

# Liao, Ziwei

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Xueyuan Road 37, Haidian District, Beijing, China

## EDUCATION

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**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** 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

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- 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).

## RESEARCH EXPERIENCES

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**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 articles have been published [1][2]. One paper is under review [3].**

**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 destined 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** 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 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] Zhang, X., Wang, W., Qi, X., **Liao, Z.**, & Wei, R. (2019). Point-Plane SLAM Using Supposed Planes for Indoor Environments. *Sensors*, 19.
- [3] Zhang, X., **Liao, Z.**, Qi, X., & Wang, W. (2020). Stereo Plane SLAM Based on Intersecting Lines. ArXiv, abs/2008.08218. Submitted to RA-L/ICRA 2021.
- [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 (Patent)

## 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 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.

### 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).

## Selected Honors & Awards

National	National Scholarship (Top 5%, the highest reward for a research student in China)	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 (literature, science fiction)