Deep-RL Models for Autonomous Driving

Bhartendu Thakur

Supervisor: Dr. Sumitra S
(Associate Professor)

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Dept. of Mathematics, Indian Institute of Space Science & Technology, Thiruvananthapuram

DECLARATION

I declare that this thesis titled DEEP-RL MODELS FOR AUTONOMOUS DRIVING submitted in fulfillment of the degree of MASTER OF TECHNOLOGY is a record of original work carried out by me under the supervision of DR. SUMITRA S, and has not formed the basis for award of any degree, associateship, fellowship or other titles in this or any other Institution or University of higher learning. In keeping with the ethical practice in reporting scientific information, due acknowledgements have been made wherever the findings of others have been cited.

Bhartendu Thakur
Machine Learning & Computing (SC16M051)
Dept. of Mathematics , IIST

Thiruvananthapuram
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Abstract

Learning & automation contains essential vitamins of engineering, one such vitamin is Deep Reinforcement Learning (DRL) viz., conjunction of neural networks & reinforcement learning. This project is about applying Deep-RL models to train autonomous vehicles, creating a novel framework for optimal-route planning & conclusive analysis of current approaches to improve level of autonomy in self-driving cars.

The study started with supervised approach to visualize 'learning in Deep models' and then DRL models & its variants have been applied to specific problems such as learning to steer, route planning etc. in context of autonomous driving. In this thesis, DQN models for Enduro (Atari, in OpenAI environment), a car racing game and an implementation of actor-critic algorithm, a policy gradient approach to control self driving car (in Unity3D simulator) are presented.

Later, Reinforced Deep Learning (RDL) framework has been developed, which aims to learn weights of a neural network by alternating movements between a RL set-up and the neural network with decreasing explorations and self-rewards. The model is designed to learn with no prior/given outcomes and rewards is dependent on input features & predicted outcomes. As a proof of concept (a) Optimal Route Planning: Finding end-to-end optimal routes from source to destination node based on time, cost & other constraints, (b) Shape Predictor: Learning to predict parameters of various shapes, has been presented with different *structure* of actions & self-rewards.

Contents

List of Tables

List of Figures