Autonomous Driving system

Submited By:

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1. Introduction:

An autonomous driving system enables vehicles to operate without human intervention through a combination of sensors, software, and algorithms. Key components include perception, which utilizes cameras, lidar, and radar to detect objects, pedestrians, and road conditions; localization, which determines the vehicle's precise position using GPS and high-definition maps; planning, which develops safe and efficient routes based on real-time data and traffic conditions; and control, which executes driving maneuvers like steering, acceleration, and braking.

2. Objective:

Objective for 1st week: - Semantic segmentation

The goal of this report is to investigate the application of DeepLabV3+ for semantic segmentation tasks and evaluate its accuracy in segmenting images, particularly urban scenes. We aim to measure the model's effectiveness in identifying and segmenting different regions such as roads, vehicles, sidewalks, and pedestrians.

3. Dataset Description:

The dataset used in this study is from the Cityscapes dataset, which is widely utilized for urban scene understanding. I have selected a subset from the "Frankfurt" validation set, consisting of high-resolution images depicting cityscapes in real-world environments.

Image Directory: /content/dataset/leftImg8bit/val/frankfurt

Label Directory: /content/dataset/gtFine/val/frankfurt

File Format: Images are in .png format, with corresponding labeled masks that provide pixel-wise annotations for various classes such as roads, cars, buildings, and vegetation.

4. Model Architecture:

I have used pretrained model DeepLabV3 with ResNet-101 Backbone. The model was pre-trained on ImageNet and fine-tuned on the Cityscapes dataset.

```
# Load pre-trained DeepLabV3 model
model = deeplabv3_resnet101(pretrained=True).eval()
```

5. Preprocessing

The images were prepared for segmentation using the following steps:

Loading: Images were read using OpenCV and converted from BGR to RGB format to be compatible with the model.

```
image = cv2.imread(image_path)
original_images.append(cv2.cvtColor(image,cv2.COLOR_BGR2RGB))
```

Resizing: All images were resized to a standard size of 512x512 pixels.

```
T.Resize((512, 512))
```

Normalization: Pixel values were normalized using the mean and standard deviation from the ImageNet dataset, ensuring compatibility with the pre-trained model.

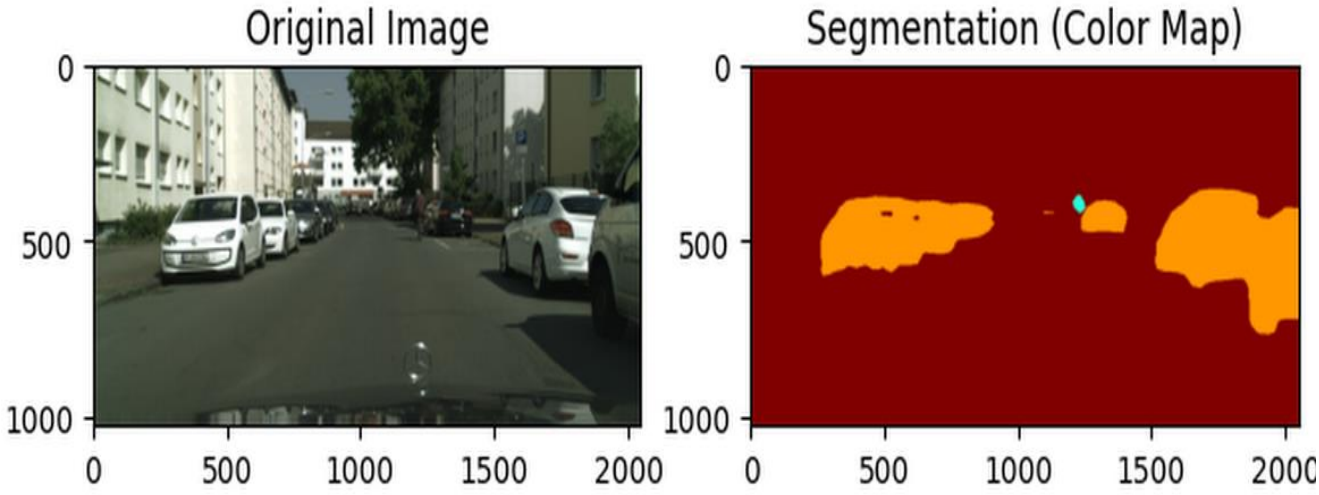
```
T.Normalize(mean=[0.485, 0.456, 0.406], std=[0.229, 0.224, 0.225])
```

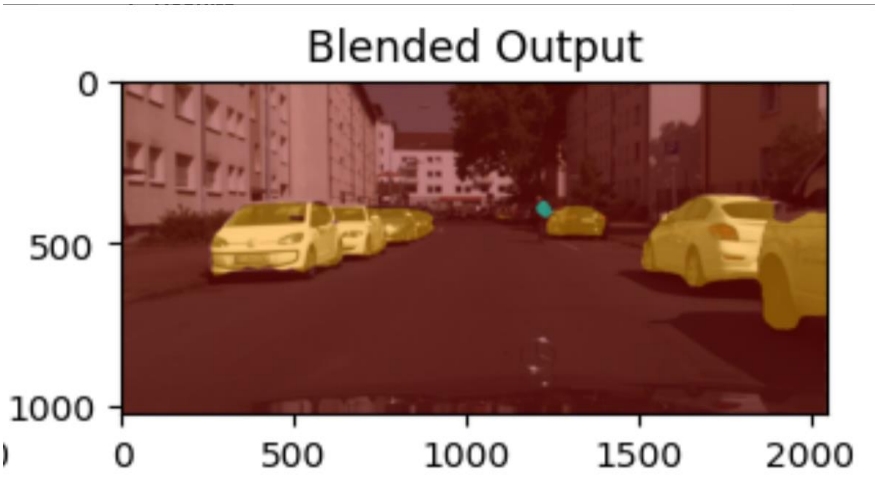
6. Results

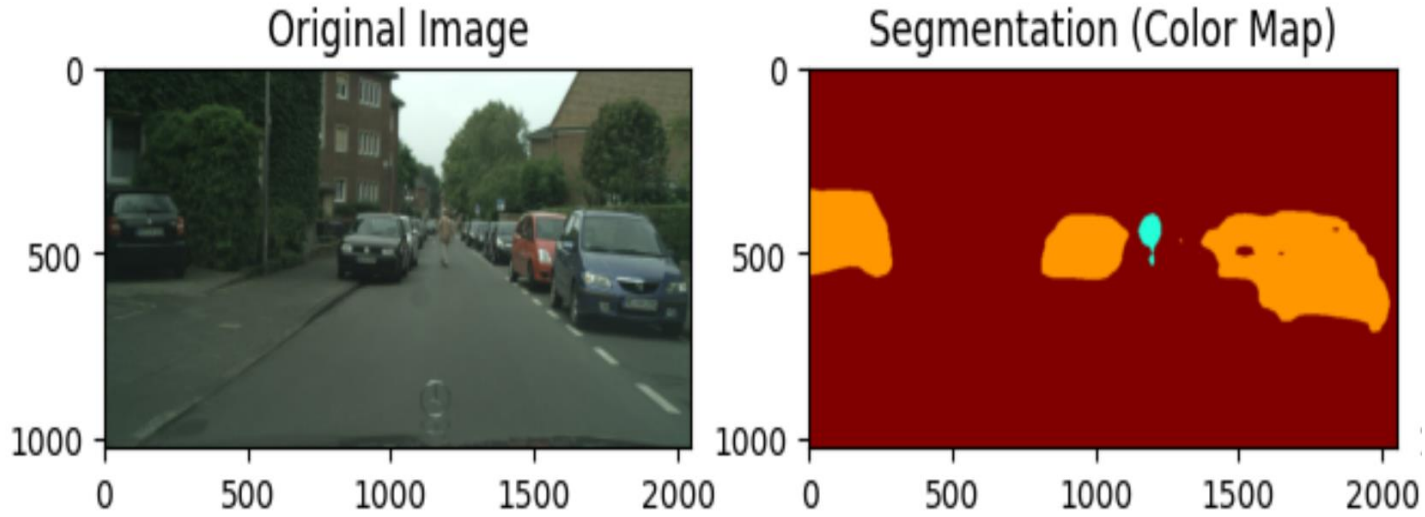
Segmentation Quality

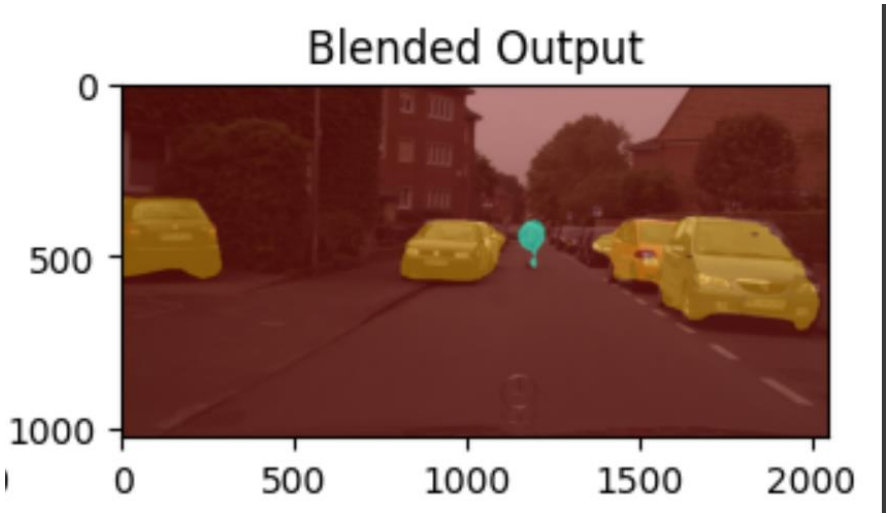
The DeepLabV3+ model demonstrated high-quality segmentation:

It effectively distinguished between various object classes such as roads, vehicles, and humans.









Objective for next week:- Lane Detection

I will work on and study lane detection techniques, focusing on understanding different algorithms and models used for effective lane detection in autonomous driving systems. This will include exploring image processing methods, machine learning approaches, and evaluating existing lane detection frameworks

Google Colab code link:-
https://colab.research.google.com/drive/13XJl7ZQY4iRcrwms-nvQ43NyTx5KZ1AB?usp=sharing