

Ruihua Han

Ph.D. Candidate, Email: hanrh@connect.hku.hk
Department of Computer Science, The University of Hong Kong
Website: hanruihua.github.io ◊ [github](https://github.com/hanruihua) ◊ [Google Scholar](https://scholar.google.com/citations?user=hanrh)

RESEARCH INTERESTS

Topics: Optimal control for robotics, Motion planning, Robotics navigation and exploration, Reinforcement learning, Whole-body humanoid robot.

Overview: I am deeply passionate about developing the **generally intelligent and theoretically guaranteed robotics systems** capable of performing complex tasks comparable to human capabilities. My current research focuses on the **optimal control and motion planning** for ground mobile robots navigating cluttered and inhabited environments. I am utilizing learning techniques and optimization theory (**Model-based learning**) to enhance the adaptability and efficiency of mobile robot systems. Additionally, I am also interested in the whole body humanoid robot control and planning.

EDUCATION

The University of Hong Kong Ph.D., Computer Science <i>Advised by Profs. Jia Pan and Qi Hao</i>	2020 – present
Xiamen University M.Eng. Microelectronics and Solid State Electronics <i>Advised by Prof. Hang Guo</i>	2014 – 2017
Wuhan University of Technology B.Eng. Industrial Equipment and Control Engineering	2010 – 2014

JOURNAL PUBLICATIONS

- [J1] He Li, **Han, Ruihua**, Zirui Zhao, Wei Xu, Qi Hao, Shuai Wang, and Chengzhong Xu. “Seamless Virtual Reality with Integrated Synchronizer and Synthesizer for Autonomous Driving”. In: *IEEE Robotics and Automation Letters (RAL)* (2024).
- [J2] **Han, Ruihua**, Shuai Wang, Shuaijun Wang, Zeqing Zhang, Qianru Zhang, Yonina C Eldar, Qi Hao, and Jia Pan. “RDA: An accelerated collision free motion planner for autonomous navigation in cluttered environments”. In: *IEEE Robotics and Automation Letters (RAL)* 8.3 (2023), pp. 1715–1722.
- [J3] Shuaijun Wang, Rui Gao, **Han, Ruihua**, and Qi Hao. “3DSF-MixNet: Mixer-Based Symmetric Scene Flow Estimation From 3D Point Clouds”. In: *IEEE Robotics and Automation Letters (RAL)* 9.1 (2023), pp. 611–618.
- [J4] **Han, Ruihua**, Shengduo Chen, Shuaijun Wang, Zeqing Zhang, Rui Gao, Qi Hao, and Jia Pan. “Reinforcement learned distributed multi-robot navigation with reciprocal velocity obstacle shaped rewards”. In: *IEEE Robotics and Automation Letters (RAL)* 7.3 (2022), pp. 5896–5903.
- [J5] Zeqing Zhang, Yinqiang Zhang, **Han, Ruihua**, Liangjun Zhang, and Jia Pan. “A generalized continuous collision detection framework of polynomial trajectory for mobile robots in cluttered environments”. In: *IEEE Robotics and Automation Letters (RAL)* 7.4 (2022), pp. 9810–9817.
- [J6] Zeqing Zhang, **Han, Ruihua**, and Jia Pan. “An efficient centralized planner for multiple automated guided vehicles at the crossroad of polynomial curves”. In: *IEEE Robotics and Automation Letters (RAL)* 7.1 (2021), pp. 398–405.

CONFERENCE PUBLICATIONS

- [C1] Lexiong Huang*, **Han, Ruihua***, Guoliang Li, He Li, Shuai Wang, Yang Wang, and Chengzhong Xu. “iCOIL: Scenario Aware Autonomous Parking Via Integrated Constrained Optimization and Imitation Learning”. In: *2023 IEEE 43rd International Conference on Distributed Computing Systems Workshops (ICDCSW)*. **Best student paper**, *Equal contribution. IEEE. 2023, pp. 97–102.
- [C2] Xinyi Wang, Yulong Ding, Yizhou Chen, **Han, Ruihua**, Lele Xi, and Ben M Chen. “OA-ECBVC: A Cooperative Collision-free Encirclement and Capture Approach in Cluttered Environments”. In: *2023 62nd IEEE Conference on Decision and Control (CDC)*. IEEE. 2023, pp. 5416–5422.
- [C3] Qianru Zhang, Chao Huang, Lianghao Xia, Zheng Wang, Siu Ming Yiu, and **Han, Ruihua**. “Spatial-temporal graph learning with adversarial contrastive adaptation”. In: *International Conference on Machine Learning (ICML)*. PMLR. 2023, pp. 41151–41163.
- [C4] Shuaijun Wang, Rui Gao, **Han, Ruihua**, Shengduo Chen, Chengyang Li, and Qi Hao. “Adaptive environment modeling based reinforcement learning for collision avoidance in complex scenes”. In: *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2022, pp. 9011–9018.

- [C5] **Han, Ruihua**, Shengduo Chen, and Qi Hao. “A distributed range-only collision avoidance approach for low-cost large-scale multi-robot systems”. In: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2020, pp. 8020–8026.
- [C6] **Han, Ruihua**, Shengduo Chen, and Qi Hao. “Cooperative multi-robot navigation in dynamic environment with deep reinforcement learning”. In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 2020, pp. 448–454.

UNDER REVIEW

- [U1] **Han, Ruihua**, Shuai Wang, Shuaijun Wang, Zeqing Zhang, Jianjun Chen, Shijie Lin, Chengyang Li, Chengzhong Xu, Yonina C Eldar, Qi Hao, et al. “NeuPAN: Direct Point Robot Navigation with End-to-End Model-based Learning”. In: *Under review at IEEE Transactions on Robotics (TRO) (2024)*.
- [U2] Guoliang Li*, **Han, Ruihua***, Shuai Wang, Fei Gao, Yonina C Eldar, and Chengzhong Xu. “Edge Accelerated Robot Navigation with Hierarchical Motion Planning”. In: *Under review at IEEE/ASME Transactions on Mechatronics (TMECH) (2023)*. *Equal contribution.

ACADEMIC SERVICES AND ACHIEVEMENTS

Reviewer: ICRA(2021, 2023, 2024), IROS(2021-2024), ACC(2024), RAL, TIE.

Paper Presentation: ICRA 2020 [C6], IROS 2020 [C5], ICRA 2023 [J4], IROS 2023 [J2].

Open source code: GitHub 400+ stars (*rl_rvo_nav*(120 + stars, 50 + Citations) [J4], *RDA_planner*(120 + stars, 10 + Citations) [J2]).

TEACHING

Intelligent Robotics *ROS Tutor*

February 2023 – June 2023

↪ Southern University of Science and Technology (SUSTech)

Course Website

Taught the students how to use ROS to control the simulated and real robot.

Designed and graded the course project (Robot navigation in a maze).

Programming Technologies *Assistant*

September 2023 – December 2023

↪ The University of Hong Kong (HKU)

Designed and graded the course project (Implemented a text-based mini-game by C/C++).

Computer Programming *Assistant*

September 2023 – December 2023

↪ The University of Hong Kong (HKU)

Assisted in completing the assignments and grading the course project.

PERSONAL PROJECTS

IR_SIM:

- A Python-based, lightweight, and user-friendly 2D simulator designed for robotics planning and learning with research and educational purposes.
- Provided a range of robot kinematics, sensor options, environmental configurations, and geometric operations.
- Used in the papers [J4], [J2], [U1], and HKU, SUSTECH robotics courses.

TECHNICAL SKILLS

Programming Languages	Python, C++, MATLAB
Software	ROS, Gazebo, Carla, SolidWorks
Libraries	PyTorch, CVXPY

AWARDS

HKU Postgraduate Scholarship (PGS)	2020-2024
RoboMaster Second Prize (30%)	2015
Awarded at a national robotics competition in China. Served as the embedded engineer for the team.	
ABU China Robocon First Prize (15%)	2014
A national robotics competition in China. Served as the the mechanics engineer for the team.	

WORK EXPERIENCE

Southern University of Science and Technology *Research Assistant*

2017 – 2020

- Developed a multi-robot system platform comprising a dozen Turtlebots for navigation research.
- Completed the papers [C5] and [C6] in the field of multi-robot navigation.