LATENT MAP MOTION PLANNING

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ABSTRACT. The goal of this project is to learn a lower dimensional representation of a map and plan a path within it given multiple camera views and lidar data captured from a car driving in the city. We will use CARLA driving simulator in order to collect this data for which will be used to train a variational autoencoder (VAE). Finally, this latent space representation can be used to find control inputs so that the car follows a path from A to B.

1. INTRODUCTION

In mapping and planning, computational efficiency is extremely important for real world systems. In order to be efficient, the robot cannot simply store all the data its collected and search through to perform navigation. We propose using a VAE that can learn a low dimensional latent space which can still represent the map in a rich way.

2. PRIOR ART

[Baris Kayalibay, 2018] shows that agents can plan paths in a probabilistic sequential latent-variable model of laser scans of an environment. They effectively encode these observations with control inputs in generative graphical model for sequential data, and use A* to search for paths within this graph. Similarly, [Hu, 2018] provides work in performing planning with just 2D images. They use a VAE to learn a lower dimension representation of a house's layout. However, this work was unsuccessful in being able to guarantee smooth transitions from image to image in real space from plans in latent space.

3. METHODS

Robotic systems usually contain multiple perception sensors. [Hu, 2018] uses a single camera video stream and [Baris Kayalibay, 2018] relies solely on lidar. Our approach will be to leverage both lidar and multiple camera views to learn a low dimension representation of the environment with a VAE, however other methods will be explored such as VAE-GAN to potentially overcome any difficulty [Hu, 2018] experienced from image planning. Also [Baris Kayalibay, 2018] presented their work in a structured maze, and would like to explore the ability to navigate a more complex city with the extra sensors to help.

4. Timeline and splitting of work

Each tasked is assigned someone to be primarily responsible but each member will have parts to do within each task.

- Week 1: Layout pipeline from observation to control input, and have data collection - Klayton
- Week 2: Implement baseline VAE, and begin tests - Chris
- Week 3: Additional improvement research, and debug - Hohun
- Week 4: Consolidate, run comparisons, and write project report. - All

References

[Baris Kayalibay, 2018] Baris Kayalibay, Atanas Mirchev, M. S. P. v. d. S. J. B. (2018). Navigation and planning in latent maps. *FAIM workshop*.

[Hu, 2018] Hu, K. (2018). Learning a representation map for robot navigation using deep variational autoencoder.