

INFO-6147 Capstone Project Proposal

Context-Aware Semantic Segmentation for MR-Enhanced Vehicle Cabins

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Project Description

This project develops a semantic segmentation model using the Cityscapes dataset to explore how AI can enhance driver experience in autonomous vehicles. By training a deep learning model to segment roads, vehicles, and pedestrians, it aims to enable context-aware adjustments to the cabin environments, such as changing ambient lighting or media based on real-time external conditions.

Why Is It a Good Project?

This project combines computer vision with smart mobility and MR/IoT design. As a web developer who has worked with 2D interactions, I'm interested in exploring how IoT technology can create intuitive experiences in Mixed Reality environments. I believe autonomous driving will give drivers more free time in the cabin, requiring a completely new approach to interior design. Since I've loved cars since childhood, I want to focus on how environmental data can enhance the driver's experience through adaptive lighting, atmosphere, and content recommendations. I previously built a web application using Meta's Segment Anything Model, and this project lets me explore image segmentation more deeply after taking this AI course.

How Will I Do It?

1. Import and inspect the Cityscapes dataset
2. Apply preprocessing (resizing, normalization, data augmentation)
3. Select a baseline model (U-Net or DeepLab)
4. Train and validate the model
5. Tune hyperparameters
6. Explore MR interaction use cases

What Data Will You Use?

The Cityscapes dataset from `torchvision.datasets` provides pixel-level annotations of urban street scenes including roads, vehicles, and pedestrians, making it suitable for automotive applications. Since these images reflect real-world driving environments, they are well-suited for training segmentation models in automotive applications.

How Will You Evaluate Your System Performance?

Performance will be measured using mIoU and pixel accuracy. Visual inspection will also be conducted by comparing predictions with ground truth to identify where the model works well and where it struggles.

Final Note

While this proposal could benefit from more thorough literature review, I plan to document my process carefully throughout the project, reflecting any insights and technical pivots in the final report.