Kun Song

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Education

The University of Hong Kong, Computer Science — Hong Kong
PhD Student in Robotics — *Sept. 2025 - Expected Jun. 2029*

Shanghai Jiao Tong University, Robot Institute — Shanghai
Master of Engineer, Mechanical Engineering; GPA: 3.96/4 (rank 2/371) — *Sept. 2022 - Jun. 2025*

Shanghai Jiao Tong University, The School of Mechanical Engineering — Shanghai
Bachelor of Engineer (with honors), Mechanical Engineering; GPA: 3.73/4.3 (rank 11/180) — *Sept. 2018 - Jun. 2022*

Experience

University of California, Berkeley, MSC-Lab — Berkeley
Research Intern advised by Prof. Masayoshi Tomizuka, Mingyu Ding — *May 2024 - Jan. 2025*

Awards

- **National Scholarship**, 2023, 2020, Top 2%
- Shanghai Merit Graduate, 2022, Top 2%
- Shanghai-FANUC Scholarship, 2021, Top 1%
- Zhiyuan Honors Degree, 2022, Top 1.5%
- Agilent Scholarship, 2022, Top 3%
- Zhiyuan Honors Scholarship, 2018, 2019, 2020, 2021, Top 5%

Research Interests

I am generally interested in enabling robotics systems, like autonomous cars, mobile manipulators, multi-robot system, and humanoids, to interact with the environment intelligently and safely. To be more specific, my research topics lie in the crossing field of perception, planning, control, optimization, foundation models, reinforcement learning, and imitation learning.

- **Robot Learning**: Reinforcement Learning, Imitation Learning, VLA, LLM, VLM, Diffusion Model
- **Multi-robot System**: Cooperative Manipulation, Multi-robot SLAM, Formation Control, Relative Pose Accuracy in a Swarm
- **Perception**:Scene Understanding, SLAM System, Light-weight Mapping

Publications (*Equal Contribution)

[1] **K. Song**, G. Chen, M. Tomizuka, W. Zhan, Z. Xiong, and M. Ding "P^2 *Explore*: Efficient Exploration in Unknown Clustered Environment with Floor Plan Prediction," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2025

[2] **K. Song**, G. Chen, W. Liu, and Z. Xiong, "Multi-Robot Rendezvous in Unknown Environment with Limited Communication," *IEEE Robotics and Automation Letters (RA-L)*, vol. 9, no. 11, pp. 9478-9485, 2024

[3] **K. Song**, W. Liu, G. Chen, X. Xu, and Z. Xiong, "FHT-Map: Feature-based Hybrid Topological Map for Relocalization and Path Planning," *IEEE Robotics and Automation Letters (RA-L)*, vol. 9, no. 6, pp. 5401-5408, 2024

[4] **K. Song**, S. Ma, G. Chen, N. Jin, G. Zhao, M. Ding, Z. Xiong, and J. Pan, "CollaBot: Vision-Language Guided Simultaneous Collaborative Manipulation," *Arxiv*, 2025

[5] W. Liu, M. Ren, **K. Song**, M. Wang, and Z. Xiong, "A Novel Planning Framework for Complex Flipping Manipulation of Multiple Mobile Manipulators," *IEEE Robotics and Automation Letters (RA-L)*, Vol. 10, pp. 5162-5169, 2025

[6] M. Ren, W. Liu, **K. Song**, L. Shi, and Z. Xiong, "Containment Control of Multi-Robot Systems with Non-uniform Time-varying Delays," *IEEE Transactions on Robotics (T-RO)*, vol. 41, pp. 1657-1672, 2025

[7] G. Chen, **K. Song**, X. Xu, W. Liu, and Z. Xiong. "RHAML: Rendezvous-based Hierarchical Architecture for Mutual Localization," *IEEE Robotics and Automation Letters (RA-L)*, vol. 9, no. 7, pp. 6440-6447, 2024

[8] W. Liu, M. Ren, **K. Song**, M. Wang, and Z. Xiong, "Distributed Motion Control of Multiple Mobile Manipulator System with Disturbance and Communication Delay," *Arxiv*, 2024

Research Experience

Exploration in Clustered Environment with Floor Plan Prediction [1] May 2024 - Sept. 2024, Berkeley, CA

Mechanical Systems Control Lab (MSC-Lab), Supervisor: ***Masayoshi Tomizuka*** *University of California, Berkeley*

- Implemented **floor plan prediction** in the task of indoor environment exploration. 2D maps of scenes in KTH floor plan dataset are collected for the training process. FPUNet (Floor Plan UNet) is used for floor plan prediction. Then, the local predicted maps are merged for **global predicted map**. Room segmentation and their topology are extracted to provide a high-level guidance for exploration.

Multi-robot Rendezvous in unknown environment [2] Sept. 2023 - Aug. 2024, Shanghai, China

Robot Control and Machine Vision Lab, Supervisor: ***Zhenhua Xiong*** *Shanghai Jiao Tong University*

- Divided rendezvous task into **two stages**: incomplete exploration of the environment with relative pose (RP) estimation, and rendezvous point selection. Partitioned and incomplete exploration for rendezvous (**PIER**) is proposed firstly. Then, lightweight **topological maps** are constructed to represent the environmental structure and shared among robots for RP estimation. Finally, an **optimal rendezvous point** is selected based on the merged topological map

Rendezvous-based Mutual Localization [7] Aug. 2023 - Apr. 2024, Shanghai, China

Robot Control and Machine Vision Lab, Supervisor: ***Zhenhua Xiong*** *Shanghai Jiao Tong University*

- Proposed a novel rendezvous-based hierarchical architecture for mutual localization (**RHAML**). Firstly, anisotropic convolutions are introduced into the network, yielding **initial localization results**. Then, the **iterative refinement** module with rendering is employed to adjust the observed robot poses. Finally, the **pose graph** is used to optimize all localization results to get an accurate result

Motion Planning for Multiple Mobile Manipulator System [5][8] Jun. 2023 - Jun. 2024, Shanghai, China

Robot Control and Machine Vision Lab, Supervisor: ***Zhenhua Xiong*** *Shanghai Jiao Tong University*

- Proposed a novel planning framework for **complex flipping manipulation** by incorporating platform motions and regrasping. Two types of trajectories, mobile manipulator planning and regrasping planning, are classified and assigned different priorities for various tasks. Comprehensive experiments emphasize the significance of proposed planner in extending the capabilities of multiple mobile manipulator systems in complex tasks

Feature-based Hybrid Topological Mapping [3] Jan. 2023 - Feb. 2024, Shanghai, China

Robot Control and Machine Vision Lab, Supervisor: ***Zhenhua Xiong*** *Shanghai Jiao Tong University*

- Proposed a featured-based hybrid topological map (**FHT-Map**). Lightweight **support nodes** are introduced in traditional topological maps with main nodes only. **Relocalization** and **path planning** algorithms are realized based on FHT-Map, which is capable of reducing **storage requirements** compared with geometric maps and benefiting **path planning** capability compared with traditional topological maps

Design of Soft Pneumatic Actuator using TPMS Sept. 2020 - Sept. 2021, Shanghai, China

Soft Robotics Lab, Supervisor: ***FeiFei Chen*** *Shanghai Jiao Tong University*

- Proposed a new class of **soft pneumatic actuators** with single-material, uniaxial deformation, high energy density, and scalability, purely based on periodic curved air channels. The shape of channels is implicitly parameterized by modified triply periodic minimal surfaces (mTPMS). This kind of actuator can be used as artificial muscles in the future

Projects with Enterprise

- **Multi Robot LiDAR-based SLAM and Exploration**: Multi robot system is utilized to explore the unknown environment, GMapping is used for localization and mapping. Map merging algorithms are performed.
- **Robotic Arm based Scanning of Unknown Surfaces**: The robotic arm is equipped with an Eddy Current Sensor for metal part defect detection. A coverage path is planned for scanning potential defect.

Teaching Experience

- **Teaching Assistant**: COMP7308 *Introduction to unmanned systems* Fall, 2025, The University of Hong Kong
- **Teaching Assistant**: ME3403 *Introduction to Robotics* Spring, 2024, Shanghai Jiao Tong University
- **Teaching Assistant**: ME4409 *Multi-robot System and Control* Fall, 2024, Shanghai Jiao Tong University

Skills

- **Language**: Mandarin Chinese (Native), English (Fluent, TOEFL 104)
- **Knowledge**: VLA, VLM, SLAM, Computer Vision, Deep Learning, Reinforcement Learning
- **Programming**: Proficient in Python, Matlab, Linux, and ROS; familiar with C++, Git
- **Libraries**: Proficient in Numpy, PyTorch, Ceres, OpenCV, PCL, MoveBase; familiar with Moveit, Pandas

Academic Services

- **Journal Reviewer**: IEEE Robotics and Automation Letters (RA-L), Robotics and Autonomous Systems (RAS)
- **Conference Reviewer**: IEEE International Conference on Robotics and Automation (ICRA), The Association for the Advancement of Artificial Intelligence (AAAI), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Advanced Intelligent Mechatronics (AIM)