Xuxin Cheng (Homepage)

Mobile: +86-18810606936 / +1-(510)-423-1592; **Email**: chengxuxindavid@outlook.com / chengxuxindavid@163.com
Address: 1357 S. 46th Street, Building 454, Richmond, CA 94804

EDUCATION

Beijing Institute of Technology (BIT) Sept. 2016-June. 2019

- Major: **Automation**; Overall GPA: **4.0/4.0 (Top 1/167)**
- **TOEFL 110** (R29, L28, S27, W26); **GRE 328** (V161+Q167+AW3.5)

University of California, Berkeley (UC Berkeley) Jul. 2019-May. 2020

- Research assistant at **Berkeley California PATH** (Link) and Hybrid Robotics Lab(Link);
- Complete the final-year study at UC Berkeley as an exchange student.
- Fall 2019 GPA: **3.918/4.0**

PUBLICATION

- Fei Ye, **Xuxin Cheng** (co-first author), Pin Wang, Ching-Yao Chan. "Automated Lane Change Strategy using Proximal Policy Optimization-based Deep Reinforcement Learning", ***The 2020 IEEE Intelligent Vehicles Symposium (IV)***. (Submitted)
- Tianyu Shi, Pin Wang, **Xuxin Cheng**, Ching-Yao Chan. "Driving Decision and Control for Automated Lane Change based on Deep Reinforcement Learning", ***IEEE International Conference on Intelligent Transportation (ITSC)***. (Accepted) (Link)

RESEARCH PROJECTS

California PATH, UC Berkeley (Supervisor: Dr. Ching-Yao Chan) Dec. 2018-Present

Research Assistant; Cooperated with Dr. Pin Wang (UC Berkeley)

Project 1: Driving Decision and Control for Autonomous Lane Change Based on Deep Reinforcement Learning

- Utilized the methods of classical control and machine learning in a hierarchical way by leveraging their advantages and disadvantages.
- Divided the decision and control process into two correlated processes: 1) when to conduct lane change maneuver; 2) how to conduct the maneuver.
- Decision Process: designed two similar Deep Q learning frameworks with quadratic approximator for deciding how to select a comfortable gap or just follow the preceding vehicle.
- Control Process: generated a polynomial lane change trajectory and implemented the Pure Pursuit Control for path tracking to finally complete lane change maneuver.
- Designed a test environment to test our method. The proposed method demonstrated effectiveness and potential to be implemented in other scenarios.

Project 2: Adaptive Lane Change Decision Making in Various Situations Based on Meta-Reinforcement Learning

- Incorporated SUMO (Simulation of Urban Mobility), a microscopic simulation environment, with the previously designed environment (mentioned in Project 1) and modified it to better fit our tasks. We packaged it into OpenAI gym for more general usage.
- Designed a hierarchical structure of decision and control for lane change maneuver in highway environment.
- Implemented PPO(Proximal Policy Optimization) to optimize ego vehicle behaviors according to designed reward function.
- On-going: Implement Meta-learning methods to make autonomous vehicle adapt to new

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situations which has never been met before faster, based on acquired knowledge of the concealed features of different environments.

Behavior Imitation of Cassie Under Robot Dynamics Constraints based on Deep Reinforcement Learning Sept. 2019-Present

Team Leader; Supervisor: Prof. Koushil Sreenath, UC Berkeley

- Tested a simulation environment of a bipedal robot Cassie based on Mujoco.
- Designed PD controllers and feedback control algorithms to control the 10 joint motors of Cassie in order to make it stand with external perturbations present.
- Designed reward functions and network structures. Used PPO(Proximal Policy Optimization) to make Cassie stand with the presence of perturbations.
- Made Cassie imitate desired reference trajectories while satisfying system dynamics and constraints using Deep Reinforcement Learning.

PKU Omni Smart Sensing (POSS), Peking University Apr. 2018-Mar. 2019

Research Assistant; Supervisor: Prof. Huijing Zhao

Traversability Analysis in Field Environments Using Deep Inverse Reinforcement Learning

- Presented an approach to learn cost maps for traversable area extraction from human demonstration using Deep Inverse Reinforcement Learning for driving in field environments, bypassing the effort of manual labeling of traditional supervised methods.
- Designed two contrast experiments using 2D camera image input and Lidar input.
- Evaluated the resulting cost representations of two inputs by compare them with a carefully manually designed cost map.
- Proposed using Value Iteration Network to accelerate training, leaving out the massive computation requirements of iterative calculation.

Development of Spherical Amphibious Robot Apr. 2017-Present

Team Leader; National Innovation and Entrepreneurship Training Program for College Students

- Intended to design a new amphibious spherical mobile platform which combines the advantages of ground mobile robots and UAVs, achieving the functions of traveling, stopping and turning without radius in any time, any position and complex terrain.
- Divided the spherical amphibious robot into three parts, including spherical motion mechanism, UAV module and magnetic connection interface.
- Redesigned the mechanical structure with 3D-printing parts in UC Berkeley.
- Developed a PD balancing algorithm using Kalman Filter to reduce the effect of perturbations.

OTHER INFORMATION

Computer Skills: Particularly proficient in Python (including TensorFlow, PyTorch, Numpy, etc); Proficient in C, C++, MATLAB, Assembly Language; Familiar with Java, HTML, CSS.

Honors & Awards: China National Scholarship (Top 1%); DWIN Scholarship (Top 1%); Honorable Mention of MCM; Excellent Student (school-level); Excellent Student model (school-level); 3rd Prize of the Intelligent Car Competition (school-level).