Jie Li

jie-li18@mails.tsinghua.edu.cn, +86 178 8882 5774
Ph.D. Candidate, School of Vehicle and Mobility, Tsinghua University, Beijing

EDUCATION

School of Vehicle and Mobility, Tsinghua University Beijing
Ph.D. of Engineering – Advisor: Prof. Shengbo Eben Li Expected in Jul. 2024
Bachelor of Engineering – Advisor for Dissertation: Prof. Shengbo Eben Li Jul. 2018

- **Award**: Beijing Distinguished Undergraduate Student (top 1%), Distinguished Graduate of Tsinghua University (top 5%)

Department of Mathematical Sciences, Tsinghua University Beijing
Bachelor of Science – Advisor for Dissertation: Assoc. Prof. Hao Wu Jul. 2018

- Relevant Coursework: Differential Equations, Differential Geometry, Statistical Inference, Numerical Analysis, Probability Theory, Real Analysis, Complex Analysis

RESEARCH INTERESTS

Model Predictive Control | Adaptive Dynamic Programming | Robust Reinforcement Learning

RECENT PUBLICATIONS

- **J. Li**, S. E. Li, J. Duan, Y. Lyu, W. Zou, Y. Guan, and Y. Yin, "Relaxed policy iteration algorithm for nonlinear zero-sum games with application to H-infinity control," IEEE Transactions on Automatic Control, 2023.
- **J. Li**, R. Nagamune, Y. Zhang, and S. E. Li, "Robust approximate dynamic programming for nonlinear systems with both model error and external disturbance," IEEE Transactions on Neural Networks and Learning Systems, 2023.
- J. Duan#, **J. Li#**, X. Chen, K. Zhao, S. E. Li, and L. Zhao, "Optimization landscape of policy gradient methods for discrete-time static output feedback," IEEE Transactions on Cybernetics, 2023.
- **J. Li**, J. Wang, S. E. Li, and K. Li, "Learning optimal robust control of connected vehicles in mixed traffic flow" in Proceedings of 62nd IEEE Conference on Decision and Control, 2023.
- J. Duan#, **J. Li#**, Q. Ge, S. E. Li, M. Bujarbaruah, F. Ma, and D. Zhang, "Relaxed actor-critic with convergence guarantees for continuous-time optimal control of nonlinear systems," IEEE Transactions on Intelligent Vehicles, 2023.

PROJECTS PARTICIPATED

Networked Modeling and Cooperative Control of Connected and Automated Electric Vehicles
Student Leader Supported by MOST Sep. 2019 – Mar. 2021

- Performance evaluation of connected platoon under different communication topologies
- Distributed controller (LQR, MPC) design with C/C++ and platoon simulation with MATLAB/Simulink
- **Software Platform** design with C/C++ in ROS, including positioning, radar, V2V

communication, platoon control and vehicle control

- **Hardware Modification** of CHANGAN passenger vehicles with power supply system, CAN communication module, GPS, IMU and V2V communication module
- Algorithm deployment and **platoon test** with 3 heterogeneous electric vehicles in various scenarios including car following, cooperative lane change, and vehicle cut in/out

Road-Vehicle-Cloud Cooperative Control Technology

Participant Supported by Toyota Dec. 2019 – Dec. 2020

- Safety oriented model predictive controller design with Ipopt and simulation with Python
- Traffic scene design of virtual crossroad
- Controller deployment and **vehicle test** at virtual crossroad

Development and Deployment of Motion Control Algorithm with Domain Controller

Main Participant Supported by UAES Sep. 2018 – Mar. 2019

- Construction of vehicle dynamics simulation model with MATLAB/Simulink
- Longitudinal and lateral motion controller (MPC) design with C/C++ and simulation with S-Function
- Algorithm program in XCU and **Hardware-in-the-Loop** experiment

DOCTORAL THESIS

Nonlinear Robust Reinforcement Learning and Its Application in Vehicle Control

This research intends to explore a decision-making and control mechanism with robust characteristic and self-learning capability. Construct and solve nonlinear robust control problems to improve anti-disturbance performance. Design additional cost function considering model uncertainty to satisfy the Hamilton--Jacobi inequality in nonlinear robust control theory under all considered model error. Build a unified training platform and verify the effectiveness of proposed methods through simulations and road tests. The research is expected to lay the foundation for the practical application of reinforcement learning algorithms in the field of autonomous driving.

Main Specific Aspects

- Convergence speed of the proposed robust reinforcement learning algorithm
- Concurrently addressing model error and external disturbance in nonlinear dynamics
- Robust offline training based on the fusion of model and data

SKILLS

- Proficient in MATLAB/Simulink and Python programming (PyTorch), familiar with C/C++ programming and ROS
- Basic use of automobile and traffic simulation software (CarSim and SUMO)
- IELTS 6.5