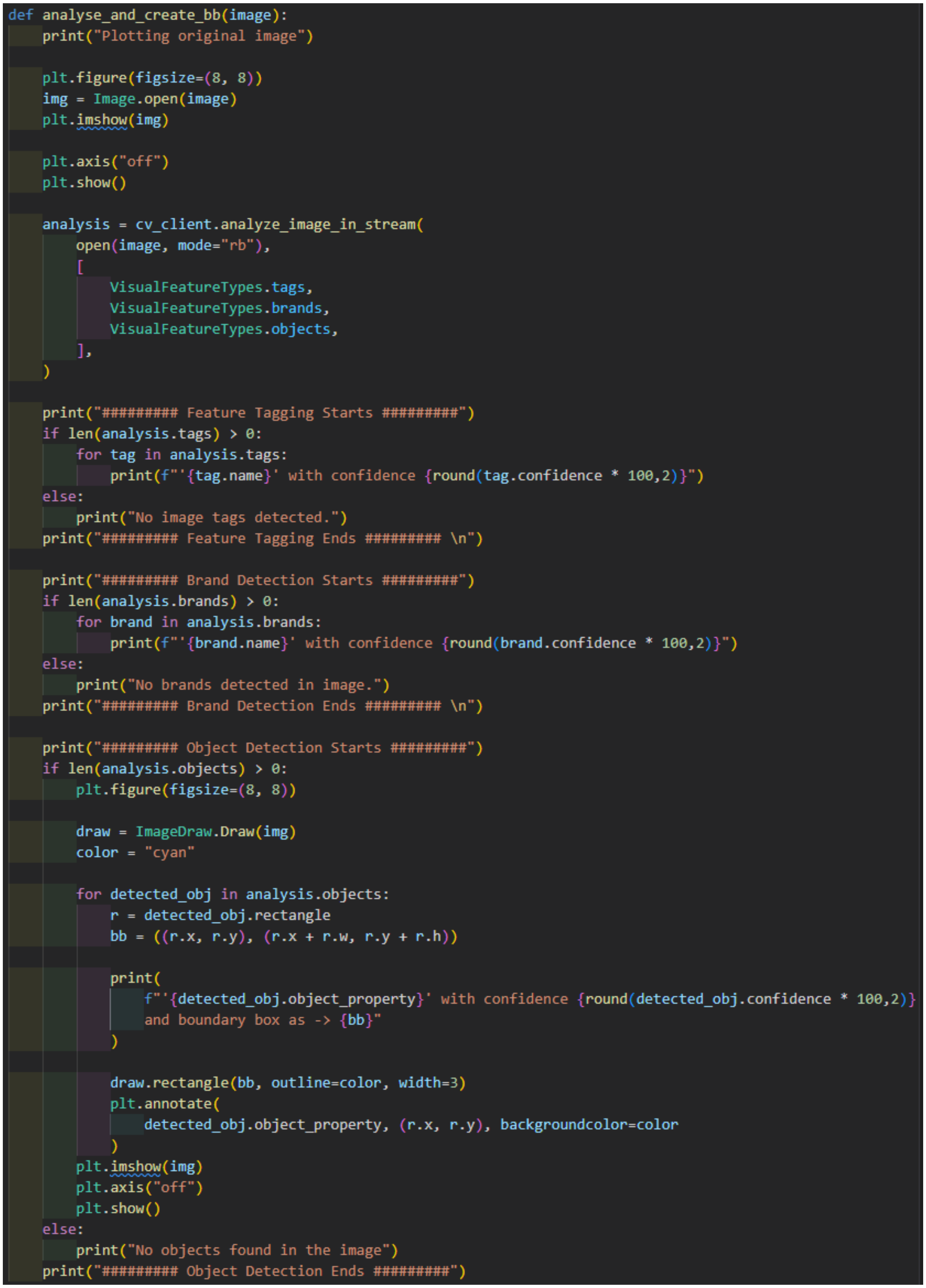
6. Once computer vision client is set-up, we can use different services provided with this client for our further analysis.

Azure Computer Vision Notebook

In our notebook we will be using azure computer vision client to analyze different images as input with visual features as ‘Tags’, ‘Brands’ and ‘Objects’. On the basis of these different features, we will be providing output with different data.

In the below code snippet, 3 APIs have been invoked, i.e.:

- Feature tagging, where different tags are applied based on a set of thousands of recognizable objects.
- Object detection, where commons objects are detected and bounding box is created over the coordinates.
- Brand detection, where logos are identified from the image.

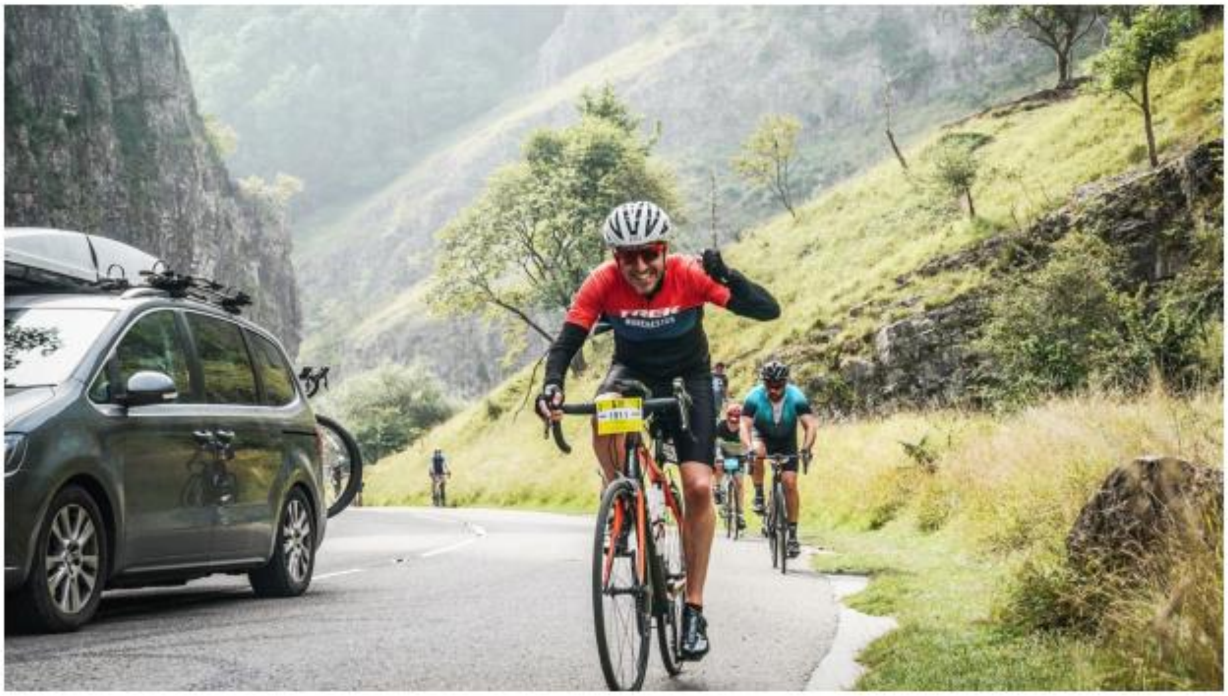


```
def analyse_and_create_bb(image):
    print("Plotting original image")

    plt.figure(figsize=(8, 8))
    img = Image.open(image)
    plt.imshow(img)

    plt.axis("off")
    plt.show()

    analysis = cv_client.analyze_image_in_stream(
        open(image, mode="rb"),
        [
            VisualFeatureTypes.tags,
            VisualFeatureTypes.brands,
            VisualFeatureTypes.objects,
        ],
    )

    print("######### Feature Tagging Starts #########")
    if len(analysis.tags) > 0:
        for tag in analysis.tags:
            print(f"'{tag.name}' with confidence {round(tag.confidence * 100,2)}")
    else:
        print("No image tags detected.")
    print("######### Feature Tagging Ends ######### \n")

    print("######### Brand Detection Starts #########")
    if len(analysis.brands) > 0:
        for brand in analysis.brands:
            print(f"'{brand.name}' with confidence {round(brand.confidence * 100,2)}")
    else:
        print("No brands detected in image.")
    print("######### Brand Detection Ends ######### \n")

    print("######### Object Detection Starts #########")
    if len(analysis.objects) > 0:
        plt.figure(figsize=(8, 8))

        draw = ImageDraw.Draw(img)
        color = "cyan"

        for detected_obj in analysis.objects:
            r = detected_obj.rectangle
            bb = ((r.x, r.y), (r.x + r.w, r.y + r.h))

            print(
                f"'{detected_obj.object_property}' with confidence {round(detected_obj.confidence * 100,2)}
                and boundary box as -> {bb}"
            )

            draw.rectangle(bb, outline=color, width=3)
            plt.annotate(
                detected_obj.object_property, (r.x, r.y), backgroundcolor=color
            )
        plt.imshow(img)
        plt.axis("off")
        plt.show()
    else:
        print("No objects found in the image")
    print("######### Object Detection Ends #########")
```

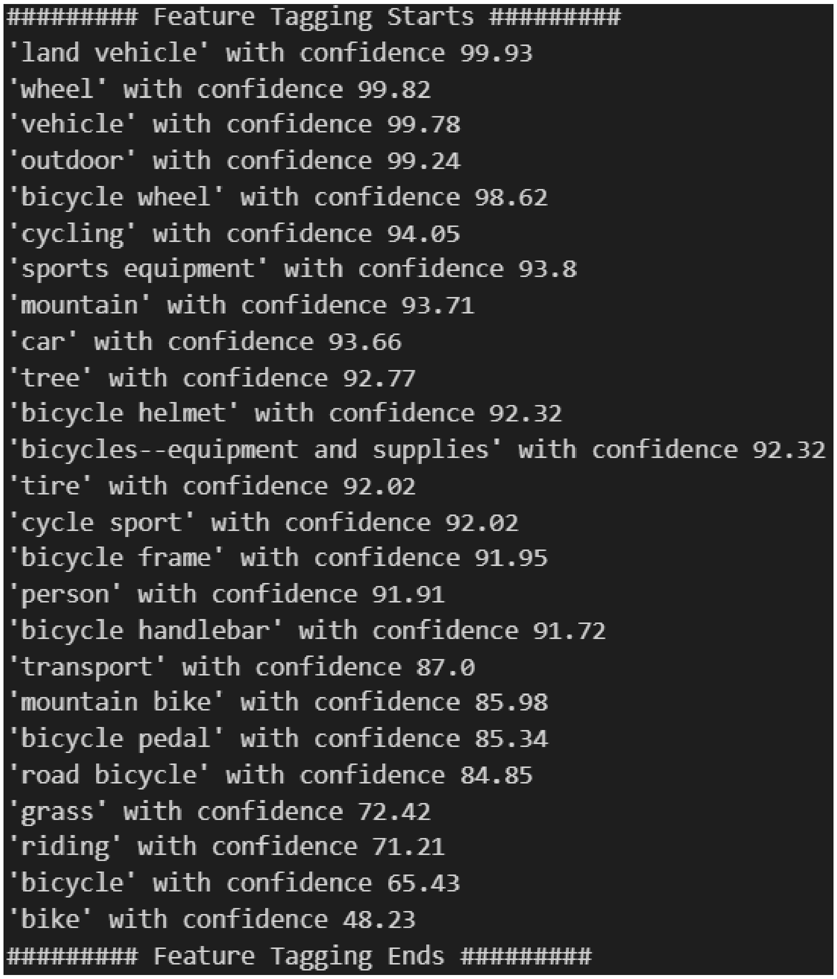
Testing

Image Test-1

- Plotting Original Image

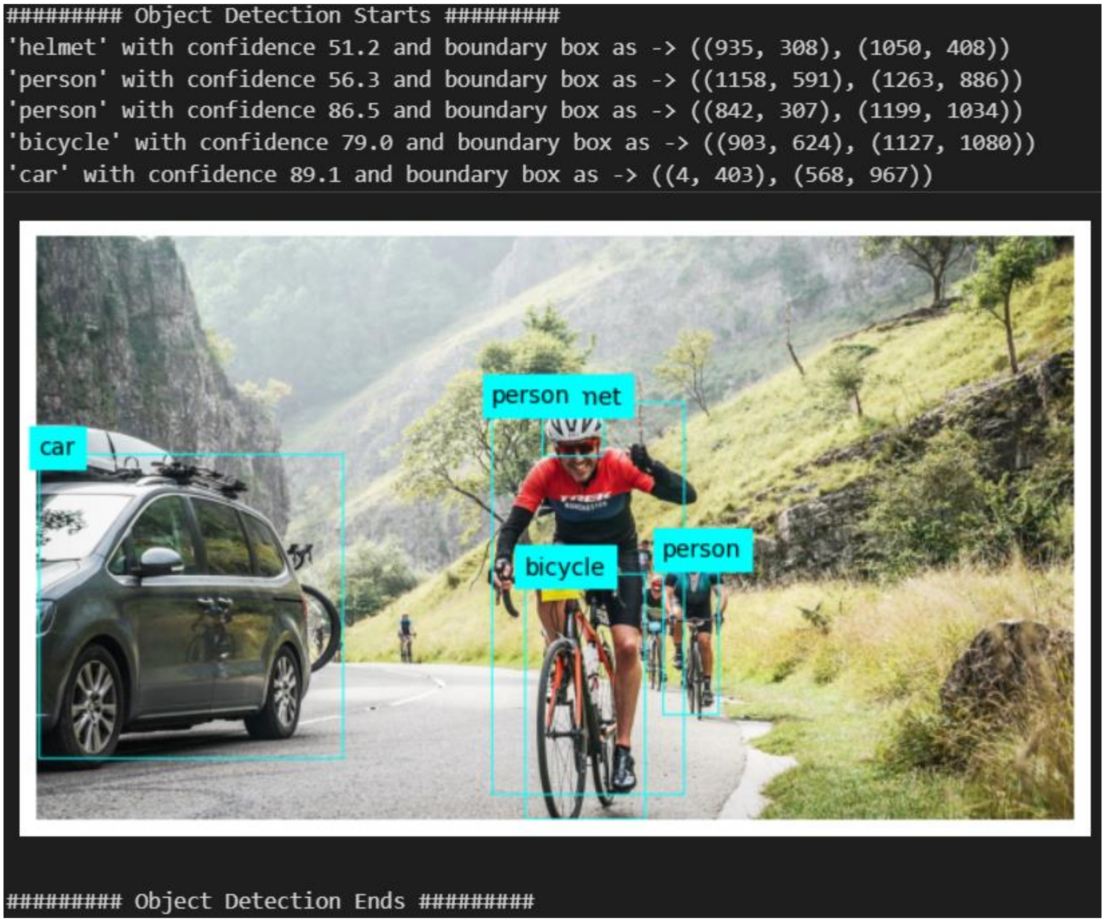


- Feature Tagging:



```
######### Feature Tagging Starts #########
'land vehicle' with confidence 99.93
'wheel' with confidence 99.82
'vehicle' with confidence 99.78
'outdoor' with confidence 99.24
'bicycle wheel' with confidence 98.62
'cycling' with confidence 94.05
'sports equipment' with confidence 93.8
'mountain' with confidence 93.71
'car' with confidence 93.66
'tree' with confidence 92.77
'bicycle helmet' with confidence 92.32
'bicycles--equipment and supplies' with confidence 92.32
'tire' with confidence 92.02
'cycle sport' with confidence 92.02
'bicycle frame' with confidence 91.95
'person' with confidence 91.91
'bicycle handlebar' with confidence 91.72
'transport' with confidence 87.0
'mountain bike' with confidence 85.98
'bicycle pedal' with confidence 85.34
'road bicycle' with confidence 84.85
'grass' with confidence 72.42
'riding' with confidence 71.21
'bicycle' with confidence 65.43
'bike' with confidence 48.23
######### Feature Tagging Ends #########
```

- Object Detection:

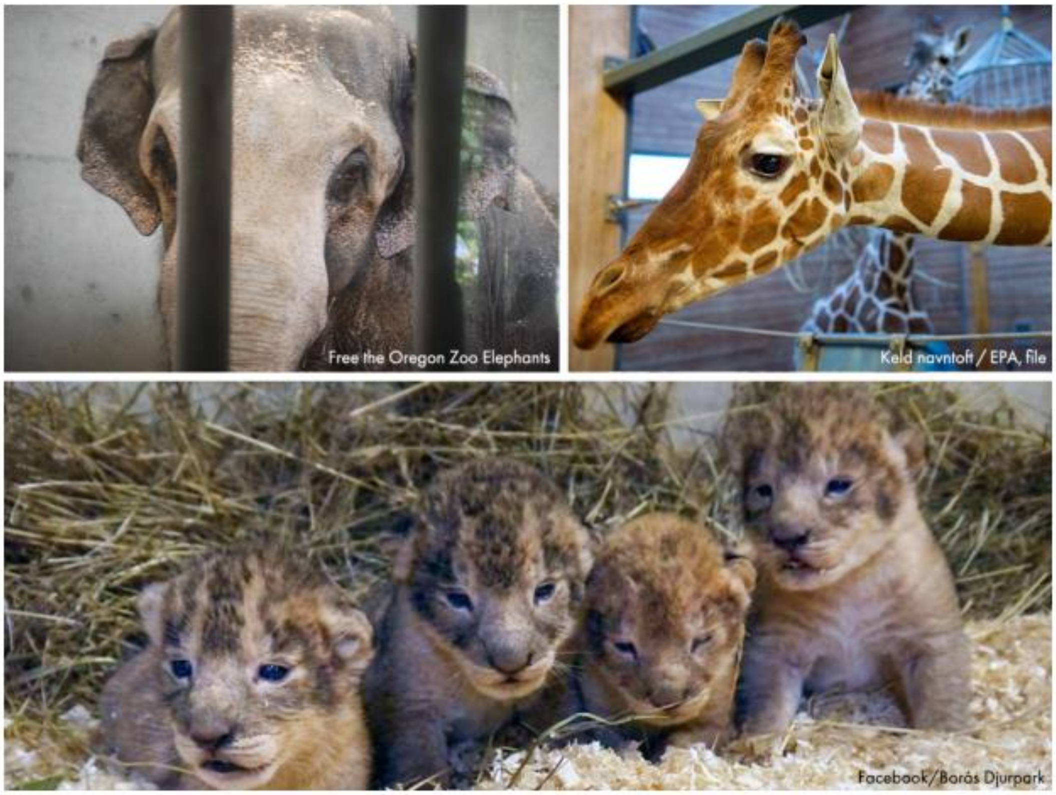


```
######### Object Detection Starts #########
'helmet' with confidence 51.2 and boundary box as -> ((935, 308), (1050, 408))
'person' with confidence 56.3 and boundary box as -> ((1158, 591), (1263, 886))
'person' with confidence 86.5 and boundary box as -> ((842, 307), (1199, 1034))
'bicycle' with confidence 79.0 and boundary box as -> ((903, 624), (1127, 1080))
'car' with confidence 89.1 and boundary box as -> ((4, 403), (568, 967))
```

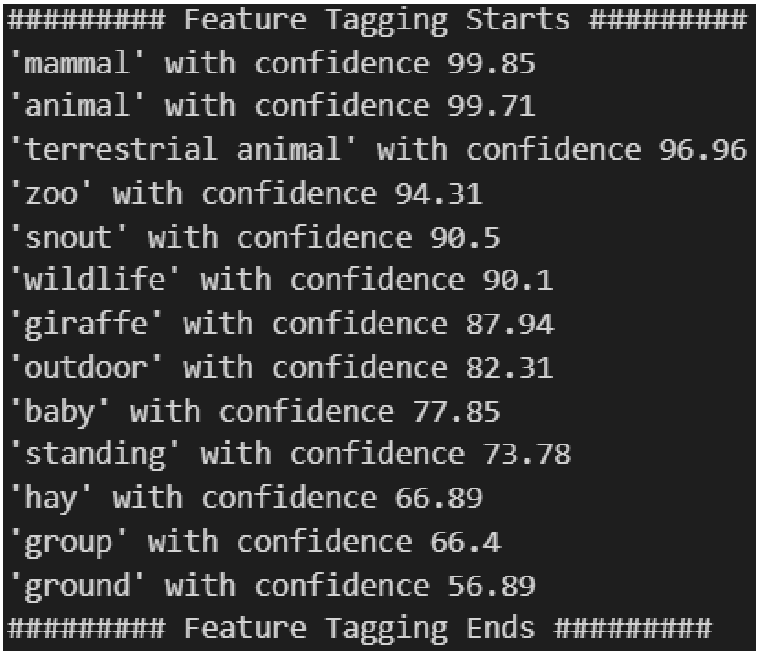
```
######### Object Detection Ends #########
```

Image Test-2

- Plotting Original Image

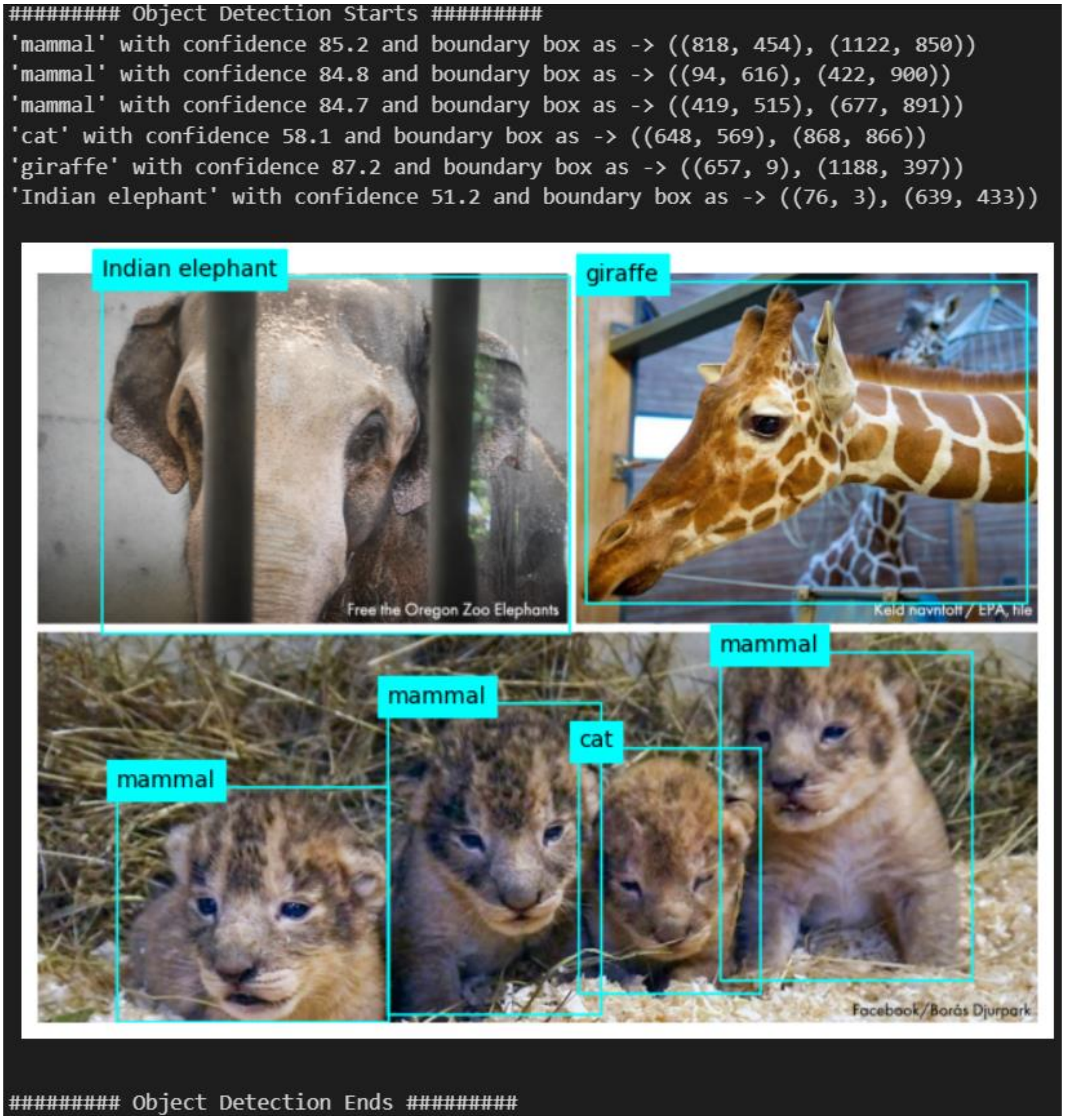


- Feature Tagging:



```
######### Feature Tagging Starts #########
'mammal' with confidence 99.85
'animal' with confidence 99.71
'terrestrial animal' with confidence 96.96
'zoo' with confidence 94.31
'snout' with confidence 90.5
'wildlife' with confidence 90.1
'giraffe' with confidence 87.94
'outdoor' with confidence 82.31
'baby' with confidence 77.85
'standing' with confidence 73.78
'hay' with confidence 66.89
'group' with confidence 66.4
'ground' with confidence 56.89
######### Feature Tagging Ends #########
```

- Object Detection:

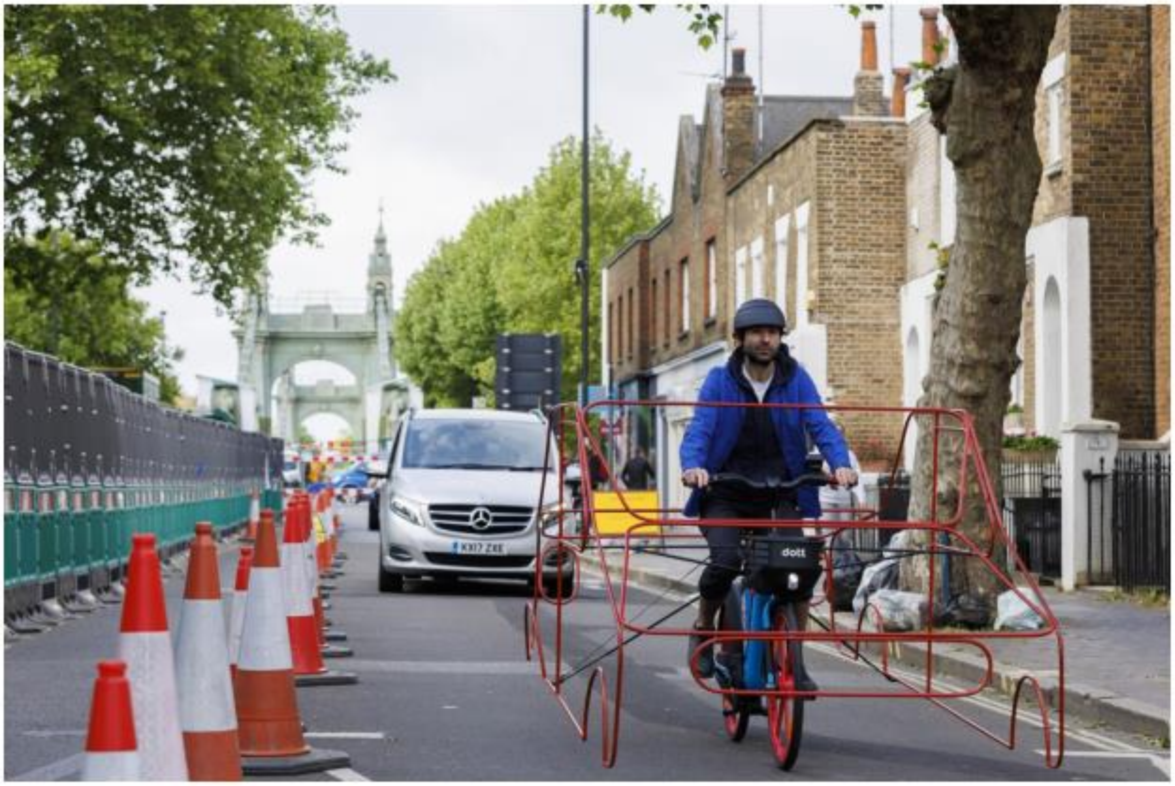


```
######### Object Detection Starts #########
'mammal' with confidence 85.2 and boundary box as -> ((818, 454), (1122, 850))
'mammal' with confidence 84.8 and boundary box as -> ((94, 616), (422, 900))
'mammal' with confidence 84.7 and boundary box as -> ((419, 515), (677, 891))
'cat' with confidence 58.1 and boundary box as -> ((648, 569), (868, 866))
'giraffe' with confidence 87.2 and boundary box as -> ((657, 9), (1188, 397))
'Indian elephant' with confidence 51.2 and boundary box as -> ((76, 3), (639, 433))
```

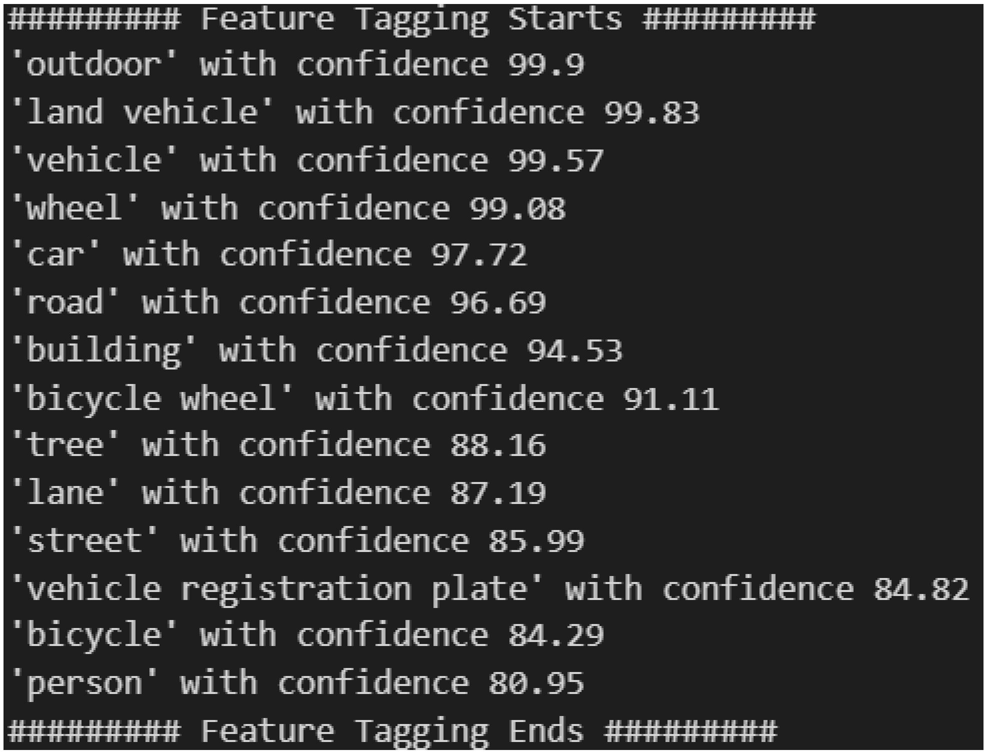
```
######### Object Detection Ends #########
```

Image Test-3

- Plotting Original Image

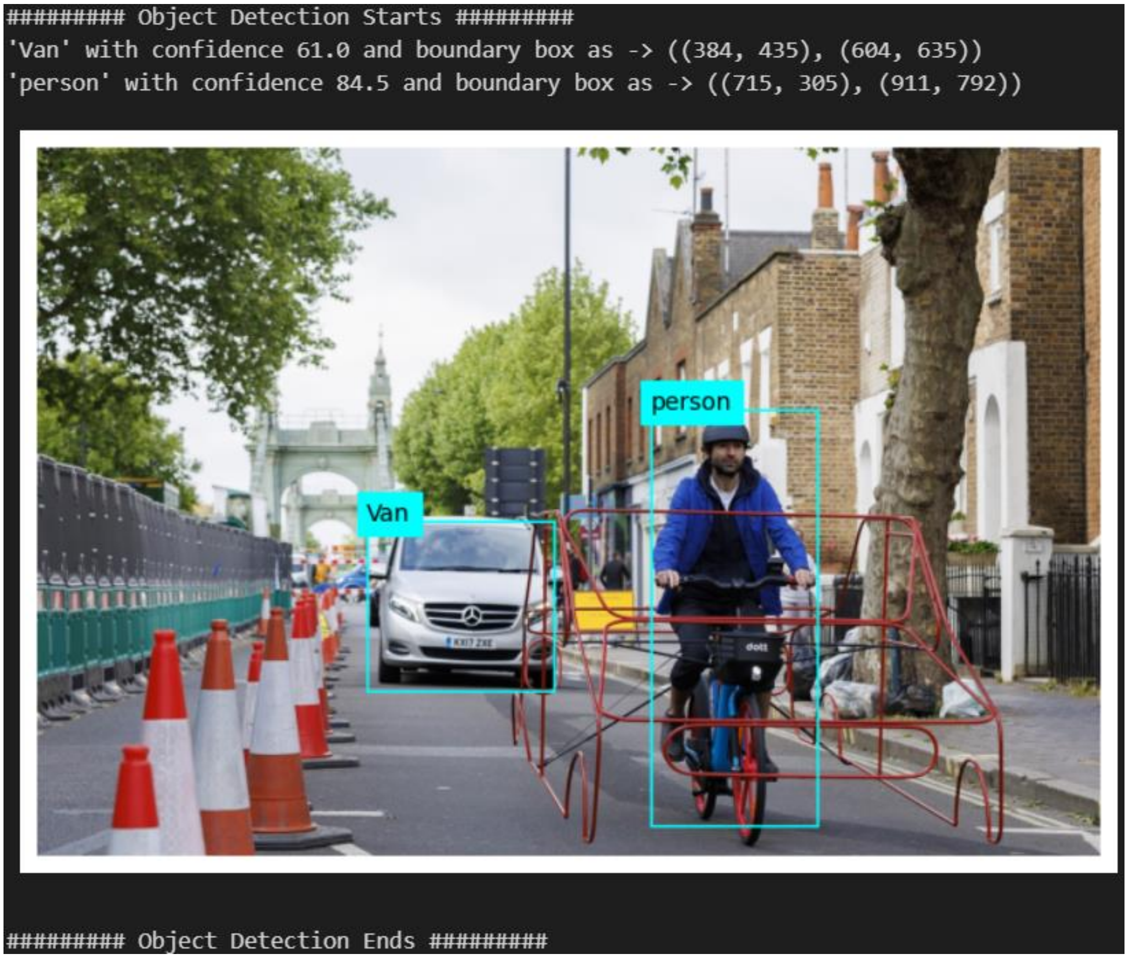


- Feature Tagging:



```
######### Feature Tagging Starts #########
'outdoor' with confidence 99.9
'land vehicle' with confidence 99.83
'vehicle' with confidence 99.57
'wheel' with confidence 99.08
'car' with confidence 97.72
'road' with confidence 96.69
'building' with confidence 94.53
'bicycle wheel' with confidence 91.11
'tree' with confidence 88.16
'lane' with confidence 87.19
'street' with confidence 85.99
'vehicle registration plate' with confidence 84.82
'bicycle' with confidence 84.29
'person' with confidence 80.95
######### Feature Tagging Ends #########
```

- Object Detection:

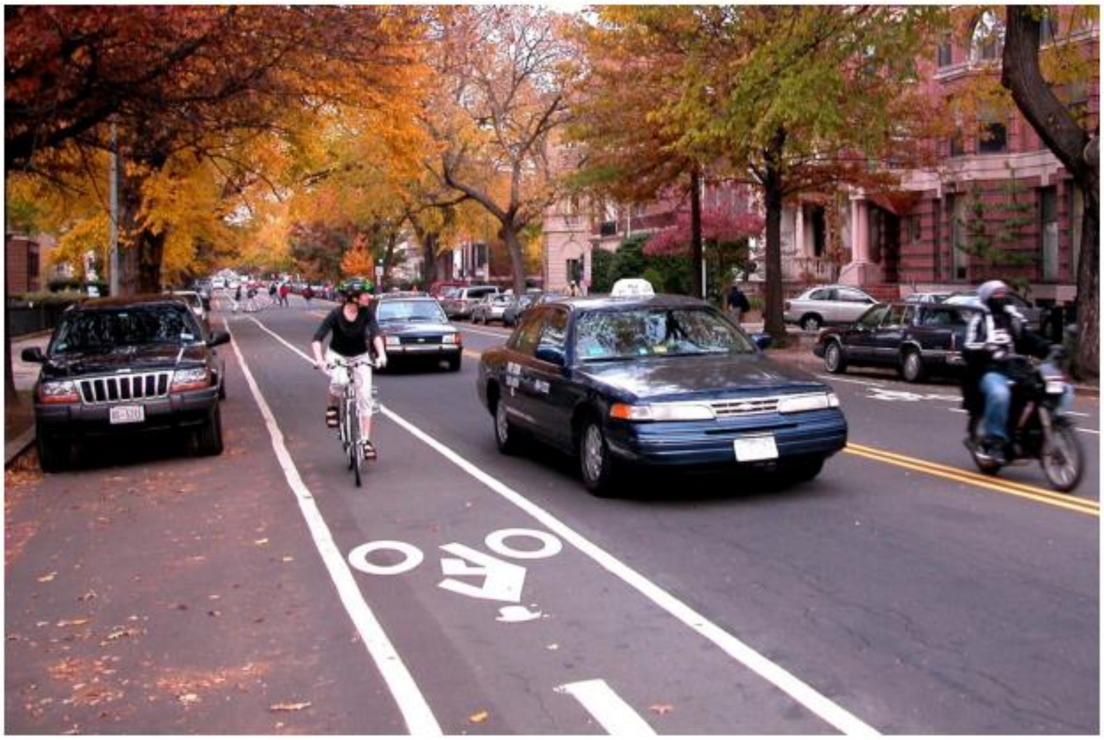


```
######### Object Detection Starts #########
'Van' with confidence 61.0 and boundary box as -> ((384, 435), (604, 635))
'person' with confidence 84.5 and boundary box as -> ((715, 305), (911, 792))
```

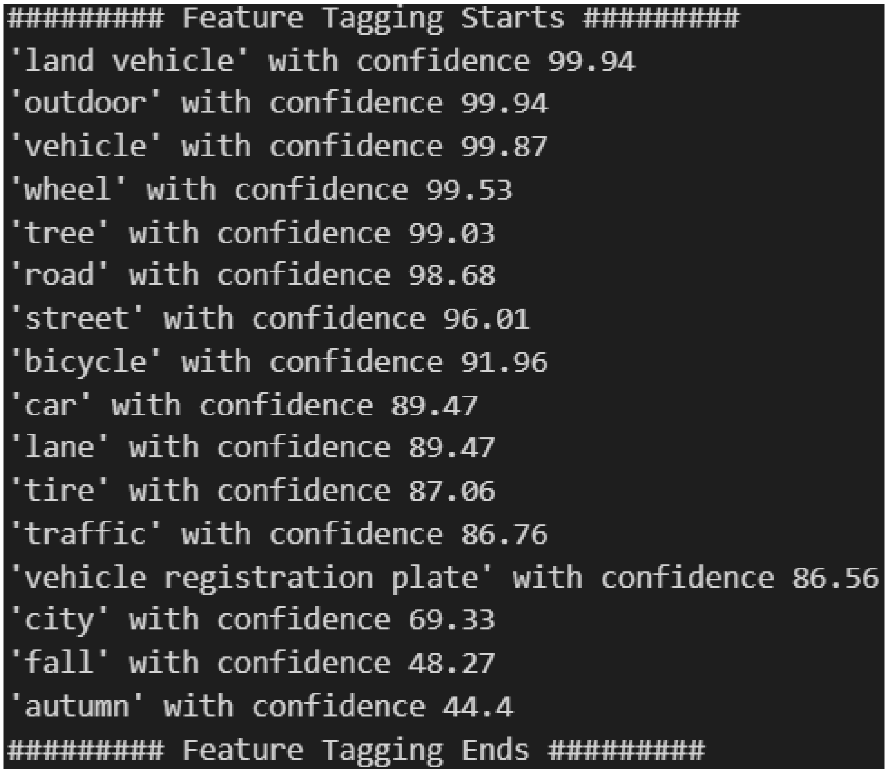
```
######### Object Detection Ends #########
```

Image Test-4

- Plotting Original Image

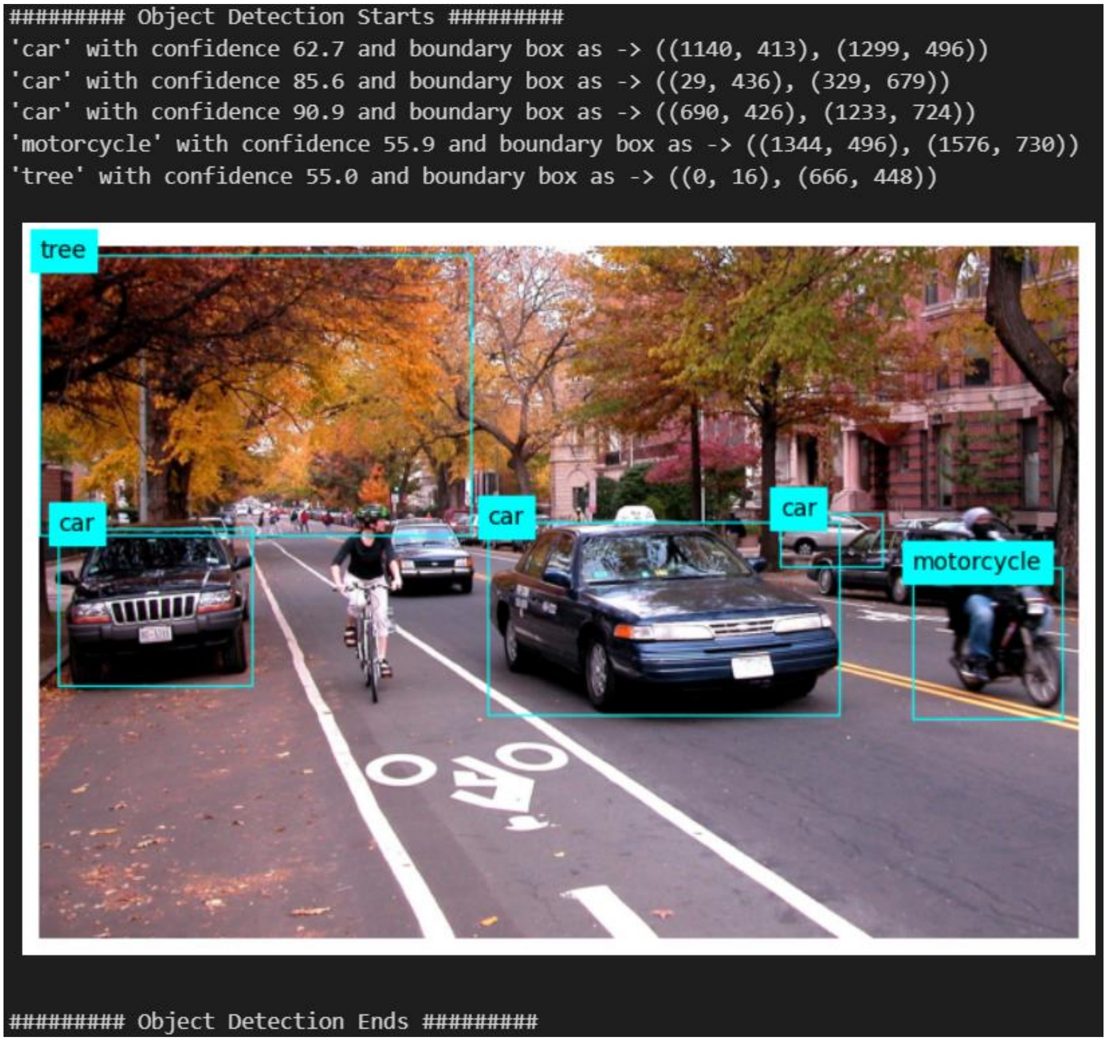


- Feature Tagging:



```
######### Feature Tagging Starts #########
'land vehicle' with confidence 99.94
'outdoor' with confidence 99.94
'vehicle' with confidence 99.87
'wheel' with confidence 99.53
'tree' with confidence 99.03
'road' with confidence 98.68
'street' with confidence 96.01
'bicycle' with confidence 91.96
'car' with confidence 89.47
'lane' with confidence 89.47
'tire' with confidence 87.06
'traffic' with confidence 86.76
'vehicle registration plate' with confidence 86.56
'city' with confidence 69.33
'fall' with confidence 48.27
'autumn' with confidence 44.4
######### Feature Tagging Ends #########
```

- Object Detection:



```
######### Object Detection Starts #########
'car' with confidence 62.7 and boundary box as -> ((1140, 413), (1299, 496))
'car' with confidence 85.6 and boundary box as -> ((29, 436), (329, 679))
'car' with confidence 90.9 and boundary box as -> ((690, 426), (1233, 724))
'motorcycle' with confidence 55.9 and boundary box as -> ((1344, 496), (1576, 730))
'tree' with confidence 55.0 and boundary box as -> ((0, 16), (666, 448))
```

```
######### Object Detection Ends #########
```

Summary

In this task we have learnt about computer vision and the usage of Azure with computer vision. Using pre-defined libraries and models to predict and discover the object from image.

Still there are some objects that aren't getting detected, we can make our own model for this purpose so that we can get an appropriate accuracy with higher performance.

References

- https://olympus.mygreatlearning.com/courses/109578?module_id=747612
- https://learn.microsoft.com/en-us/azure/ai-services/computer-vision/overview
- Different google surfing.