Journal of
Electrical Engineering & Electronic Technology

Abstract

Adversarial Inverse Reinforcement Learning for Decision Making in Autonomous Driving

Pin Wang
University of California, Berkeley, Institute of Transportation Studies, Berkeley United States of America

Abstract:

The application of Reinforcement Learning (RL) and Inverse Reinforcement Learning (IRL) in robotics has seen significant in recent years. The application tasks range from flying inverted helicopter to robot soccer and other robotic manipulations. Though the results are encouraging, some barriers of applying RL or IRL to real-world problems is that RL requires the definition of a reward function and IRL needs a RL in the inner learning loop which makes it computationally inefficient.

Generative Adversarial Imitation Learning (GAIL) is an efficient way to learn sequential control strategies from demonstration. Adversarial Inverse Reinforcement Learning (AIRL) is similar to GAIL but also learns a reward function at the same time and has better training stability. However, AIRL has mostly been demonstrated on robotic control in artificial environments in previous work, e.g. open AI Gym. Autonomous driving is a complicated problem as it involves extensive interactions with other vehicles in a dynamically changing environment, and this is particularly true for the decision-making task that needs to monitor the environment and decides maneuvering commands to the control module.

In this paper, we apply AIRL to learn the challenging decision-making behavior for autonomous vehicles in a simulated driving environment where each vehicle is interacting with all other vehicles in its surroundings. Our study, different from RL based studies, makes good use of demonstration data and, different from IRL based studies, learns both a reward function and a policy.

We use four metrics to evaluate its learning performance in a simulated driving environment. Results show that the vehicle agent can learn decent decision-making behaviors from scratch and can reach the level of performance comparable with that of experts.

Biography:

Dr. Wang is a research faculty at Institute of Transportation Studies (ITS), UC Berkeley, US. Her focus is on deep learning algorithms and applications for autonomous vehicles. As a team leader of the machine learning group, she leads projects on learning human-like driving behaviors, decision-making strategies, intention prediction, and motion planning, based on deep learning methods such as Imitation Learning, Reinforcement Learning, Inverse Reinforcement Learning, Generative Adversarial Learning, Meta Learning, Semi-supervised learning, etc. She also collaborates with industries on projects such as intelligent traffic control and advanced vehicular technology assessment. Some other prior work included cooperative collision warning system, big data analysis on vehicle driving patterns, crash data analysis, road safety evaluation, etc.

Publication of speakers:

1. Generative adversarial imitation learning, Pin Wang, 2016
2. Learning robust rewards with adversarial inverse reinforcement learning, Pin Wang, 2018
3. Areinforcement learning based approach for automated lane change maneuvers, Pin Wang, 2018
4. Evolving Mario levels in the latent space of a deep convolutional generative adversarial network, Niels Justesen, 2018

8TH International conference on Robotics and Artificial Intelligence, August 10-11, 2020 London, UK

Citation: Pin Wang, Adversarial Inverse Reinforcement Learning for Decision Making in Autonomous Driving, Euro Robotics 2020, August 10-11, 2020 London, UK