Mengya Xu

Robotics Institute University of Technology Sydney (UTS)

Active SLAM | Motion Planning | Deformable SLAM

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Education

Doctor of Philosophy — *University of Technology Sydney*

Apr. 2020 - Feb. 2025 — *Sydney, Australia*

Supervisors: Prof. Shoudong Huang, Prof. Qi Hao, and Dr. Liang Zhao

Research topic: Filter Based Active SLAM in Static and Deformable Environments

Summer Exchange Project — *University of British Columbia*

Jun. 2017 - Aug. 2017 — *Vancouver, Canada*

Computer Science and Technology

Courses and projects: Algorithms and the World Wide Web

Bachelor of Engineering — *Southern University of Science and Technology*

Aug. 2015 - Jun. 2019 — *Shenzhen, China*

Major in Computer Science and Technology, GPA: 3.56/4

Thesis title: Trajectory Planning Based on Reinforcement Learning

Employment

Visiting Scholar — *University of Technology Sydney*

Sep. 2024 - Now — *Sydney, Australia*

Simultaneous localisation and mapping in deformable environments

Supervised by Prof. Shoudong Huang

Research Assistant — *Southern University of Science and Technology*

Sep. 2019 - Mar. 2020 — *Shenzhen, China*

Reinforcement learning based path planning, runtime safety assurance for autonomous driving

Supervised by Prof. Qi Hao

Research

RIEKF based active SLAM in static environments

In this work, we design an Right Invariant Extended Kalman Filter (RIEKF) based active SLAM algorithm to explore 2D feature based environments. An improved RIEKF based 3D active SLAM framework is then proposed for exploring 3D environments with obstacles.

This research in 2D case has been published in ICRA2021 [1], and the research in 3D case has been submitted to TETC [4].

Active SLAM in 3D deformable environments

In this work, we propose an EKF based active SLAM algorithm for 3D feature-based deformable environments. The algorithm is designed based on possible assumptions of the feature dynamic model. This is the first step in developing an efficient active SLAM algorithm in deformable environments.

This work has been published in IROS2021 [2] and IROS2022 [3].

Reinforcement learning based active SLAM

This work focus on combining reinforcement learning method with active SLAM in exploration tasks. Reinforcement learning is used to select a goal frontier and generate the robot motion.

Autonomous Robotic Laparoscopy System For Minimally Invasive Surgery (MIS)
For this project, we use a UR16e robot arm holding an Olympus Stereo Laparoscopy to perform visual tracking and visual serving in the MIS. This system has been used to test our EKF and RIEKF based SLAM and active SLAM algorithms in a phantom environment.

Publication

[1] **Mengya Xu**, Yang Song, Yongbo Chen, Shoudong Huang and Qi Hao. Invariant EKF based 2D Active SLAM with Exploration Task. In 2021 IEEE International Conference on Robotics and Automation (ICRA), 2021, pp. 5350-5356.

[2] Shoudong Huang, Yongbo Chen, Liang Zhao, Yanhao Zhang, and **Mengya Xu**. Some research questions for slam in deformable environments. In 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021, pp. 7653-7660.

[3] **Mengya Xu**, Liang Zhao, Shoudong Huang and Qi Hao. Active SLAM in 3D Deformable Environments. In 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022, pp. 7952-7958.

[4] **Mengya Xu**, Shengduo Chen, Liang Zhao, Shoudong Huang and Qi Hao. Invariant EKF based 3D Active SLAM with Exploration Task. In IEEE Transactions on Emerging Topics in Computing (TETC), submitted.

Professional Activity

Reviewer for Journal:

- IEEE Transactions on Robotics (T-RO)
- ELSEVIER Journal of Visual Communication and Image Representation (JVCI)

Reviewer for Conference:

- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

Teaching:

- Tutor for UTS 49928 Design Optimisation for Manufacturing (49928-2024-SPRING-CITY) *2024*
- Tutor for UTS 49928 Design Optimisation for Manufacturing (49928-2023-SPRING-CITY) *2023*
- Tutor for 2021 IEEE RAS Winter School on SLAM in Deformable Environments *2021*
- Tutor for SUSTech CS401 Intelligent Robotics (CS401-30008488-2021SP) *2021*
- Tutor for SUSTech CS405 Machine Learning (CS405-30000313-2020FA) *2020*

Award

- UTS FEIT PhD Post-Thesis Scholarship Award *2024*

Referee

Prof. Shoudong Huang

Professor, Deputy Director of Robotics Institute, University of Technology Sydney, Australia

Shoudong.Huang@uts.edu.au

Dr. Liang Zhao

Reader, Robot Systems in the School of Informatics, The University of Edinburgh, United Kingdom

liang.zhao@ed.ac.uk

Prof. Qi Hao

Professor, Deputy Head of Department of Computer Science and Engineering, Southern University of Science and Technology, China

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