Automatic License Plate Recognition: A Machine Learning Approach

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The aim of this project is to develop an automatic License plate recognition (ALPR) program using machine learning techniques, specifically utilizing TensorFlow and Easy OCR libraries. The program will be capable of accurately detecting and recognizing number plates from images or Real Time footage.

The need for ALPR

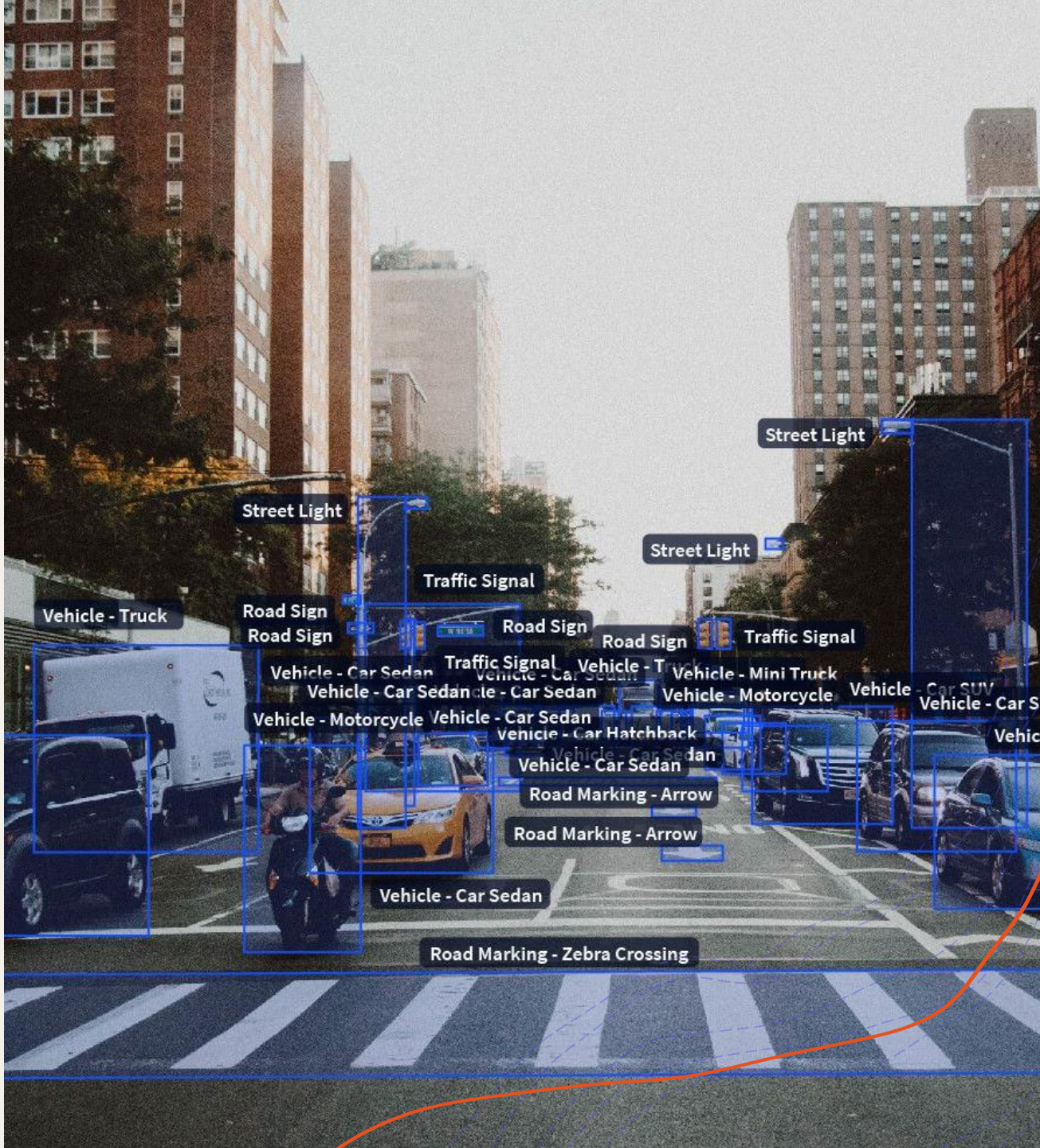
- Law enforcement support: ALPR aids in identifying stolen vehicles and wanted individuals.
- Traffic management optimization: ALPR enables real-time monitoring, traffic violation detection, and intelligent traffic management, reducing congestion and improving road safety.
- Efficient parking operations: ALPR automates parking processes, streamlining entry/exit control, payments, and monitoring for parking operators and users.
- Toll collection and road pricing: ALPR automates toll collection, reducing manual intervention and improving traffic flow at toll plazas.

Methodology

+ The methodology used in ALPR involves several stages, starting with image capture. In this stage, images of license plates are captured using cameras or other imaging devices. Then we use Tenser Flow model for image recognition These images are then preprocessed to enhance their quality and remove any noise or distortions. Once the images have been preprocessed, the next stage is feature extraction for which we use Easy OCR engine to extract text from image.

How's It going to work?

+ For this we're going to use 2 key libraries for ALPR
+ First we'll use TensorFlow object detection to find Region of interest
+ Then we'll use Easy OCR to extract the text

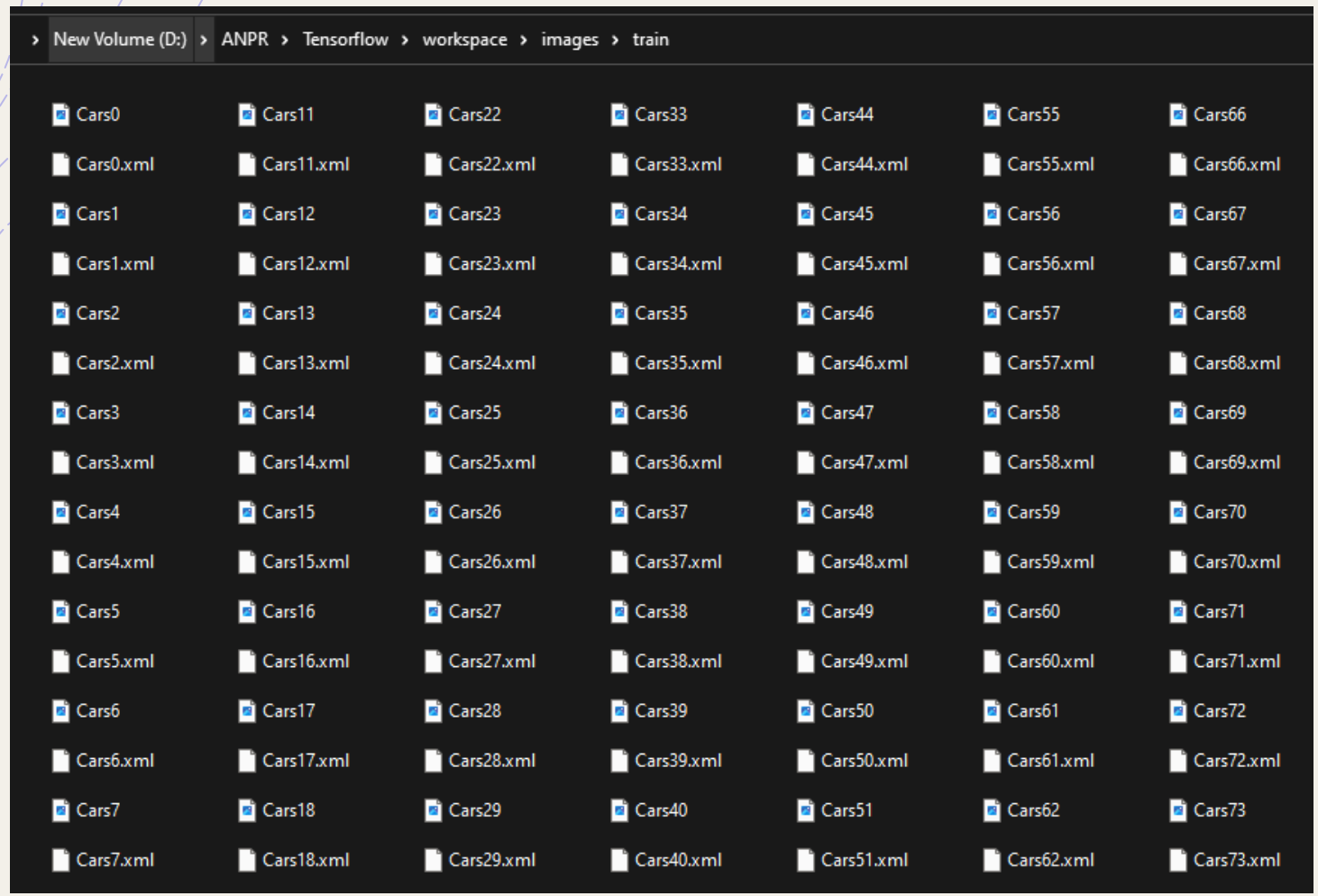


+ 1.Real time web cam feed grabs image of a plate or we can also use an existing image

+ 2.TensorFlow object detection will be used to detect the plate

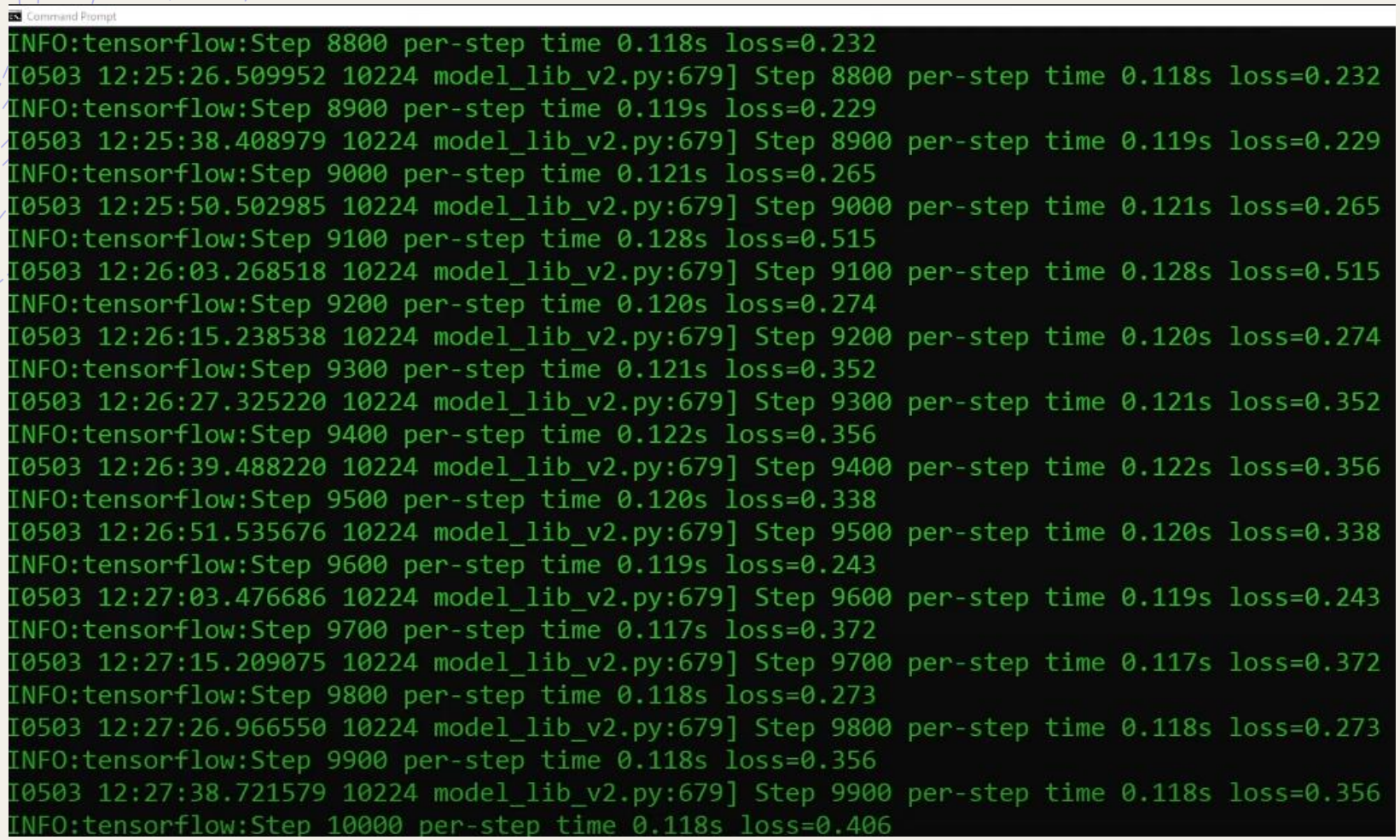
+ 3.Use Easy OCR to extract text and leverage a size filtering algorithm to grab the largest region

Dataset Description



+ This dataset contains 433 images with bounding box annotations of the car license plates within the image.
+ Annotations are provided in the PASCAL VOC format. This dataset contains 433 images with bounding box annotations of the car license plates within the image. Annotations are provided in the PASCAL VOC format.

Training and Model Development



- In order to detect plates first we need to train the object detection model.
- The dataset we used will be split in training and testing data we will build our system by training our TensorFlow object detection model on over 400 images and their annotations for 15,000 steps to get a precise model.

What is TensorFlow?
How's it used in our Program?

+ TensorFlow is an open-source end-to-end platform for creating Machine Learning applications. It is a symbolic math library that uses dataflow and differentiable programming to perform various tasks focused on training and inference of deep neural networks.

We use TensorFlow model in our Program by training the Model 15,000 times on our dataset which enables our model to be able to perform object detection in input image or live footage to determine the presence of a license plate in the live footage or input image.

Implementation and Results

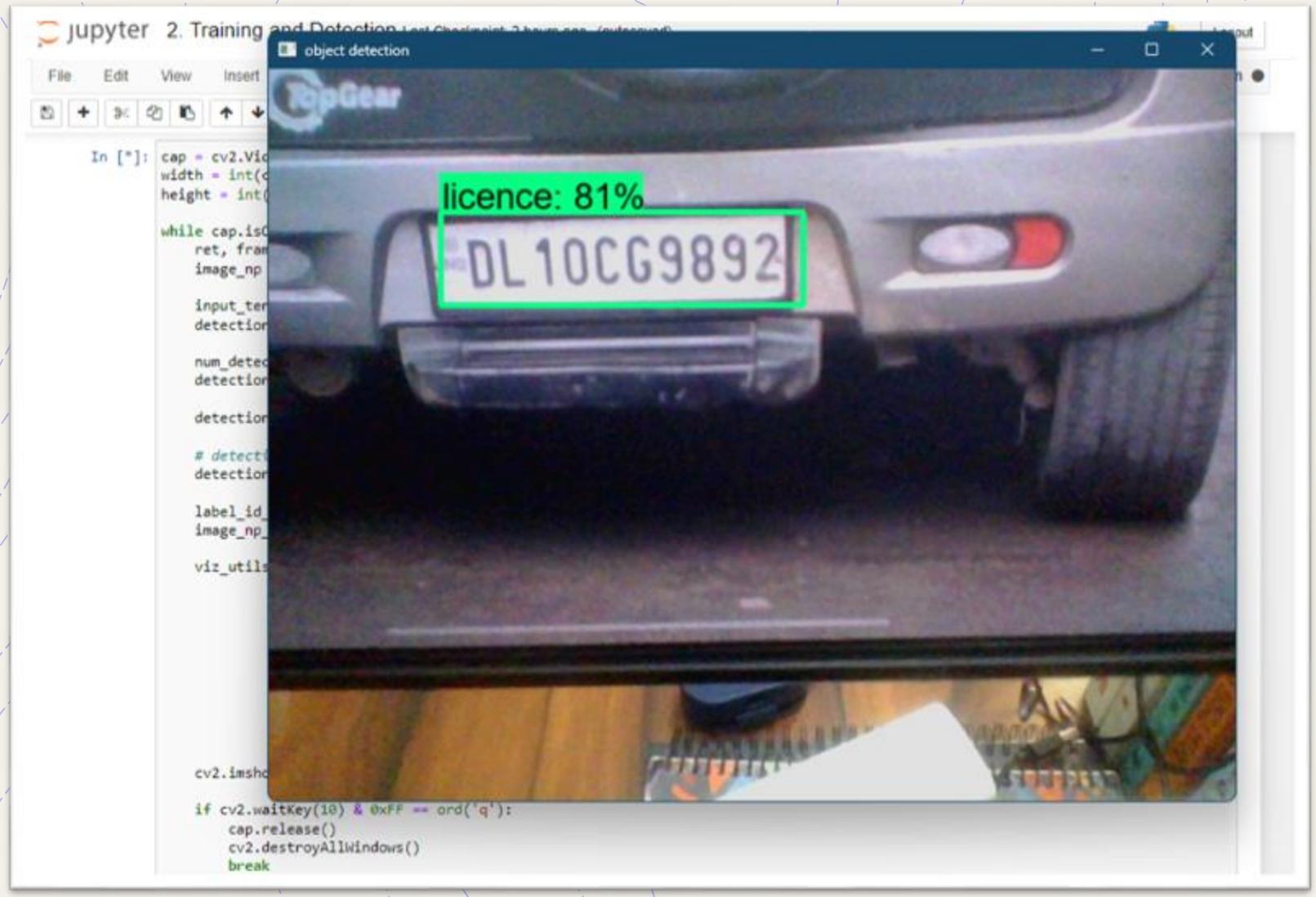
+ 1.Object Detection using TensorFlow:

+ 2.Extracting text from the image on we applied TensorFlow model using easy OCR

+ 3.Creating a csv file and connecting it with our engine to automatically stores the extracted License plate numbers

Using our Trained TensorFlow Model to detect object(License Plate) from an image:

Using our Trained TensorFlow Model to detect object (License Plate) from Real time footage:



Optical character recognition(OCR)

- OCR is what gives us to extract the text from our regions of interest
- In this particular case we'll use Easy OCR to extract text from the region of interest

Extracting text from License Plate from an image:

In [87]:
```
# Apply ROI filtering and OCR
for idx, box in enumerate(boxes):
    print(box)
    roi = box*[height, width, height, width]
    print(roi)
    region = image[int(roi[0]):int(roi[2]),int(roi[1]):int(roi[3])]
    reader = easyocr.Reader(['en'])
    ocr_result = reader.readtext(region)
    print(ocr_result)
    plt.imshow(cv2.cvtColor(region, cv2.COLOR_BGR2RGB))
```

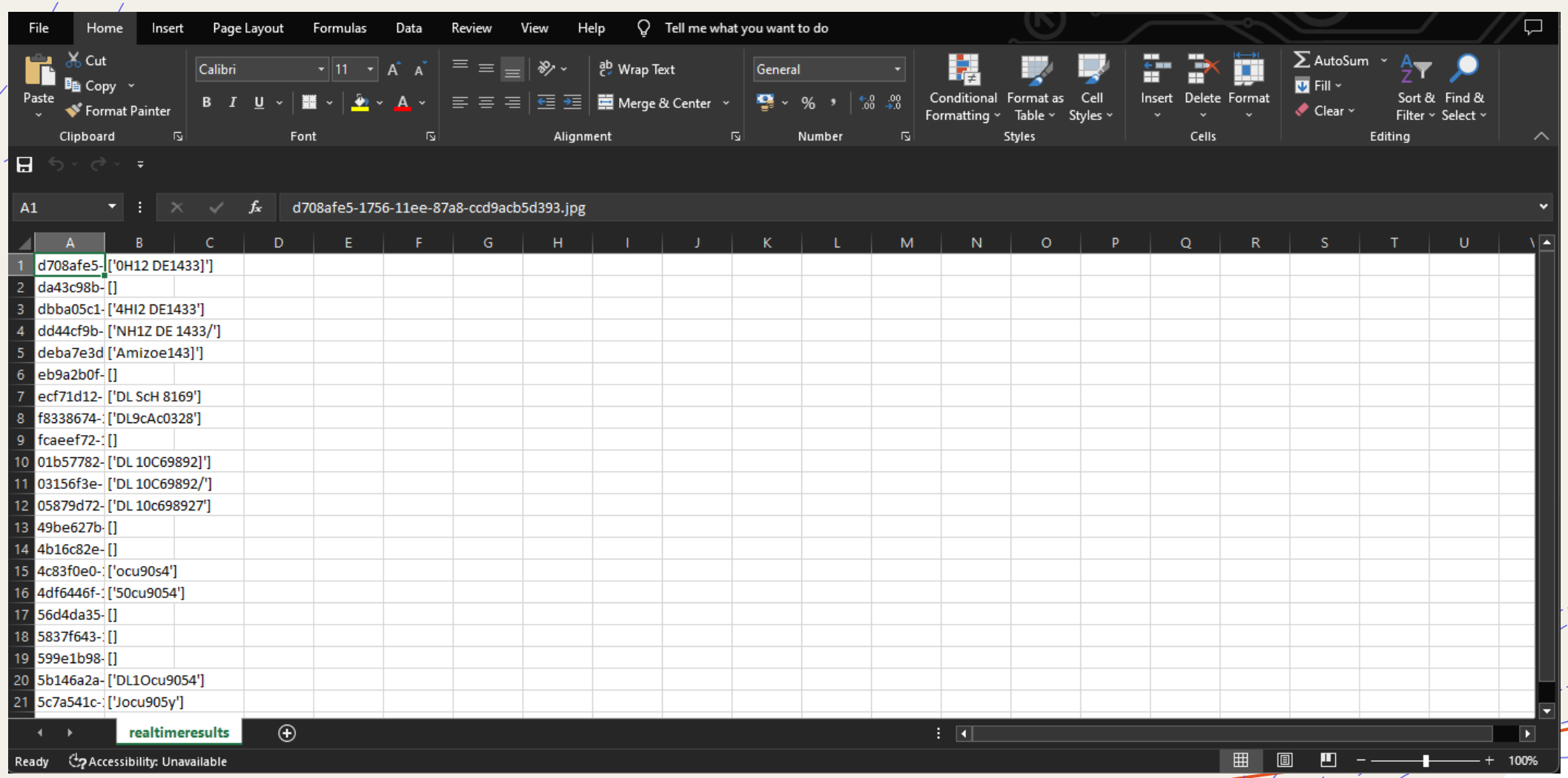
```
[0.48415986 0.5114827  0.5595987  0.7549542 ]
[209.6412181  295.12552691 242.30623031 435.60858428]
[([[6, 4], [128, 4], [128, 28], [6, 28]], 'MH 04 JM 8765', 0.9288839990952636)]
```

In [88]:
```
for result in ocr_result:
    print(np.sum(np.subtract(result[0][2],result[0][1])))
    print(result[1])
```

```
24
MH 04 JM 8765
```

Extracting text from License Plate from Real time footage:

Creating a csv file and connecting it with our engine to automatically store the extracted License plate numbers



	A	B
1	d708afe5-	['0H12 DE1433]']
2	da43c98b-	[]
3	dbba05c1-	['4HI2 DE1433']
4	dd44cf9b-	['NH1Z DE 1433/']
5	deba7e3d	['Amizoe143]']
6	eb9a2b0f-	[]
7	ecf71d12-	['DL ScH 8169']
8	f8338674-	['DL9cAc0328']
9	fcaeef72-	[]
10	01b57782-	['DL 10C69892]']
11	03156f3e-	['DL 10C69892/']
12	05879d72-	['DL 10c698927']
13	49be627b	[]
14	4b16c82e-	[]
15	4c83f0e0-	['ocu90s4']
16	4df6446f-	['50cu9054']
17	56d4da35-	[]
18	5837f643-	[]
19	599e1b98-	[]
20	5b146a2a-	['DL1Ocu9054']
21	5c7a541c-	['Jocu905y']

Conclusion

- The automatic number plate recognition program developed using TensorFlow and Easy OCR libraries showcases the effectiveness of machine learning in the domain of ANPR. By leveraging model training for number plate detection and OCR for character recognition, the program achieves high accuracy and efficiency. The successful completion of this project highlights the potential of machine learning techniques in automating the recognition of number plates, which can have numerous applications in various fields, including traffic management, law enforcement, and parking systems.