

HONGYU CHEN

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EDUCATION BACKGROUND

ShanghaiTech University 09/2017 - Present
M.E. in Computer Application Technology
Core courses: Algorithm Design and Analysis, Matrix Analysis, Robotics, Computer Vision, Deep Learning, Machine Learning

China University of Petroleum 09/2013 - 06/2017
B.E. Electronic Information Engineering
Core courses: Digital Image Processing, Pattern Recognition, Signal and System, Principle of Communication, Principle of Microcomputer Linguistics
Bachelor Thesis : 3D Terrain Classification for Mobile Ground Robots
Supervisors: Sören Schwertfeger and Yujuan Qi

PUBLICATIONS

- **Chen, H.**, and S. Schwertfeger, "Heterogeneous Multi-sensor Calibration Based on Graph Optimization", 2019 IEEE International Conference on Real-time Computing and Robotics (RCAR): IEEE, 2019.
- **Chen, H.** et al., "Towards Generation and Evaluation of Comprehensive Mapping Robot Datasets", Workshop on Dataset Generation and Benchmarking of SLAM Algorithms for Robotics and VR/AR, 2019 IEEE International Conference on Robotics and Automation (ICRA): IEEE Press, 2019.
- Cai, J., **Chen, H.**, L. Kneip and S. Schwertfeger, "Improving CNN-based Planar Object Detection with Geometric Prior Knowledge", 2020 IEEE International Conference on Robotics and Automation (ICRA): IEEE Press, 2020. (status: **Submitted**)
- **Chen, H.** et al., "Advanced Mapping Robot and High-Resolution Dataset", Robotics and Autonomous Systems (status: **Submitted**)

RESEARCH INTEREST

Robotics Perception, Computer Vision, SLAM, Deep Learning, Multi-sensor Calibration

RESEARCH EXPERIENCE

Project: **MARS Mapper Robot** 09/2017 - Present

- Goal: Design a hardware-synchronized advanced mapping robot with external tracking. Provide High Resolution Datasets for Robotic community.
- My job: Manager of this Project; Organize hardware synchronization part; Regulate sensor's layout; Collect Datasets; Coordinate tasks and schedule project's weekly meeting
- Result: Succeeded creating our Mapper Robot with all the sensors **hardware synchronized**; Accomplished three **High Resolution Datasets** contains : (I) **Nine** 5 MP wide-angle color cameras (10 HZ), **Two** Velodyne HDL-32E 3D Laser scanners(10 HZ), IMU Xsense MTi-300(200Hz), Optitrack tracking system (21 Prime 13 cameras, 30Hz); (II) Provide **ground truth map** and **robot odometry**; (III) Providing **reproducible evaluations** of standard mapping software based on the datasets.

Project: **Multi-sensor Calibration via Graph Optimization** 09/2017 - 05/2019

- Goal: Calculate relative pose of each sensor mounted on MARS Mapper Robot.
- My job: Calculate extrinsic parameter of different sensors; Reduce global calibration error.
- Result: Proposed graph based optimization approach to decrease global calibration error; Achieved dealing different types of uncertainties due to different sensor pairs; Explored conventional hand eye calibration to calibrate tracking system. Simulation experiment shows our method can decrease the global error and its variance.

Project: **Hazmat Sign Detection using RGBD sensors** 06/2019 - Present

- Goal: Researched hazmat sign detection algorithms to solve common failures in current methods (e.g. large angle of hzmat sign etc.) to improve technology crucial for rescue robot
- My job: Create a RGBD hazmat sign dataset; Analyze the performance of our network.
- Result: Annotated the **first** RGBD datasets for hazmat sign with **360** RGBD images which contains **13** categories with **9** azimuths ($\pm 75^\circ, \pm 60^\circ, \pm 45^\circ, \pm 30^\circ, 0^\circ$) with **3** distances ($1.25m, 1.50m, 1.75m$); Proposed new method to rectify large angle images by utilizing the geometry of depth information; Average precision improved **20%**, Average recall increased **22%**. Our approach performs well especially in large angles such as $\pm 60^\circ, \pm 45^\circ$.

Project: **Hand-Eye Calibration** 10/2018 - 03/2019

- Goal: Calibrate Kinova Arm with camera
- My job: Calibrate the transformation of Kinova Arm and one camera
- Result: Succeed calibrate extrinsic parameters of camera with Kinova Arm; Completed a very simple software interaction interface

Project: **Pointcloud with Colors** 10/2017 - 03/2018

- Goal: Add color information to Pointcloud
- My job: Fuse the camera data with 3D Lidar data
- Result: Calibrated 3D Lidar with cameras; Solved the fusion of one 3D Lidar with nine cameras; Add color information the Pointcloud.

Project: **3D Terrain Classification on Mobile robots** 02/2017 - 06/2017

- Goal: researched 3D terrain classification algorithms to solve common failures in current methods (e.g. cases of negative obstacles etc.) to improve the safety of mobile robot
- My job: Detect negative obstacles; Segment ground from Pointcloud
- Result: Analyzed the data format from 3D Lidars; Proposed a new method which can efficiently detect negative obstacles such as holes and underground stairs

CONTEST & INTERN EXPERIENCES

TA for Robotics course 09/2019 - Present

- My job: Organize exercise lesson, Correcting coursework, Adverser for course project.

Robocup Wordcup Rescue Competition 07/2019, Sydney, Australia

- Succeed in detecting the change in CO_2 concentration
- Succeed in detecting moving objects

- Succeed in detecting hazmat signs
- Succeed create 3D Maps of the competition area

TA for Digital image processing course 09/2018 - 02/2019

- My job: Organize exercise lesson, Correcting coursework, Help student with course project.

Volunteer For IEEE Safety, Security and Rescue Robotics Conference 09/2017

- My job: Participant registration, Organize Robot rescue Competition

Intern at Shanghai Gaoxian Automation Technology Company 07/2017 - 09/2017

- My job: 3D Pointcloud classification
- Result: Extract features from 3D Pointcloud for 10 categories of objects. Using Random Forest algorithm to classify objects. For each category of objects achieve around **87%** precision.

HONORS & AWARDS

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| Robocup China rescue competition, Second Prize | 04/2018 |
| IEEE SSRR Conference Robot Rescue Best Design Award | 10/2017 |
| ROS Summer School Robot Competition, First Prize | 07/2017 |
| Utility model patents (1); Software copyright (1) | 07/2016 |
| Undergraduate Electronic Circuit Design Competition, Shandong Province First Prize | 10/2016 |
| Outstanding Student | 10/2015 |
| National Inspirational Scholarship | 10/2015 |
| Technology Innovation Scholarship | 10/2015 |

LANGUAGES

English, German(Beginner Level), Cantonese(Dialect)

SKILLS

Programming Languages and Tools: Python, MATLAB, C/C++, ROS, LaTeX, TensorFlow, PyTorch