A Realistic Simulation System for Environmental Understanding of Autonomous Driving Vehicles

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Introduction

Problem: The behavior of autonomous vehicles tends to be unpredictable, which could affect the behavior of other vehicles around them.

Goal: Make autonomous vehicles drive as human do using Inverse Reinforcement Learning (IRL).

- Need for a realistic simulation system
  - A simulator is required to collect human driving data and to simulate human driving policies.
  - We target urban areas for this work.

Collecting human driving data

Method

Collect human driving data by letting subjects drive in simulation with steering wheel and pedals.

Data Collection

(a) Normal vision camera
(b) Depth map camera
(c) Semantic segmentation camera
(d) Human driving data

Figure 2: (a) - (c) are images obtained from three cameras on the front of the car, (b) and (c) are images converted to a more human readable palette of colors [2], (d) shows speed and acceleration of the human-driven vehicle corresponding to throttle/brake pedal input against time.

We collected the following data at each step: three types of images in Figure 2, sensor data from a ray-cast based rotating LIDAR, and driving data of both the human-driven vehicle and vehicles around it. The depth map image and LIDAR sensor tell us how far the objects are, and semantic segmentation tells us what the objects are.

Future Work

- Collect more human driving data
- Generalize human driver’s behavior model
- Find preferred reward function
- Mimic human driver’s behavior for autonomous vehicles

References


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