Wenhan **Cao**

Ph.D. Candidate

School of Vehicle and Mobility, Tsinghua University, Beijing, China

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Education

Tsinghua University

Beijing, China

Ph.D. Candidate in School of Vehicle and Mobility

Sep. 2019 - Present

- Supervisor: Prof. Shengbo Eben Li

University of Manchester

Manchester, UK

Visiting Ph.D. Student in Department of Computer Science

Jan. 2023 - Present

- Supervisor: Prof. Wei Pan

Beijing Jiaotong University

Beijing, China

B.Eng in School of Electrical Engineering

Sep. 2015 - Jun. 2019

- GPA ranking: 1/305

Research Interests

Optimal Filtering | Optimal Control | Reinforcement Learning

Publications

Book Chapters

Participation in book, SE Li, et.al. "Reinforcement Learning for Decision Making and Control"

- **Chapter 11** Miscellaneous RL Topics

Papers

- **W. Cao**, C. Liu, Z. Lan, Y. Piao, S. Eben Li, "Primal-dual Estimator Learning: an Offline Constrained Moving Horizon Estimation Method with Feasibility and Near-optimality Guarantees," accepted in 2023 American Control Conference (ACC).
- **W. Cao**, J. Duan, S. Eben Li, C. Chen, C. Liu and Y. Wang, "Primal-dual Estimator Learning: an Offline Constrained Moving Horizon Estimation Method with Feasibility and Near-optimality Guarantees," published in 2022 IEEE Conference on Decision and Control (CDC).
- J. Duan, **W. Cao**, Y. Zheng and L. Zhao, "On the Optimization Landscape of Dynamic Output Feedback: A Case Study for Linear Quadratic Regulator," published in 2022 IEEE Conference on Decision and Control (CDC).
- J. Duan, **W. Cao**, Y. Zheng and L. Zhao, "On the Optimization Landscape of Dynamical Output Linear Quadratic Control," submitted in IEEE Transactions on Automatic Control (TAC). (Under Review)
- **W. Cao**, J. Chen, J. Duan, S. Eben Li, Y. Lv, Z. Gu and Y. Zhang, "Reinforced Optimal Estimator," in 2021 IFAC Modeling, Estimation and Control Conference (MECC). (Student Best Paper Finalist)
- Z. Gu, Y. Yang, J. Duan, S. Eben Li and J. Chen, **W. Cao**, S. Zheng, "Belief state separated reinforcement learning for autonomous vehicle decision making under uncertainty," in 2021 IEEE International Conference on Intelligent Transportation (ITSC).
- J. Li, S. Eben Li, K. Tang, Y. Lv and **W. Cao**, "Reinforcement Solver for H-infinity Filter with Bounded Noise," in 15th IEEE International Conference on Signal Processing (ICSP).
- L. Xin, S. Eben Li, P. Wang, **W. Cao**, B. Nie, C. Yao and B. Cheng, "Accelerated Inverse Reinforcement Learning with Randomly Pre-sampled Policies for Autonomous Driving Reward Design," in 2019 IEEE International Conference on Intelligent Transportation (ITSC).

Projects Participated

Networked Modeling and Cooperative Control of Connected and Automated Electric Vehicles (Supported by Ministry of Science and Technology of China)

Beijing and Chongqing, China

Student Leader

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.

General Optimal Control Problems Solver *Beijing, China*

Main Participant *Feb. 2021 - Present*

- Software Platform design with python/C++/Simulink for general optimal control problems, including environment modeling, network training, performance evaluation, code deployment and hardware-in-the-loop experiment.
- Distributed Architecture design for network training, integrating data sampling, data storage, gradient computation and network update.

Real-time Monocular 3D Detection (Supported by IDRIVERPLUS company) *Beijing, China*

Main Participant *Jun. 2021 - Aug. 2021*

- Code Implementation of a two-stage monocular 3D detection algorithm for automated vehicles.

Honors & Awards

Honors

2019	**Top 5%**	Outstanding Graduates of Beijing Jiaotong University	*Beijing, China*
2016	**Top 1%**	National Scholarship	*Beijing, China*
2016-2018	**Top 5%**	The First Prize Scholarship	*Beijing, China*

Awards

2021	**Top 5%**	Stduent Best Paper Finalist of 2021 Modeling, Estimation and Control Conference	*Texas, USA*
2016	**Top 5%**	Second Prize of Beijing Physics Competition	*Beijing, China*

Skills

Related Courses	Optimal Filtering, Optimal Control, Convex Optimization, Reinforcement Learning, Machine Learning, Stochastic Process, Probabilistic Graphical Model, System Identification
Programming	Proficient in MATLAB/Simulink and Python programming (PyTorch), familiar with C/C++ programming and ROS
Language	English (IELTS 7.0)