Jiawei Zhang

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EDUCATION

Tsinghua University *September 2020 - Present*
Department of Automation
Ph.D student in Control Science and Engineering

Tsinghua University *September 2016 - June 2020*
Department of Automation
B.S. of Engineering (Graduate with honor)

AREAS OF INTERESTS

Research Interests Artificial Intelligence, Autonomous Driving, Complex System, Intelligent Vehicle, Intelligent Transportation System, Deep Reinforcement Learning

PROJECTS

1. Lane Change for Autonomous Vehicles *August 2020 - October 2022*
Published on IEEE Transactions on Intelligent Transportation Systems

- **Description**: The project proposes a multi-agent deep reinforcement learning (DRL) based lane change method for autonomous vehicles, which can effectively deal with the lane change behaviors with multiple objectives, complex right-of-way conflicts, and frequent interactions between vehicles. This method promotes autonomous vehicles to havec right-of-way collaboration awareness.
- **Innovation**: The proposed method has four core innovations: (*i*) More collaborative lane-change problem modeling: multi-agent based lane-change formulation; (*ii*) Driving intention: achieving implicit negotiation about the conflicting right-of-ways by considering the driving intentions of surrounding vehicles; (*iii*) Ingenious reward function: considering not only the ego benefits but also the impact of lane change on the traffic system to promote collaborative performance; (*iv*) Novel architecture: integrating rule-based and learning-based methods to ensure the safety of the lane change behaviors.
- **Bright-spot**: The first multi-agent autonomous lane change method, achieving safe, efficient, and collaborative lane change performance. Reviewers: "*The topic is significant*", "*The models are solid*".

2. Autonomous Driving Simulation Platform CAVSim *October 2020 - Present*
Published on IEEE ITSC-2022

- **Description**: This project designs and develops CAVSim, a microscopic traffic simulation and testing platform for connected and automated vehicles (CAVs), which integrates rich scenarios and standardized algorithms, and provides multiple automatic testing and evaluation functions.
- **Innovation**: Unlike all existing autonomous driving simulators, CAVSim focuses on feed-forward, proactive decision-making and planning of autonomous vehicles, providing (*i*) rich and typical scenarios, (*ii*) standardized benchmark algorithms, and (*iii*) comparable performance metrics.
- **Bright-spot**: The first simulation platform focusing on cooperative decision-making and planning of CAVs. It has supported dozens of graduate students in their research.

3. Mechanistic Study of Autonomous Vehicle (AV) Swarms *November 2020 - December 2021*
Published on Transportation Research Part C: Emerging Technologies

- **Description**: This project is the first to analyze and study the mechanistic characteristics of AV swarms at the road network level, and we introduce a new performance metric: the macroscopic fundamental diagram (MFD).
- **Innovation**: This project proposes the mechanistic characteristics of AV swarms: the microscopic self-organized driving behaviors of AVs lead to significant performance differences in the macroscopic system level, with the right-of-way conflicts playing a dominant role.

· **Bright-spot**: This project proposes the microcosmic-mesoscopic-macroscopic mechanism characteristics of the AVs swarms and systematically summarizes the core issues of cooperative decision-making and planning of AVs.

4. Scheduling and Collaborative Operation of AGVs in Parking Lots *October 2019 - April 2021*

Published on Transportation Research Part C: Emerging Technologies

· **Description**: Aiming at the inefficiency and even deadlock deficiencies faced by AGVs, this project proposes an integrated AGV scheduling and cooperative operation method based on deep reinforcement learning (DRL), achieving safe, efficient and cooperative operation performance of AGVs.

· **Innovation**: This project systematically solves the problem of scheduling and cooperative operation of AGVs in parking lots, and proposes: (*i*) An integrated cooperative operation framework for AGV swarms; (*ii*) An AGV scheduling method based on deep reinforcement learning (DRL); (*iii*) Multi-AGV cooperative driving based on tree search; (*iv*) Deadlock detection and elimination method.

· **Bright-spot**: The first generalized systematic approach for scheduling of AGVs in parking lots. Reviewer: " *The practical application value is great.*"

RESEARCH PUBLICATION

1. **Jiawei Zhang**, Cheng Chang, Xianlin Zeng, Li Li. (2023). Multi-agent DRL-based lane change with right-of-way collaboration awareness. *IEEE Transactions on Intelligent Transportation Systems (TITS)*. doi: 10.1109/TITS.2022.3216288 (**SCI, IF: 9.551**)

2. **Jiawei Zhang**, Shen Li, Li Li. (2023). Coordinating CAV swarms at intersections with a deep learning model. *IEEE Transactions on Intelligent Transportation Systems (TITS)*. doi: 10.1109/TITS.2023.3250704 (**SCI, IF: 9.551**)

3. **Jiawei Zhang**, Cheng Chang, Zimin He, Wenqin Zhong, Danya Yao, Shen Li, Li Li. (2023). CAVSim: A microscopic traffic simulator for evaluation of connected and automated vehicles. *IEEE Transactions on Intelligent Transportation Systems (TITS)*. doi: 10.1109/TITS.2023.3273565 (**SCI, IF: 9.551**)

4. **Jiawei Zhang**, Zhiheng Li, Li Li, Yidong Li, Hairong Dong. (2021). A bi-level cooperative operation approach for AGV based automated valet parking. *Transportation Research Part C: Emerging Technologies (TRC)*, 128, 103140. doi: 10.1016/j.trc.2021.103140 (**SCI, IF: 9.002**)

5. **Jiawei Zhang**, Huaxin Pei, Xuegang(Jeff) Ban, Li Li. (2022). Analysis of cooperative driving strategies at road network level with macroscopic fundamental diagram. *Transportation Research Part C: Emerging Technologies (TRC)*, 135, 103503. doi: 10.1016/j.trc.2021.103503 (**SCI, IF: 9.002**)

6. **Jiawei Zhang**, Cheng Chang, Huaxin Pei, Xinyu Peng, Yuqing Guo, Renzong Lian, Zhenwu Chen, and Li Li. (2022) CAVSim: A microscope traffic simulator for connected and automated vehicles Environment. In *2022 IEEE Intelligent Transportation Systems Conference (ITSC)*. pp. 3719-3724. doi: 10.1109/ITSC55140.2022.9922267 (**EI**)

7. Xinyu Peng, **Jiawei Zhang**, Fei-Yue Wang, Li Li. (2021). Drill the cork of information bottleneck by inputting the most important data. *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)*. pp. 6360-6372. doi: 10.1109/TNNLS.2021.3079112 (**SCI, IF: 14.255**)

8. Huaxin Pei, **Jiawei Zhang**, Yi Zhang, Xin Pei, Shuo Feng, Li Li. (2022). Fault-tolerant cooperative driving at signal-free intersections. *IEEE Transactions on Intelligent Vehicles (TIV)*. doi: 10.1109/TIV.2022.3159088 (**SCI, IF: 5.009**)

9. Jingwei Ge, **Jiawei Zhang**, Yi Zhang, Danya Yao, Zuo Zhang, Rui Zhou (2023). Autonomous vehicles testing considering utility-based operable tasks. *Tsinghua Science and Technology*. doi: 10.26599/TST.2022.9010037 (**SCI, IF: 3.515**)

10. Cheng Chang, Kunpeng Zhang, **Jiawei Zhang**, Shen Li, Li Li (2022) Driving safety monitoring and warning for connected and automated vehicles via edge computing. In *2022 IEEE Intelligent Transportation Systems Conference (ITSC)*. pp. 3940-3947. doi: 10.1109/ITSC55140.2022.9922076 (**EI, Best Student Paper Award**)

11. Jingwei Ge, Huile Xu, **Jiawei Zhang**, Yi Zhang, Danya Yao, and Li Li. (2022). Heterogeneous driver modeling and corner scenarios sampling for automated vehicles testing. *Journal of Advanced Transportation (JAT)*. doi: 10.1155/2022/8655514 (**SCI, IF: 2.249**)

HONORS & AWARDS

- Outstanding Ph.D Student (BEIJING ASSOCIATION OF AUTOMATION) *2022*
- The First Prize Scholarship (Tsinghua-Xuancheng Scholarship) *2022*
- Best Student Paper Award (IEEE ITSC 2022) *2022*
- The Second Prize Scholarship (Tsinghua-Weihai Scholarship) *2021*
- Outstanding Graduates of Dept. Automation *2020*
- National Encouragement Scholarship*3 *2017, 2018, 2019*
- The Top Scorer of Science in Wuwei City *2016*

TECHNICAL STRENGTHS

Computer Languages C/C++, Python, MATLAB
Deep Learning Framework Pytorch, Tensorflow, Keras

OTHERS

Reviewer Service IEEE Transactions on ITS, IEEE Transactions on IV Vehicles, ITSC 2022, CAC 2022 ACTA AUTOMATICA SINICA, IEEE Antennas and Wireless Propagation Letters, et al.

Teaching Assistant Convex Optimization (2020-2021; 2021-2022)

Blue Book Annual Report On The Development Of Autonomous Driving Industry In China (2020)