ORIS – ON ROAD INTELLI-SENSE

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Problem Statement

Autonomous frameworks have been an extensive field of research in the field of intelligent computing. With faster hardware, we see the increase in the application space for software. Tesla with their Level 4 Autonomy induced vehicles have deemed to be the pioneers in this field. Autonomy has its own vast use case and can be associated with tasks apart from just mobility.

Background

Focus is on 3 major aspects when it comes to autonomous traversal:

1. Lane Segmentation: Using Unet as our primary model for demarcation of the drivable portions in a road. Keeping in mind the Indian Roads.
2. Road Sign Detection: Using Yolov3 as the primary model for fast recognition of on road constraints and intimation to underlying hardware. Constraint only trained on legalized road signs
3. Vehicle Detection: All and every aspect of a road being detected and tagged. YOLOv5 the primary model for real time execution giving an edge.

Project Requirements

System Requirements:

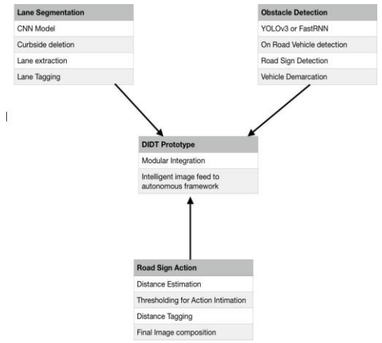
- Google Collaboratory and Kaggle. (GPU: 12 GB and RAM: 12 GB)

Datasets:

1. Lane Segmentation: IDD
2. Road Sign Detection: Annotated Video Dataset
3. Vehicle Detection: Car Object Detection

Input can be given as a video stream or individually segmented frames. The given video sequence must be checked and asserted before feeding to the model as to not hamper the ongoing learning. Strict outdoor conditions must be set and training face must be thorough with a high number of permutations of test conditions to maximize accuracy.

Design Approach

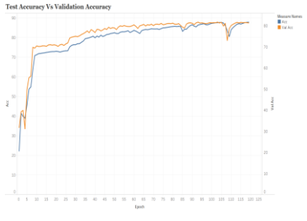


This is the high-level view of the modules that make up ORIS. The modules are: Lane Segmentation using Semantic Segmentation, Road Sign Detection and Vehicle or Object Detection on the Road.

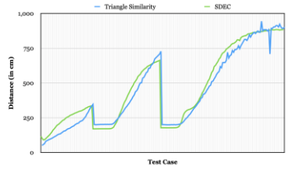
The image shows the various components under each module with their interfacing and interoperability. The ORIS prototype operates with all these modules running concurrently and in tandem.

Results and Discussion

Lane Segmentation:



Road Sign Detection:



Vehicle Detection:

Summary of Project Outcome

Through ORIS we aim to automate detection and tracking. The two fields can be systematically broken down into a much narrower scope as follows:

1. We implement on-road vehicle detection,
2. lane segmentation and
3. road sign detection for action intimation.

ORIS will act as an end-to-end framework for automating safe path planning imagery to autonomous vehicles. With tailor-made constrained enforcement we look to give a foundation to more robust path planning.

Conclusion and Future Work

Conclusion:

In the second phase of the CAPSTONE project, we have successfully created Lane Segmentation, Road Data sign Detection and Action Intimation, and Vehicle Detection Modules for the Surveillance Bot as per specifications specified by Bharath Electronics and the suggestions of the esteemed Capstone Panel. We have completed a thorough analysis on the effectiveness of our modules by validating them across a set of various Datasets, including but not limited to: Indian Road Segmentation Dataset, Annotated Driving Dataset, KITTI Visualization Benchmark. The results obtained for all our models are accurate

Future Work:

ORIS is a multi-faceted on road assist system, which aids in autonomous traversal within the given set of sensing areas:

1. Lane Segmentation
2. Road Sign Detection
3. Vehicle Detection

ORIS is a proof of concept and requires further optimisation on targeted hardware platforms. Using various front end compiler frameworks to make ORIS truly hardware independent is the final milestone for this project. The work will involve a deep dive into frameworks such as MLIR and TVM.

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