Wenhan (Winston) Cao

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RESEARCH INTERESTS

My research interests are optimal control and estimation using Bayesian machine learning, with applications to autonomous vehicles and robots.

EDUCATION

Tsinghua University, Beijing, China
Ph.D. Student, School of Vehicle and Mobility, September 2019-Now
Supervisor: Dr. Shengbo Eben Li, Professor of Mechanical Engineering and Artificial Intelligence
Co-supervisor: Dr. Chang Liu, Assistant Professor of Intelligent Robotics Systems

The University of Manchester, Manchester, UK
Visiting Ph.D. Student, Department of Computer Science, January 2023-June 2024
Supervisor: Dr. Wei Pan, Senior Lecturer of Computer Science

Technical University of Munich, Munich, Germany
Visiting Ph.D. Student, School of Computation, Information and Technology, September 2023-December 2023
Supervisor: Dr. Sandra Hirche, Professor of Control and Optimization

Beijing Jiaotong University, Beijing, China
Bachelor of Engineering, School of Electrical Engineering, September 2015-June 2019
GPA ranking: 1/305

SELECTED PAPERS

Wenhan Cao, Shiqi Liu, Chang Liu, Zeyu He, Stephen S.-T. Yau & Shengbo Eben Li. *Convolutional Bayesian Filtering.* Submitted to IEEE Transactions on Automatic Control (Available at https://arxiv.org/abs/2404.00481).

Wenhan Cao, Chang Liu, Zhiqian Lan, Shengbo Eben Li, Wei Pan & Angelo Alessandri. *Robsut Bayesian Inference for Moving Horizon Estimation.* Provisionally Accepted by Automatica (Available at https://arxiv.org/abs/2210.02166).

Shiqi Liu, **Wenhan Cao**, Chang Liu, Tianyi Zhang & Shengbo Eben Li. *Convolutional Unscented Kalman Filter for Multi-Object Tracking with Outliers.* Accepted by IEEE Transactions on Intelligent Vehicles (Available at https://arxiv.org/abs/2406.01380).

Wenhan Cao & Wei Pan (2024). *Impact of Computation in Integral Reinforcement Learning for Continuous-Time Control.* In 2024 International Conference on Learning Representations (ICLR). **(Spotlight)**

Wenhan Cao, Alexandre Capone, Rishabh Yadav, Sandra Hirche & Wei Pan. *Computation-Aware Learning for Stable Control with Gaussian Process.* Accepted by Robotics: Science and Systems (RSS) 2024.

Wenhan Cao, Chang Liu, Zhiqian Lan, Yingxi Piao & Shengbo Eben Li (2023, May). *Generalized Moving Horizon Estimation for Nonlinear Systems with Robustness to Measurement Outliers.* In 2023 American Control Conference (ACC) (pp. 1614-1621). IEEE.

Jingliang Duan, **Wenhan Cao**, Yang Zheng & Lin Zhao (2023). *On the Optimization Landscape of Dynamic Output Feedback Linear Quadratic Control.* IEEE Transactions on Automatic Control. **(Regular Paper)**

Wenhan Cao, Jingliang Duan, Shengbo Eben Li, Chen Chen, Chang Liu, & Yu Wang. (2022, December). *Primal-Dual Estimator Learning Method with Feasibility and Near-Optimality Guarantees*. In 2022 IEEE 61st Conference on Decision and Control (CDC) (pp. 4104-4111). IEEE.

Wenhan Cao, Jianyu Chen, Jingliang Duan, Shengbo Eben Li & Yao Lyu. (2021). *Reinforced Optimal Estimator*. IFAC-PapersOnLine, 54(20), 366-373.

HONORS & AWARDS

Student Best Paper Finalist of 2021 IFAC Modeling, Estimation and Control Conference, Texas, USA, 2021
National Scholarship, Beijing, China, 2016
The First Prize Scholarship, Beijing, China, 2016 – 2018

INVITED TALKS & CONFERENCES PRESENTATIONS

NANO filter: Bayesian Filtering with Natural Gradient Gaussian Approximation at the Department of Astronomy, Tsinghua University, Beijing, China, hosted by Prof. Zheng Cai, August 2024.

Convolutional Bayesian Filtering at the Department of Mathematical Sciences, Tsinghua University, Beijing, China, hosted by Prof. Stephen Shing-Toung Yau, February 2024.

Generalized Moving Horizon Estimation for Nonlinear Systems with Robustness to Measurement Outliers in 2023 American Control Conference, San Diego, CA, USA (Oral Presentation), May 2023.

Learning-based state estimation methods at the Technical University of Munich, Munich, Germany (Online Presentation), hosted by Prof. Sandra Hirche, February 2023.

Primal-Dual Estimator Learning Method with Feasibility and Near-Optimality Guarantees in 2022 IEEE 61st Conference on Decision and Control, Cancún, Mexico (Oral Presentation), December 2022.

Reinforced Optimal Estimator in 2021 IFAC Modeling, Estimation and Control Conference, Texas, USA (Oral Presentation), October 2021.

Accelerated Inverse Reinforcement Learning with Randomly Pre-sampled Policies for Autonomous Driving Reward Design in 2019 IEEE Intelligent Transportation Systems Conference, Auckland, New Zealand (Oral Presentation), October 2019.

PROFESSIONAL SERVICES

Conference Reviewer: CDC, ACC, L4DC, ICLR, AAMAS & IFAC NMPC
Journal Reviewer: TASE, TITS & RA-L