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

- 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, 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 China's 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, **C++ language, ROS, Gazebo, Linux (Ubuntu), OpenCV**, Git, Eigen, g2o, etc.

- Familiar with: deep learning, embedded development (STM32, Arduino), 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*

Developed 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 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.

- **Published a first-author article about object-level SLAM [1].**

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. [video]

- 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 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. Developed 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 [2]. A Chinese patent is granted [3].**

Publications & Patents

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

[2] **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)

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

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

EXTRACURRICULAR ACTIVITIES

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 Reward**: 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 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 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).

Selected Honors & Awards

National	National Scholarship (Top 5%)	*2020*
National	Second Reward 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*

INTERESTS

Robotics, entrepreneurship, psychology, swimming, running, reading, science fiction movies