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(expect)*

- GPA: 3.75/4.0
- Research Area: Visual SLAM, Semantic Scene Understanding, Robots Navigation
- Related Courses: Multiple View Geometry, Mathematical Statistics, Digital Image Processing, Software Technique

***B.Eng.,** Mechanical Engineering, School of Mechanical Engineering and Automation* *Sep 2014 - Jun 2018*

- GPA: 3.64/4.0, **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 the China Scholarship Council

LANGUAGES & SKILLS

- Languages: **English (TOEFL 109, R 30, L 28, S 23, W 28)**, **Japanese (N2)**, Chinese.
- Experienced in: **SLAM Algorithms**, Nonlinear Optimization, Filtering, Multi-view Geometry, **ROS, Gazebo, Linux (Ubuntu), OpenCV**, Git, Eigen, g2o, etc.
- Familiar with: **C++ language**, deep learning (object detection), embedded development (STM32, Arduino), mobile robot platforms (wheeled robots, rotorcrafts).

RESEARCH EXPERIENCES

The Robotics Institute, Beihang University (BUAA) *Beijing, China*

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

Developing novel SLAM algorithms using objects and structures for indoor mobile robot's navigation. [video]

- 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 the 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.
- **A first-author article about object-level SLAM [1], and two co-author articles about plane SLAM and semantic mapping are accepted [2][3].**

Intelligent Robot Laboratory, Tsukuba University *Japan*

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

Developing a navigation system using a floor map as prior for logistic robots in office corridor environments. [video]

- Designed a navigation and mapping system for domestic logistic robots to travel from the entry of a floor to the destination 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 laser sensor and 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 Reward.

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.

Developing a visual localization system for autonomous driving scenarios using a semantic compact map. [video]

- 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.
- **A paper is publicly available on arXiv [4]. A Chinese patent is granted [5].**

Publications & Patents

[1] **Liao, Z.**, Wang, W., Qi, X. & Zhang, X.(2020). RGB-D Object SLAM using Quadrics for Indoor Environments. *Sensors, 20*.

[2] Qi, X., Wang, W., **Liao, Z**., Zhang, X., Wei, Ran. (2020). Object Semantic Grid Mapping with 2D LiDAR and RGB-D Camera for Domestic Robot Navigation. Applied Science, *20*.

[3] Zhang, X., Wang, W., Qi, X., **Liao, Z.**, & Wei, R. (2019). Point-Plane SLAM Using Supposed Planes for Indoor Environments. *Sensors, 19*.

[4] **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. *ArXiv, abs/1910.04936*. (Preprint)

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

EXTRACURRICULAR ACTIVITIES

ABU Robocon National Robotic Competition

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

Robocon is one of the largest 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 Reward**: Our team designed two omnidirectional robots throwing and picking silk balls. I developed a visual localization system by detecting cross lines for two robots.
- 2016-2017 National Third Reward: Our team designed an omnidirectional robot launching disk onto platforms. I developed a visual disk tracking system to help learn the best launch parameters.

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 teaching courses about algorithms for robotics beginners weekly (I was one of the teachers).
- Ranked the 1st scientific student associations of Beihang University during 2015-2016 (The successive presidents continue organizing the competition and teaching until now).

Selected Honors & Awards

National	Second Reward of China ABU Robocon Robotics Competition	2018
Beijing	Outstanding Graduate of Beijing (Top 5%)	2018
National	National Innovation and Entrepreneurship Training Program Award (Top 5%)	2017
National	National Encouragement Scholarship (Top 5%)	2015

INTERESTS

Robotics, entrepreneurship, reading, science fiction movies, American TV series, swimming, running.