Zhuoren Li

+86 18201975690 | 1911055@tongji.edu.cn | Shanghai, China | https://zhuorenli.github.io/

Education

Tongji University *Sep 2019 –Present*
PhD Student, Vehicle Engineering (Supervisor: Prof. Lu Xiong and Jia Hu)
Tongji University *Sep 2017 – Jul 2018*
Minor, Department of German
Tongji University *Sep 2014 - Jul 2019*
Bachelor's, Engineering Mechanics (Supervisor: Prof. Hanwen Song)

Research Experience

LLM-Enhanced Scenario Understanding for RL-based Motion Planning *Sept 2024 - Present*
- Scenario understanding for adaptive reward adjustment

Control Granularity Improved RL-based Motion Planning *Dec 2023 - Present*
- Hybrid action-based RL using parameterized action space

Safe Reinforcement Learning for Autonomous Driving *Sept 2022 - Present*
- Prior-knowledge designed safety constraint and demonstration experience.
- Multi-Critic mechanism for multi-objective accommodation
- Epistemic uncertainty-based action governor

Optimization-based Motion Planning *Sept 2021 – Jun 2023*
- POMDP-based integrated framework of decision-making and motion planning considering prediction uncertainty
- MPC-based Trajectory planning and tracking control

Parking Path Planning *Feb 2021 – Aug 2021*
- Path planning using geometric configuration
- Path planning using hybrid A*

Publications

Published papers:

[1] **Zhuoren Li**, Guizhe Jin, Ran Yu, et al. "A Survey of Reinforcement Learning-Based Motion Planning for Autonomous Driving: Lessons Learned from a Driving Task Perspective," *Arxiv*, 2025.

[2] Guizhe Jin, **Zhuoren Li**, Bo Leng, et al. "Hybrid Action Based Reinforcement Learning for Multi-Objective Compatible Autonomous Driving," *Arxiv*, 2025.

[3] Bo Leng, Lu Xiong, **Zhuoren Li***, et.al. "Multi-Mode Evasion Assistance Control Method considering Human Driver Operation," Chin. J. Mech. Eng., 2025. (accepted)

[4] Lu Xiong, **Zhuoren Li**, Danyang Zhong, et al. "Rule-Guidance Reinforcement Learning for Lane Change Decision-making: A Risk Assessment Approach," *Chin. J. Mech. Eng.*, 2025. (accepted)

[5] **Zhuoren Li**, Jia Hu, Bo Leng, et.al. An Integrated of Decision Making and Motion Planning Framework for Enhanced Oscillation-Free Capability. *IEEE Trans. Intell. Transp. Syst.*, vol. 25, no. 6, pp. 5718-5732, June 2024.

[6] **Zhuoren Li**, Guizhe Jin, Ran Yu, Bo Leng and Lu Xiong, "Interaction-Aware Deep Reinforcement Learning Approach Based on Hybrid Parameterized Action Space for Autonomous Driving," *SAE Intell. Connected Veh. Symposium (SAE ICVS)*, 2024.

[7] **Zhuoren Li**, Lu Xiong, Bo Leng et.al. Safe Reinforcement Learning of Lane Change Decision Making with Risk-Fused Constraint, in *Proc. IEEE Intell. Transp. Syst. Conf. (ITSC)*, 2023, pp. 1313-1319.

[8] **Zhuoren Li**, Lu Xiong Bo Leng. A Unified Trajectory Planning and Tracking Control Framework for Autonomous Overtaking Based on Hierarchical MPC. in *Proc. IEEE Intell. Transp. Syst. Conf. (ITSC)*, 2022, pp. 937-944.

[9] **Zhuoren Li**, Lu Xiong, Bo Leng, et al., "Path Planning Method for Perpendicular Parking Based on Vehicle Kinematics Model Using MPC Optimization," *SAE Technical Papers*, 2022-01-0085, 2022.

[10] **Zhuoren Li**, Lu Xiong, Dequan Zeng, et al., "Real-time Local Path Planning for Intelligent Vehicle combining Tentacle Algorithm and B-spline Curve," *IFAC-PapersOnLine*, 2021, 54(10): 51-58.

Submitted papers:

[1] Bo Leng, Ran Yu, **Zhuoren Li***, Wei Han, Lu Xiong and Bo Leng, "Risk-Aware Reinforcement Learning for Autonomous Driving: Improving Safety When Driving through Intersection," *IEEE Trans. Intell. Transp. Syst.* (under review).

[2] **Zhuoren Li**, Jia Hu, Bo Leng, Lu Xiong, et.al., "Safety Enhanced Reinforcement Learning for Autonomous Driving: Dare to Make Mistakes to Learn Faster and Better," *IEEE Trans. Intell. Transp. Syst.* (under review)

[3] Ruolin Yang, **Zhuoren Li**, Bo Leng, et.al., "Convergent Harmonious Decision: Lane Changing in a more Traffic Friendly Way." *IEEE Trans. Intell. Transp. Syst.* (under review)

Project Experience

Funding/Grant Proposal Writing *Jan 2020 - Present*

- National Natural Science Foundation of China (NSFC), Excellent Young Scholars Fund, 2025; Key Program, 2024; General Program, 2023; Distinguished Young Scholars Fund, 2022; Young Scholars Grant, 2020.
- Shanghai Municipal People's Government (SMPG), Oriental Excellence Program Youth Project, 2024; Shanghai Science and Technology Progress First Award, 2022;
- Ministry of Science and Technology, PRC, National Key Research and Development Program of China, 2021;
- National Development and Reform Commission, The Breakthrough and Industrialization of Key Technologies for Intelligent Chassis, 2020;

High-Mobility Motion Planning and Control Research for Chassis-by-wire All-terrain Unmanned Vehicle with Hybrid-steering *Jan 2024 - Present*

National Natural Science Foundation of China, Role: Student Technical Director

- Overall task management.
- Multi-component coupled environmental risk characterization.
- Motion Planning for Mixed Steering Vehicles.

Key Technology of Perception and Control in Cooperative Vehicle-Infrastructure System for Urban Public Transportation *Jan 2023 – Mar 2025*

National Key Research and Development Program of China, Role: Core Participant

- Intelligent decision-making and motion planning in vehicle side.

Development of Evasion Assistance Algorithm for Emergency Collision Avoidance based on Steer-by-Wire System *Jul 2022 – Jul 2024*

Shanghai Automotive Industry Science and Technology Development Foundation, - Role: Student Technical Director

- Overall task management.
- Development of motion control algorithm emergency collision avoidance.
- Simulation validation, real vehicle modification and test.

Binary Mixed Traffic Behavior Characteristics and Collaborative Paradigm *Aug 2021 – Jul 2024*

Science and Technology Commission of Shanghai, Role: Core Participant

- Motion planning and control of connected automated vehicle according to the road-side guidance.

Research on Vehicle-Road Cooperative Control for Intelligent Public Transportation System *Sep 2021 – Aug 2022*

Shanghai Research Institute for Intelligent Autonomous Systems, , - Role: Student Technical Director

- Overall task management.
- Vehicle speed planning based on the traffic signal optimization.

Autonomous Valet Parking (AVP) System Development *Sept 2021 – Mar 2023*

Nanchang Automotive Institute of Intelligence & New Energy, Role: Student Technical Director

- Overall task management.
- Development of Parking slot allocation.
- Parking path planning and tracking control.

Development and Application of Automatic Valet Parking System *Feb 2020 – Mar 2021*

Nanchang Automotive Institute of Intelligence & New Energy, Role: Student Technical Director

- Overall task management.
- Hardware and software communication systems.
- Development of Parking path planning algorithm.
- Development of tracking control algorithm.

China Future Challenge of Intelligent Vehicles *Mar 2020 – Nov 2020*

Institute of Intelligent Vehicles, Tongji University, Role: Major developer

- System framework development of planning algorithm.
- Avoidance path planning for static obstacle.
- Parking path planning.

Honors and Awards

- SAE International Outstanding Technical Paper Award, SAE ICVS 2024.
- High-Level Academic Poster Award, China SAE Doctoral Student Academic Forum, 2024.
- Outstanding Doctoral Student Scholarship, Tongji University, 2024.
- Vehicle-road-cloud Integrated Autonomous Driving Challenge, Third Prize, 2024.
- Outstanding Individual Award, Institute of Intelligent Vehicles, Tongji University, 2022, 2023, 2024.
- World Artificial Intelligence Conference AI Driving Simulation Competition, Third Prize in the University Challenge Competition, 2022

Academic Services

Reviewer

- **Journal Reviewer:** I*EEE Transactions on Intelligent Transportation Systems (TITS), IEEE Transactions on Vehicular Technology (TVT), IEEE Transactions on Intelligent Vehicles (TIV), IEEE Transactions on Transportation Electrification (TTE), IEEE*

Robotics and Automation Letters (RAL), Journal of Intelligent Transportation Systems (JITS), IET Intelligent Transport Systems, Journal of Field Robotics.

- **Conference Reviewer:** *IV, ITSC, CVCI, SAE WCX*

Mentoring (*serving as the Student Director of the Intelligent Decision Research Group at TJU-IIV since 2021, mentored 4 Ph.D. students, 13 master's students, and several undergraduate students.*)

Ph.D. Students:

- 2025-present: ***Weiqi Zhang*****,** E2E RL racing.
- 2023-present: ***Zhiwen Chen***, LLM-enhanced RL for AD.
- 2022-present: ***Peiyuan Fang***, Motion Planning under Off-road Environment; ***Xinrui Zhang***, Cloud-Vehicle Cooperative Planning.

Master Students:

- 2024-present: ***Ran Yu***, Trajectory Prediction and Safe-RL; ***Zhizhao Ni***, LfD-based RL for Merging in Congested Traffic.
- 2023-present: ***Guizhe Jin***, Multi-objective Compatible RL; ***Zhou Sun***, Motion Planning under Off-road Environment.
- 2022-present: ***Yuqin Qi***, Learning-based MPC for Motion Control; ***Yu Che***, Cloud-Vehicle Cooperative Tracking Control.
- 2021-2024: ***Ruolin Yang***, Harmony-enchaned RL; ***Encheng Tu***, Hybrid MPC Motion Planning for Autonomous Overtaking; ***Yizhuo Guan***, Prediction and Control for Emergency Evasion.
- 2020-2023: ***Gesong Shi***, Cooperative Control for Transit Priority.
- 2019-2022: ***Puhang Xu***, Safe-RL Decision-Making; ***Hongyu Xiao***, POMDP Motion Planning; ***Zixuan Qian***, SMPC Motion Planning; ***Jie Gao***: Global Planning.