Liao, Ziwei

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Xueyuan Road 37, Haidian District, Beijing, China

EDUCATION

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

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

- GPA: 3.75/4.0, 90.1/100, **National Scholarship (Top 5%)**
- Research Area: Visual SLAM, Semantic Scene Understanding, Robots Navigation
- Related Courses: Multi-view Geometry, Mathematical Statistics, Digital Image Processing, Software Technique

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

- GPA: 3.64/4.0, 88.5/100, **Integrated Rank: 3/209 (Top 2%)**
- Recommended for admission to postgraduate study
- Related Courses: Robot Techniques, Calculus, Programming Language C, Signal Processing, Linear Algebra

Tsukuba University *Ibaraki, Japan*

*Exchange Student, **the Intelligent Robot Laboratory, School of Computer Science*** *Sep 2017 - Feb 2018*

- Received full scholarship from China's Scholarship Council

LANGUAGES & SKILLS

- Languages: **English (TOEFL 109, R 30, L 28, S 23, W 28)**, Japanese (N2), Chinese.
- Skills: **SLAM Algorithms**, Nonlinear Optimization, Filtering, Multi-view Geometry, **C++ language, ROS, Gazebo, Linux (Ubuntu), OpenCV**, Git, Eigen, g2o, embedded development (STM32, Arduino), etc.
- Experiences: deep learning (object detection, semantic segmentation), sensors (RGB-D camera, laser/lidar, odometry), robot platforms (wheeled robots, rotorcrafts).

SELECTED HONORS & AWARDS

National	**National Scholarship (Top 5%, the highest award for a research student in China)**	*2020*
National	Second Award of China National Robocon Robotic Competition	*2018*
Beijing	Outstanding Graduate of Beijing (Top 10%)	*2018*
National	Outstanding Award of National Innovation and Entrepreneurship Training Program (Top 10%)	*2017*
National	National Encouragement Scholarship (Top 10%)	*2015*

PUBLICATIONS & PATENTS

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

[2] Zhang, X., Wang, W., Qi, X., **Liao, Z.**, & Wei, R. (2019). Point-Plane SLAM Using Supposed Planes for Indoor Environments. *Sensors (Journal), 2019*. [pdf]

[3] **Liao, Z.**, Shi, J., Qi, X., Zhang, X., Wang, W., He, Y., Wei, R., & Liu, X. (2019). Coarse-To-Fine Visual Localization Using Semantic Compact Map. 2020 3rd International Conference on Control and Robots, ICCR 2020, *Tokyo, Japan. (**Best Session Paper**)* [pdf] [video]

[4] Zhang, X., **Liao, Z.**, Qi, X., & Wang, W. (2020). Stereo Plane SLAM Based on Intersecting Lines. ArXiv, abs/2008.08218. Submitted to IEEE Robotics and Automation Letters & ICRA 2021. [pdf]

[5] **Liao, Z.**, Positioning method, device, electronic equipment, readable storage medium, *CN111383286A*, *2020* (Patent)

RESEARCH EXPERIENCES

1. The Robotics Institute, Beihang University (BUAA) *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 an object-level semantic SLAM algorithm based on RGB-D data, which uses a quadric surface as an object model to compactly represent the object's position, orientation, and shape.

- Introduced the support relationships between objects and structures to help optimize 3D objects parameters.
- Introduced a nonparametric pose graph to solve data associations in the back end, and innovatively applied it to the quadric surface model.
- **Two peer-reviewed journal papers [1][2], and one journal paper under review [4].**

2. 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 building floors.
- Built a grid map by a laser sensor and a wheeled odometry of the robots, aligned it with the floor map, and then navigated the robots with the semantic information on the floor map, e.g., room numbers and positions.
- Used a monocular camera with an OCR recognition algorithm to check the destination room accurately.
- 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*

Megvii is one of the unicorn companies concentrating on computer vision, robotics, and deep learning research in China.

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

- Reproduced and evaluated the algorithm proposed in the paper *Long-term Visual Localization using Semantically Segmented Images [ICRA2018],* which is a semantic localization algorithm based on a particle filter for vehicles.
- Proposed a coarse-to-fine localization system with pole-like objects extracted from semantically segmented images.
- Introduced a localization method decoupling translation from rotation using a monocular camera as a protractor to estimate the poses precisely.
- Achieved comparable accuracy with SIFT feature-based methods with a significant small map size of 2.7 kb/km.
- **One accepted robotics conference paper [3], and one Chinese patent [5].**

EXTRACURRICULAR ACTIVITIES

1. China Robocon National Robotic Competition

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 by detecting cross lines.
- 2016-2017 National Third Award: Our team designed an omnidirectional robot launching disk onto platforms. I developed a visual disk tracking system to help learn the best launch parameters.

2. The Robots Association of Beihang University

President *Sep 2015 - Sep 2016*

- Organized a robotics competition named RoboKing for the first time in the university, with 10+ teams participating and around 200 students and professors watching for the live finals.
- Started organizing course sessions about algorithms for robotics beginners weekly (I was one of the teachers).
- Ranked the 1st scientific student association of Beihang University during 2015-2016 (The successive presidents continue organizing the competition and teaching until now).

INTERESTS

Robotics, entrepreneurship, psychology, swimming, running, reading (literature, science fiction)