

Hao Luan

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EDUCATION

National University of Singapore

Doctor of Philosophy (Ph.D.) in Computer Science

Singapore, SG

Aug. 2023 –

- NUS Research Scholarship
- Advisors: Prof. Chun Kai Ling; Prof. See-Kiong Ng

Harbin Institute of Technology, Shenzhen

Bachelor of Engineering (B.Eng.), Automation

Shenzhen, CHN

Sep. 2017 – Jun. 2021

- Overall GPA: 90.1/100, 3.8/4.0
- Thesis: “Distributed Consensus of Multi-Agent Systems with State Constraints under Switching Directed Graphs.” [Abstract] [Related Pub.]

Remarks:

- Admitted with full fellowship first to the *Master of Applied Science* (research-based) program in 2022 and then the *Direct Entry PhD* program in 2023 at the Edward S. Rogers Sr. Department of Electrical and Computer Engineering, University of Toronto, Canada. Not matriculated.

RESEARCH EXPERIENCE

Collaborative, Learning, and Adaptive Robots Lab – NUS

Graduate Researcher

Advisor: Prof. Harold Soh

Aug. 2023 – May 2024

Singapore, SG

Comp. Sci.

- Approached the problem of data-driven decision-making with temporally-extended constraints.
- Proposed a policy diffusion-based algorithm to satisfy *spatial-temporal symbolic* constraints for safe and customized robot path and motion planning.

Robotics Perception & Intelligence Lab – SUSTech & CUHK

Full-time Research Assistant

Advisors: Prof. Max Q.-H. Meng, Prof. Jiankun Wang

Aug. 2021 – Jul. 2022

Shenzhen, CHN

Electronic & Electrical Eng.

- Developed intelligent decision-making modules for a robotic solution to autonomous trolley collection and collaborative transportation at airports.
- Developed an autonomous mobile manipulation platform operating in dynamic environments.
- Proposed a safety-critical motion planner for obstacle avoidance and perception-aware planning.
- Conducted hardware experiments and tests to validate the platform prototype.

Multi-Agent Systems Lab – Harbin Inst. Tech. Shenzhen

Undergraduate Research Assistant

Advisor: Prof. Jie Mei

Oct. 2019 – Jun. 2021

Shenzhen, CHN

Automation

- Conducted theoretical research on multi-agent systems control over directed networks.
- Proposed a control framework addressing the distributed consensus problem for multi-agent systems with constraints, uncertainties, and time-varying directed topologies.
- Presented distributed consensus algorithms, theoretical proof of convergence, numerical simulations, and physical experiments for validation.

Robot. Automat. Percep. & Decis. Lab – Sun Yat-sen Univ.

Research Intern

Advisor: Prof. Hui Cheng

Nov. 2015 – May 2016

Guangzhou, CHN

Comp. Sci. & Eng.

- Optimized and implemented a centralized offline task-allocation algorithm for multi-robot systems based on the Ant Colony System.
- Performed simulations to test the proposed algorithm and presented results at the concluding report.

PROFESSIONAL EXPERIENCE

Peng Bo Technology (Shenzhen) Co. Ltd.

Mar. 2021 – Apr. 2021

Software Development Intern

Shenzhen, CHN

Supervisor: Dr. Shixin Mao

- Developed drivers for the vehicle chassis of the company's autonomous robotic cleaning products.

PUBLICATIONS & PREPRINTS

* indicates co-first authorship.

Preprints

- ◇ Z. Feng, **H. Luan**, K. Y. Ma, and H. Soh, "Diffusion meets options: Hierarchical generative skill composition for temporally-extended tasks," 2024.

Journal

- [J1] Z. Feng*, **H. Luan***, P. Goyal, and H. Soh, "LTLDoG: Satisfying temporally-extended symbolic constraints for safe diffusion-based planning," *IEEE Robotics and Automation Letters (RA-L)*, vol. 9, no. 10, pp. 8571–8578, 2024, doi: 10.1109/LRA.2024.3443501. [arXiv] [PDF] [Page] [Code]
- [J2] X. Gao, **H. Luan**, B. Xia, Z. Zhao, J. Wang, and M. Q.-H. Meng, "A divide-and-conquer control strategy with decentralized control barrier function for luggage trolley transportation by collaborative robots," *Robotica*, vol. 41, no. 11, pp. 3333–3348, 2023, doi: 10.1017/S0263574723001005. [Video]
- [J3] **H. Luan**, J. Mei, A.-G. Wu, and G. Ma, "Distributed constrained consensus of multi-agent systems with uncertainties and disturbances under switching directed graphs," *IEEE Transactions on Control of Network Systems*, vol. 11, no. 1, pp. 161–172, 2024, doi: 10.1109/TCNS.2023.3272848. [Page] [PDF]

Conference

- [C1] J. Zhao, H. Ye, Y. Zhan, **H. Luan**, H. Zhang, "Human orientation estimation under partial observation," Accepted to *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2024. [arXiv]
- [C2] B. Xia*, **H. Luan***, Z. Zhao*, X. Gao, P. Xie, A. Xiao, J. Wang, and M. Q.-H. Meng, "Collaborative trolley transportation system with autonomous nonholonomic robots," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2023, pp. 8046–8053, doi: 10.1109/IROS55552.2023.10341508. [arXiv] [PDF] [Video]
- [C3] A. Xiao*, **H. Luan***, Z. Zhao*, Y. Hong, J. Zhao, W. Chen, J. Wang, and M. Q.-H. Meng, "Robotic autonomous trolley collection with progressive perception and nonlinear model predictive control," *2022 International Conference on Robotics and Automation (ICRA)*, 2022, pp. 4480–4486, doi: 10.1109/ICRA46639.2022.9812455. [Page] [arXiv] [PDF] [Video]

AWARDS & FELLOWSHIPS

NUS Research Scholarship, <i>National University of Singapore</i>	2023 –
Edward S. Rogers Sr. Graduate Scholarship, <i>University of Toronto</i> (Declined)	2023 – 2028
Outstanding Bachelor's Thesis (top 2%), <i>HIT Shenzhen</i>	2021
Mathematical Contest In Modeling (MCM) Honorable Mention	2020
Undergraduate Academic Merit Scholarship, <i>HIT Shenzhen</i>	2018, 2019, 2020
National Olympiad in Informatics in Provinces (NOIP) Third Prize	2016
American Mathematics Contest (AMC) 12 Honor Roll and invited to the AIME	2016

ACADEMIC SERVICES

Conference Reviewing

- IEEE International Conference on Robotics and Automation (ICRA 2022, 2023)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022)
- IEEE International Conference on Robotics and Biomimetics (ROBIO 20/21)

Journal Reviewing

- IEEE Robotics and Automation Letters (RA-L)

SKILLS

Languages: Mandarin (native), Cantonese (native), English (Fluent)

Programming: C/C++, Python, Julia, Pascal

Tools: CasADi, Git, LCM, MATLAB/Simulink, PyTorch, Wolfram Mathematica, ROS, L^AT_EX