SEMANTIC SEGMENTATION FOR AUTONOMOUS DRIVING

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CSE 676: Deep Learning

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Description

A vehicle that can operate without human supervision or control is known as an autonomous vehicle. In order to navigate and make driving judgments, it makes use of a variety of technology, including cameras, sensors, and artificial intelligence algorithms.

The three main parts of an autonomous vehicle's driving function are :-

1. Perception
2. Decision-making
3. Control

Overall , The seamless and effective operation of an autonomous vehicle is intended to convey passengers reliably and safely between locations without the need for human involvement.

BACKGROUND

Why is autonomous vehicle driving required ?

Transportation could undergo a revolution thanks to autonomous car technology, which could lower accidents, boost productivity, and provide everyone more mobility. To assure the safety and dependability of autonomous cars, thorough testing and validation are necessary before they can be developed and put into use. Traditional testing techniques on actual roads can be costly, time-consuming, and dangerous.

To enable researchers and developers to test and evaluate autonomous driving algorithms in a virtual environment before deploying them in the real world, simulation-based testing platforms are required. One such platform is the CARLA simulator.

In this project , we are using the CARLA simulator generated Data . It is an effective tool for advancing the design and testing of autonomous vehicle technologies.

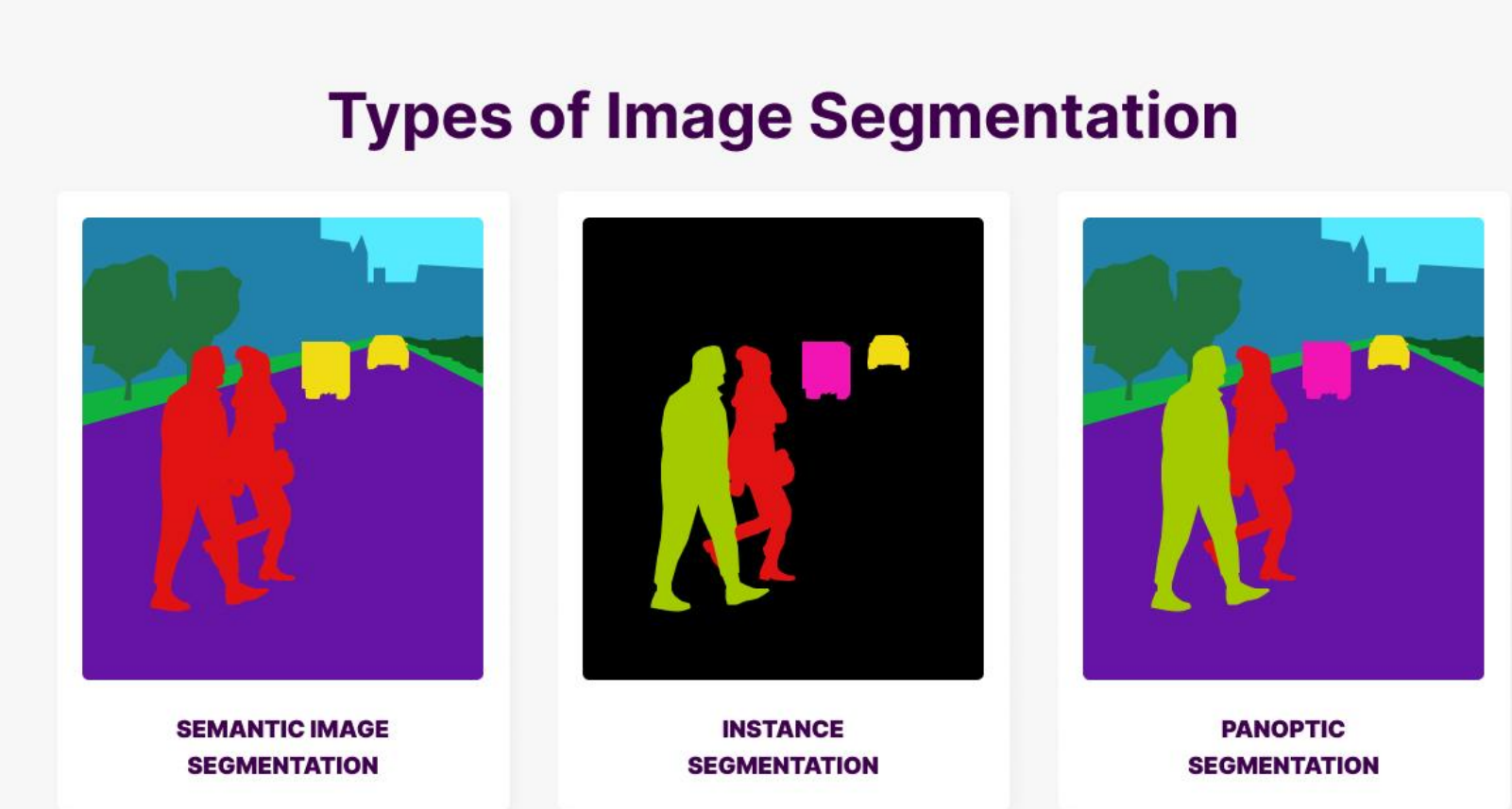
-CARLA stands for Car Learning to Act .

-It is an outdoor driving simulator .

-CARLA is a 3D setting containing a range of urban scenarios and weather conditions, including highways, city streets, and suburban areas, and it was constructed using the Unreal Engine. The simulator can replicate many types of sensors, including cameras, lidar, and radar, and it features a variety of vehicles, including cars, trucks, and motorcycles.

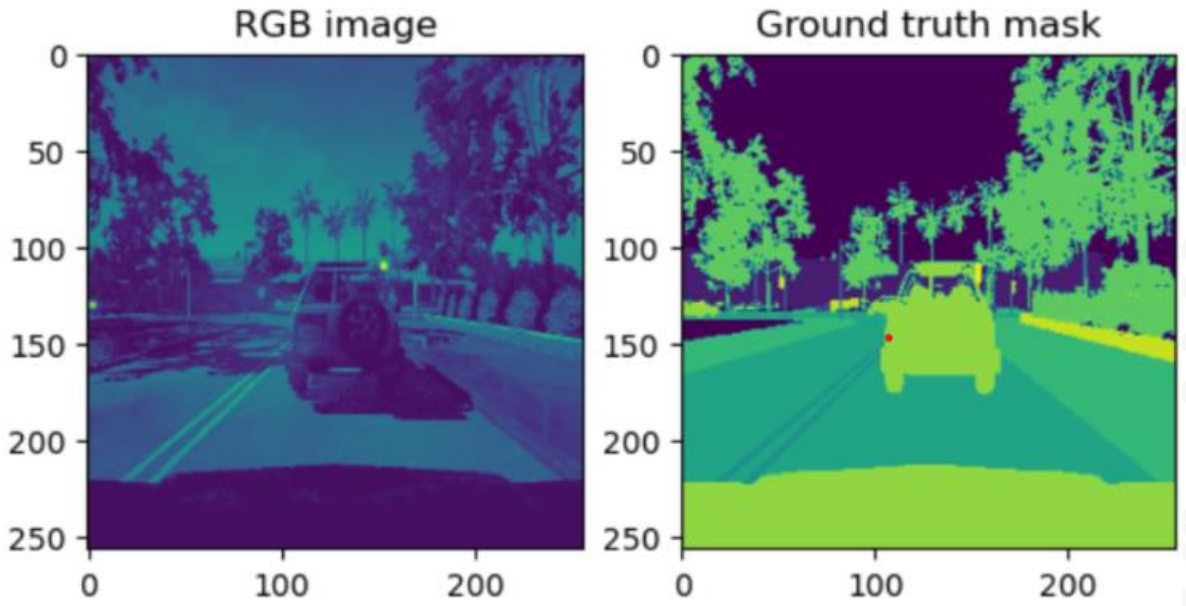
-Cameras, LIDAR, and RADAR are just a few of the sensors that CARLA offers for mounting on the cars. These sensors produce accurate data that can be utilized to train and test algorithms for autonomous driving.

Image segmentation



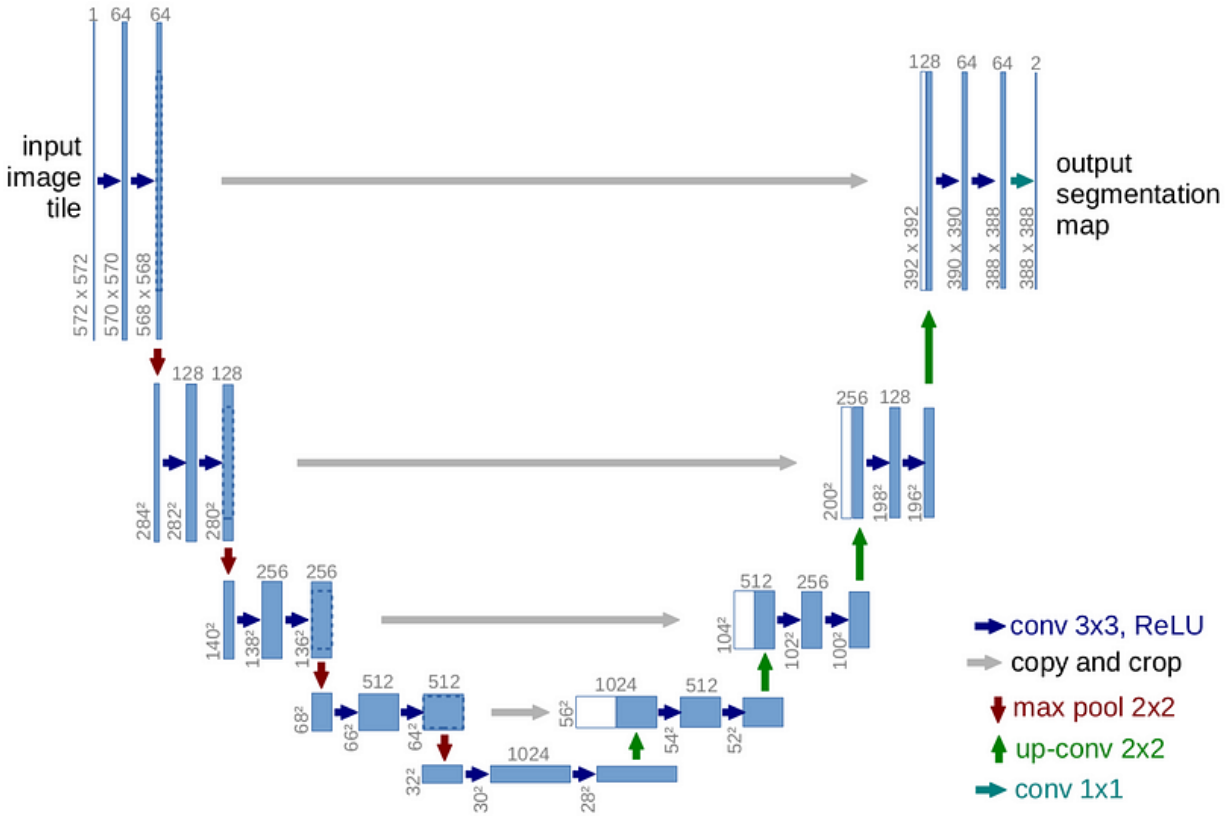
Dataset

• The dataset used for the project is Lyft – Udacity perception challenge dataset
•It consists of 5 sets of 1000 images each from different camera angle
• Each set consists of .RGB images and its corresponding semantic segments
• The images are captured from CARLA simulator environment
• RGB image is used as the input and mask images are used as ground target labels



UNet Architecture

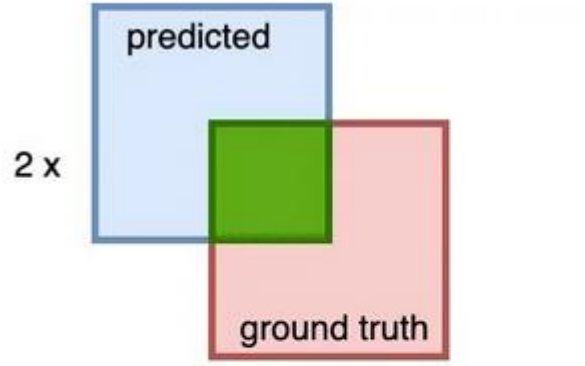
- UNet, was first designed and applied in 2015 to process biomedical images.
- Along with classification it is also able to localize area of abnormality
- In the context of autonomous driving, UNet can be used for tasks such as semantic segmentation, instance segmentation, and object detection.

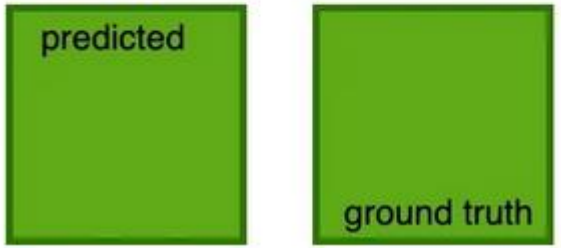


Dice Coefficient

$$Dice = \frac{2\,|A \cap B|}{|A| + |B|}$$

Dice coefficient = $\frac{\text{2x area of overlapped (green)}}{\text{total area (green)}}$ =





RESULTS

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Epoch 1, loss:  0.7931134809147228
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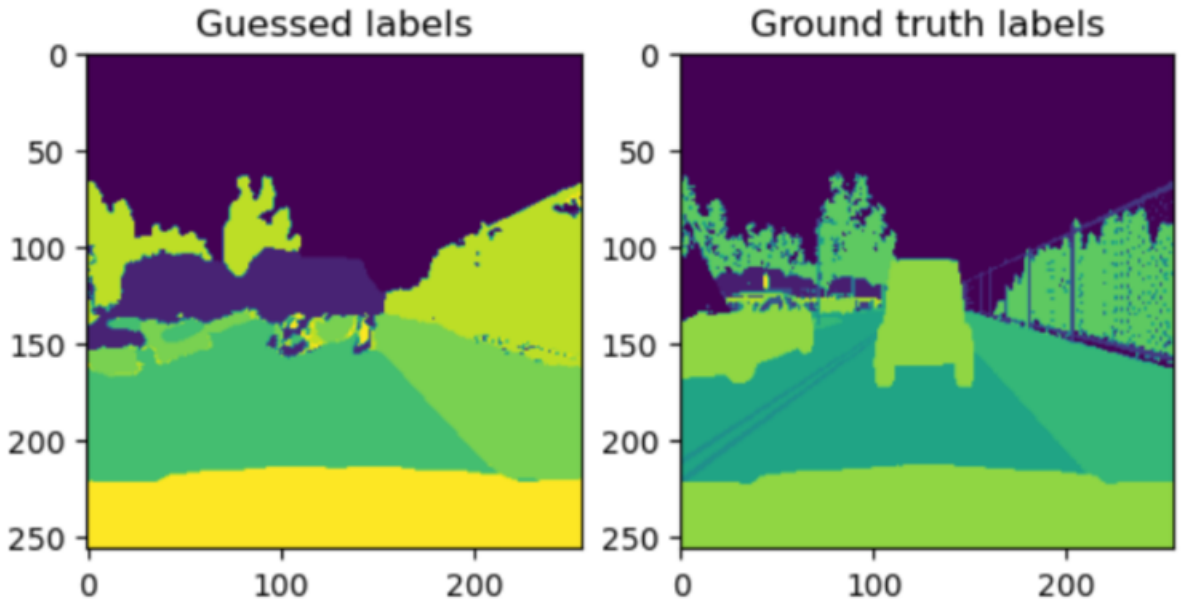


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Epoch 100, loss:  0.7412789545275948
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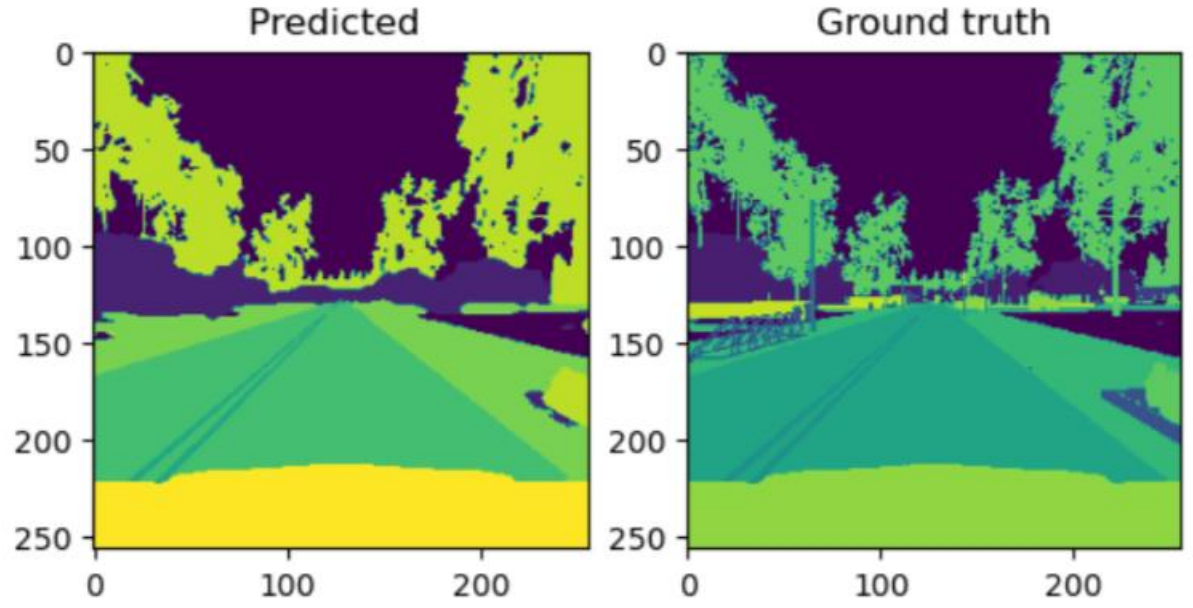


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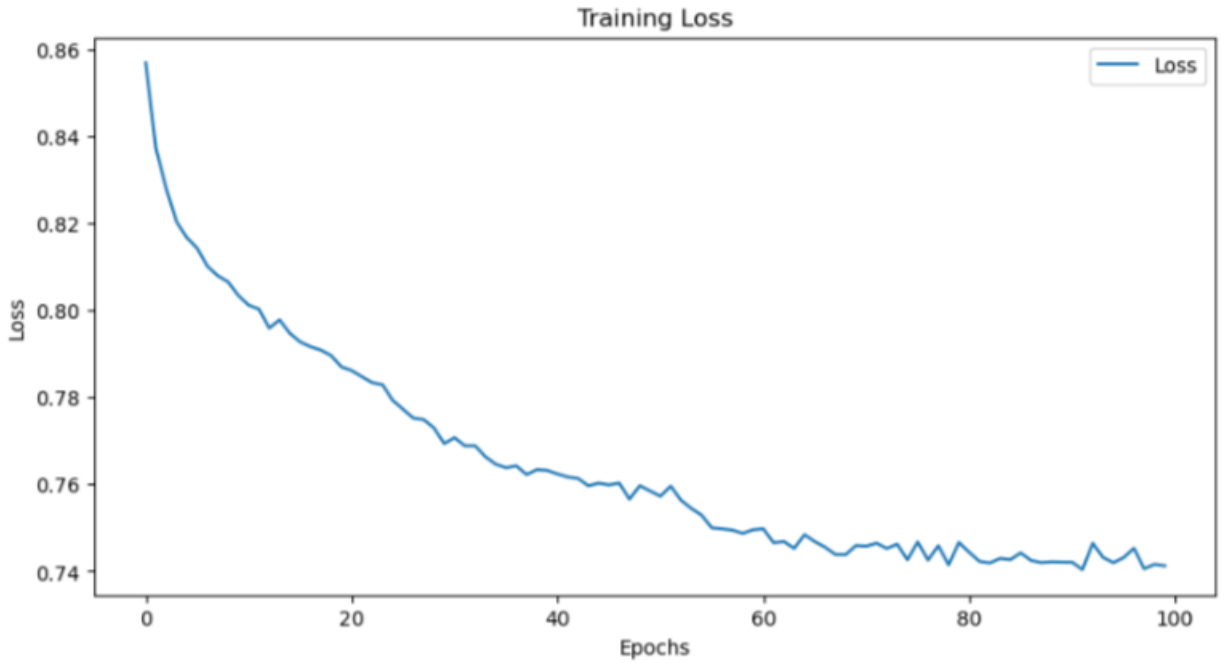
RESULTS

We can see that the UNet Model is working well with the simulation images. The loss for training shows a downward trend as the number of epochs increases



THANK YOU !!
Any Questions ?