Ziwei Liao

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PhD candidate | Institute for Aerospace Study, University of Toronto, Canada

Research Interests

My interests include Simultaneously Localization and Mapping (SLAM), Computer Vision and Robotics, aiming to make intelligent robots and machines to perceive, understand and interact with real environments.

Education

University of Toronto *Toronto, Canada*

***Ph.D. Candidate**, Institute for Aerospace Study* *Sep 2021 – Current*

- I am with Toronto Robotics & AI Lab (TRAIL), supervised by Prof. Steven Waslander

Beihang University (Double First-Class, Project 985,211) *Beijing, China*

***M.S., the Robotics Institute**, School of Mechanical Engineering and Automation* *Sep 2018 – Jun 2021*

- GPA: 3.75/4.0, 90.1/100, **National Scholarship (Top 5%)**
- Research Area: Visual SLAM, Semantic Scene Understanding, Robots Navigation

***B.Eng.,** Mechanical Engineering* *Sep 2014 - Jun 2018*

- GPA: 3.64/4.0, 88.5/100, **Integrated Rank: 3/209 (Top 2%)**
- Recommended for direct admission to postgraduate study

Tsukuba University *Ibaraki, Japan*

Research Assistant, the Intelligent Robot Laboratory, School of Computer Science *Sep 2017 - Feb 2018*

- Received full funding from CSC (China Scholarship Council)

Languages & Skills

- Languages: **English (TOEFL 109, R 30, L 28, S 23, W 28)**, Japanese (N2), Chinese.
- Skills: **SLAM**, **ROS,** Ubuntu, C++/Python, PyTorch, OpenCV**, Multi-view Geometry**, nonlinear optimization.
- Experiences: sensors (RGB-D camera, laser/lidar, odometry), robot platforms (wheeled robots, rotorcrafts), deep learning (implicit representation, object detection, semantic segmentation).

Selected Honors & Awards

National	**National Scholarship (Top 5%, the highest award for a graduate student in China)**	*2020*
National	Second Award of Chinese Robocon National Robotic Competition	*2018*
Beijing	Outstanding Graduate of Beijing (Top 10%)	*2018*

Selected Publications

[1] **Liao, Z.**, Hu, Y., Zhang, J., Qi, X., Zhang, X., & Wang, W. (2022). SO-SLAM: Semantic Object SLAM with Scale Proportional and Symmetrical Texture Constraints. IEEE Robotics and Automation Letters & ICRA 2022. [pdf]

[2] **Liao, Z.**, Wang, W., Qi, X. & Zhang, X. (2020). RGB-D Object SLAM using Quadrics for Indoor Environments. *Sensors (Journal), 2020.* [pdf] [video]

[3] **Liao, Z.**, Shi, J., Qi, X., Zhang, X., Wang, W., He, Y., Wei, R., & Liu, X. (2020). Coarse-To-Fine Visual Localization Using Semantic Compact Map. *2020 3rd International Conference on Control and Robots, ICCR 2020*, *Tokyo, Japan (**Best Session Presentation**).* [pdf] [video]

[4] Zhang, X., Wang, W., Qi, X., & **Liao, Z.** (2020). Stereo plane slam based on intersecting lines. In 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 6566-6572). IEEE.. [pdf]

Research Experiences

1. Toronto Robotics & AI Lab (TRAIL) Toronto, Canada

PhD candidate, supervised by Prof. Steven Waslander *Sep 2021 - Current*

Developing visual perception algorithms for 3D objects and environments towards semantic scene understanding.

2. The Robotics Institute, Beihang University *Beijing, China*

Master Candidate, supervised by Prof. Wei Wang *Sep 2019 – Aug 2020*

Developed novel SLAM algorithms using objects and structures for indoor mobile robot's navigation.

- Proposed a semantic Object SLAM algorithm based on RGB-D camera, which uses a quadric surface as an object model to compactly represent the object's position, orientation, and shape.
- Proposed a novel monocular semantic Object SLAM system that addresses object spatial constraints to build a map with objects, including scale proportional constraint, symmetrical texture constraint and plane supporting constraint.
- **Two first-author peer-reviewed journal papers [1][2].**

3. Intelligent Robot Laboratory, Tsukuba University *Japan*

Research Assistant, supervised by Prof. Akihisa Ohya *Sep 2017 - Feb 2018*

Developed a navigation system using a floor map as prior for logistic robots in office corridor environments.

- Designed a navigation and mapping system for domestic logistic robots to travel from the entry of a floor to a destinated room described by room number, such as A311, when entering a building for the first time.
- Proposed using the floor map for humans as prior for the robots, which commonly exists at the entry of buildings.
- Took as the graduation project for a bachelor's degree and received the **Outstanding Graduation Thesis Award**.

Internship Experience

Megvii (Face++) Technology Co., Ltd. *Beijing*

Research Intern in the SLAM Group *Oct 2018 – Jul 2019*

Developed a visual localization system for autonomous driving using a semantic compact map.

- Reproduced and evaluated a semantic localization algorithm proposed in ICRA2018 for autonomous vehicles.
- Proposed a coarse-to-fine localization system with pole-like objects extracted from semantically segmented images.
- **One international robotics conference paper (Best Session Presentation) [3],** and one Chinese patent.

Extracurricular Activities

1. National Robotic Competition Robocon

Vice Capitan *of the Beihang Robot Team* *Sep 2016 - Jun 2018*

Robocon is one of the largest national robotic competitions for undergraduate students with 70+ teams from top universities all over China per year. I participated in two tournaments as vice-captain in the Robotics Vision Group:

- **2017-2018 National Second Award**: Our team designed two omnidirectional robots throwing and picking silk balls. I developed the core control systems using ROS and a visual localization system.

2. The Robots Association of Beihang University

President *Sep 2015 - Sep 2016*

- **Ranked the 1st scientific student association of Beihang University** during 2015-2016.
- Organized a robotics competition named RoboKing with 10+ teams participating, and started organizing course sessions about algorithms for robotics beginners weekly (I was one of the teachers).

Other Interests

Robotics, reading (science fiction, biography), games, swimming