

DR. JIANHAO JIAO

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EMPLOYMENT

Senior Research Fellow , UCL, UK	<i>January 2024 - Now</i>
Research Associate (Postdoc) , HKUST, China	<i>January 2022 - December 2023</i>
Internship , Shenzhen Unity-Drive Innovation Ltd, China	<i>June 2018 - September 2018</i>
Research Assistant , CityU Shenzhen Research Institute, China	<i>December 2016 - April 2017</i>
Internship , RoboMaster, Shenzhen DJI Ltd.	<i>July 2016 - August 2016</i>

EDUCATION

The Hong Kong University of Science and Technology	Hong Kong SAR, CHINA
Ph.D. in Electronic & Computer Engineering	<i>September 2017 - January 2022</i>
Cheng Kar-Shun Robotics Institute	
Advisor: Prof. Ming Liu	
Thesis: LiDAR Perception Systems for Autonomous Robots: from Calibration to Localization, Mapping, and Recognition. ¹	
Zhejiang University	Hangzhou, CHINA
B.Eng. in Electronic Engineering	<i>Sept. 2013 - June 2017</i>
Advisors: Prof. Xiang Tian	
Thesis: Towards a Cloud-Based Visual SLAM Framework for Low-Cost Agents	

PROJECTS

- PI, China NSFC Young Scientist Fund** *January 2024 - May 2024*
ID: 62303388. Value: CNY¥300,000
Title: Research on localization and mapping in large-scale and unstructured environments for mobile robots (面向大规模非结构化场景的移动机器人定位和建图方法研究)

SELECTED PUBLICATIONS (FIRST/CO-FIRST/CORRESPONDING AUTHOR)

*: Equal Contribution. +: Corresponding Author.

IN SUBMISSION

- [1] Peng Yin*, **Jianhao Jiao***, Shiqi Zhao, General Place Recognition Survey for Modern Robotic Systems: Towards the Real-World Autonomy Age, submitted to *IEEE Transactions on Robotics (TRO)*, SCI-1.
- [2] Hexiang Wei*, **Jianhao Jiao***, Xiangcheng Hu, Jingwen Yu, Xupeng Xie, Jin Wu, Yilong Zhu, Lujia Wang, Ming Liu, FusionPortableV2: Challenging Mult-Sensor Perception Dataset Beyond Campus, submitted to *The International Journal of Robotics Research (IJRR)*, SCI-1.

¹<https://repository.ust.hk/ir/Record/1783.1-116580>

- [3] **Jianhao Jiao**, Jianxing Shi, Linwei Zheng, Yilong Zhu, Bohuan Xue, Shuyang Zhang, Jin Wu, Yingbing Chen, Rui Fan, RDMapping: Large-Scale Road Defect 3D Mapping by Coupling LiDAR-Vision-IMU Measurements, submitted to *IEEE/ASME Transactions on Mechatronics (T-Mech)*, SCI-1.
- [4] **Jianhao Jiao**, Ruoyu Geng, Yuanhang Li, Ren Xin, Bowen Yang, Jin Wu, Lujia Wang, Rui Fan, Ming Liu, Real-Time Metric-Semantic Mapping for Autonomous Navigation in Outdoor Unstructured Environments, submitted to *IEEE Transactions on Automation Science and Engineering (TASE)*, conditionally accepted, SCI-1.

BOOK CHAPTER

- [1] **Jianhao Jiao**, Xiangcheng Hu, Xupeng Xie, Jin Wu, Hexiang Wei, Lu Fan, Ming Liu, Enabling Robust SLAM for Mobile Robots with Sensor Fusion, *Autonomous Driving Perception: Fundamentals and Applications*. Springer, 2023.
- [2] **Jianhao Jiao**, Peng Yun and Ming Liu (2017) A Cloud-Based Visual SLAM Framework for Low-Cost Agents. In: Liu M., Chen H., Vincze M. (eds) *Computer Vision Systems. ICVS 2017. Lecture Notes in Computer Science*, vol 10528. Springer, Cham.

JOURNAL

- [1] Bowen Yang, Jie Cheng, **Jianhao Jiao**⁺, Ming Liu, Efficient Global Navigational Planning in 3D Structures based on Point Cloud Tomography, submitted to *IEEE/ASME Transactions on Mechatronics (T-Mech)*, 2024, SCI-1.
- [2] Xiangcheng Hu, Linwei Zheng, Ruoyu Geng, Jin Wu, Hexiang Wei, Yang Yu, Xiaoyu Tang, Lujia Wang, **Jianhao Jiao**⁺, Ming Liu, PA-SLAM: Robust Prior-Assisted Ground Truth Trajectory Generation for Benchmarking, *IEEE/ASME Transactions on Mechatronics (T-Mech)*, 2024, SCI-1.
- [3] **Jianhao Jiao**, Feiyi Chen, Hexiang Wei, Jin Wu, Ming Liu, LCE-Calib: Automatic LiDAR-Frame/Event Camera Extrinsic Calibration With a Globally Optimal Solution, *IEEE/ASME Transactions on Mechatronics (T-Mech)*, 2023, SCI-1.
- [4] **Jianhao Jiao**, Haoyang Ye, Yilong Zhu, Ming Liu, Robust Odometry and Mapping for Multi-LiDAR Systems with Online Extrinsic Calibration, *IEEE Transactions on Robotics (TRO)*, 2021, SCI-1. **TRO Popular Article in April, 2022.**

CONFERENCE

- [1] Jinhao He, Huaiyang Huang, Shuyang Zhang, **Jianhao Jiao**⁺, Ming Liu, APMP: Accurate Prior-centric Monocular Positioning with Offline LiDAR Fusion, *IEEE International Conference on Robotics and Automation (ICRA)*, 2024, CCF-B.
- [2] Shuyang Zhang, Jinhao He, Bohuan Xue, Jin Wu, **Jianhao Jiao**⁺, Ming Liu, An Image Acquisition Scheme for Visual Odometry based on Image Bracketing and Online Attribute Control, *IEEE International Conference on Robotics and Automation (ICRA)*, 2024, CCF-B.
- [3] **Jianhao Jiao**^{*}, Hexiang Wei^{*}, Tianshuai Hu^{*}, Xiangcheng Hu^{*}, Yilong Zhu, Zhijian He, Jin Wu, Jingwen Yu, Xupeng Xie, Lujia Wang, Ming Liu, FusionPortable: A Multi-Sensor Campus-Scene Dataset for Evaluation of Localization and Mapping Accuracy on Diverse Platforms, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022, CCF-C.

- [4] **Jianhao Jiao**, Yilong Zhu, Haoyang Ye, etc, Ming Liu, Greedy-Based Feature Selection for Efficient LiDAR SLAM, *IEEE International Conference on Robotics and Automation (ICRA)*, 2021, CCF-B.
- [5] **Jianhao Jiao***, Peng Yun*, Lei Tai, Ming Liu, MLOD: Awareness of Extrinsic Perturbation in Multi-LiDAR 3D Object Detection for Autonomous Driving, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020, CCF-C.
- [6] **Jianhao Jiao**, Yang Yu, Qinghai Liao, Haoyang Ye, Ming Liu, Automatic Calibration of Multiple 3D LiDARs in Urban Environments, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2019. **This work was cited and integrated into MATLAB²**, CCF-C.
- [7] **Jianhao Jiao***, Qinghai Liao*, Ming Liu, et al, A Novel Dual-Lidar Calibration Algorithm Using Planar Surfaces, *IEEE Intelligent Vehicles Symposium (IV)*, 2019.
- [8] **Jianhao Jiao**, Rui Fan, Han Ma, Ming Liu, Using DP Towards A Shortest Path Problem-Related Application, *IEEE International Conference on Robotics and Automation (ICRA)*, 2019, CCF-B.

WORKSHOP PAPER

- [1] **Jianhao Jiao**, Ruoyu Geng, Yuanhang Li, Bowen Yang, Ming Liu, Online Metric-Semantic Mapping for Autonomous Robot Navigation, *Robotics: Science and Systems Workshopt (RSSW)*, 2023.
- [2] **Jianhao Jiao**, Huaiyang Huang, Liang Li, Zhijian He, Yilong Zhu, Ming Liu, Comparing Representations in Tracking for Event Camera-based SLAM, *IEEE/CVF Conference on Computer Vision and Pattern Recognition, Event-based Vision Workshop (CVPRW)*, 2021.

PATENTS

- [1] Chinese Patent: **焦健浩**, 云鹏, 刘明; 一种定位方法、系统及介质, 2021-1-29, 中国, 4228721
- [2] Chinese Patent: 穆罕默德·奥斯曼·布塔, **焦健浩**, 云鹏, 王远, 孙学斌, 刘明; 基于半监督学习的缺陷检测方法和装置; 2020-4-26, CN202010338415.5
- [3] Chinese Patent: 王远, **焦健浩**, 云鹏, 穆罕默德·奥斯曼·布塔, 孙学斌, 刘明; 基于深度学习的缺陷检测方法和系统; 2020-4-20, 中国, CN202010312201.0
- [4] Chinese Patent: 王恒立, **焦健浩**, 云鹏, 孙宇翔, 刘明; 路径规划模型训练方法、路径规划方法、设备和系统; 2020-12-3, 中国, CN202011405403.6
- [5] Chinese Patent: 何志坚; **焦健浩**; 樊雪丽; 吕小平; 白桂青; 一种背负式移动测绘系统及具有该系统的测绘仪; 2022-7-8, 中国, 202210294126.9
- [6] Chinese Patent: 谢旭鹏, 魏鹤翔, **焦健浩**, 刘宏基, 刘明; 转接平台及联合数据采集组件; 2023-6-27, 中国, ZL202222956575.3

INVITED TALKS

- [1] Academic Talk:

²<https://uk.mathworks.com/help/lidar/ug/multi-lidar-calibration-workflow.html>

- (a) **Autonomous Navigation System of Mobile Robots for Large-scale Unstructured Environments**, IEEE International Conference on Intelligent Transportation Systems (ITSC), *Workshop: Intelligent Vehicle Meets Urban: Safe And Certifiable Navigation And Control For Intelligent Vehicles In Complex Urban Scenarios*, Invited by Professor Weisong Wang, September 2023.
- (b) **Enabling Robust Perception System for Autonomous Navigation**, The Hong Kong University of Science and Technology (Guangzhou), Robotics and Autonomous Systems Thrust, Invited by Professor Lei Zhu, February 2022.
- (c) **LiDAR Perception System for Autonomous Robots: from Calibration to Localization, Mapping, and Recognition**, Southern University of Science and Technology, Invited by Professor Hong Zhang, December 2021.
- (d) **LiDAR Perception System for Autonomous Robots: from Calibration to Localization, Mapping, and Recognition**, Zhejiang University, November 2021.
- (e) **Extending Multi-LiDAR Fusion to LiDAR-Inertial-Event Fusion for Robust SLAM**, The Hong Kong University of Science and Technology (Guangzhou), Robotics and Autonomous Systems Thrust, April 2021.

AWARDS

IEEE ROBIO, Best Paper Finalist	2019
HKUST Postgraduate Student Scholarship	2017-2021
The 2nd Runner-up in DJI RoboMaster Summer Camp.	2017
Zhejiang Province Student Scholarship	2017
Best Team Award, ZhongKong (中控杯) Robotics Competition, Zhejiang University	2016

TEACHING AND MENTORSHIP

Teaching Assistant	<i>January 2018 - December 2018</i>
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[1] ELEC 1030: The Rise of Autonomous Robots.	Instructor: Prof. WANG, Michael Yu, IEEE/ASME Fellow
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Student Mentorship	Research Topic
[1] Yuzhou Cheng (UCL-Master) (2024-Now)	Gaussian Splatting-Based Visual Localization
[2] Hexiang Wei (HKUST-Mphil) (2022-Now)	Active Perception
[3] Xupeng Xie (HKUST-Mphil) (2022-Now)	Localization with LiDAR-Inertial-Encoder Fusion
[4] Xiangcheng Hu (HKUST-PhD) (2022-Now)	Prior Map-Based Localization
[5] Shuyang Zhang (HKUST-PhD) (2023-Now)	Active Exposure Control and Vision-Based Navigation
[6] Bowen Yang (HKUST-PhD) (2023-Now)	Mapping and Planning for Quadruped Robots
[7] Yilong Zhu (HKUST-PhD) (2023-Now)	Cross-View Visual Localization
[8] Jinhao He (HKUSTGZ-PhD) (2023-Now)	Visual Localization in Outdoor Environments
[9] Ruoyu Geng (HKUSTGZ-PhD) (2023-Now)	Semantic Segmentation of Complex Terrain
[10] Tianshuai Hu (HKUSTGZ-PhD) (2022-Now)	Semantic Mapping in Dynamic Environments
[11] Bonan Liu (HKUSTGZ-PhD) (2023-Now)	Radiance Field-Based Mapping for AR/VR

ACADEMIC ACTIVITIES

Associate Editor

- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2024

Workshop and Challenge Committee

- Autonomous Robotic Technology Seminar (ARTS)³, China, 2023
- ECCV-AVVision workshop⁴, 2022
- The Conference on Pattern Recognition and Computer Vision (PRCV)-AGEP Challenge⁵, 2022

Review Services

- Journal: *IEEE Transaction on Robotics (TRO)*, *IEEE Robotics and Automation Magazine (RAM)*, *IEEE Robotics and Automation Letters (RA-L)*, *Autonomous Robots (AURO)*, *IEEE/ASME Transactions on Mechatronics (TMECH)*, *IEEE Transactions on Automation and Science Engineering (TASE)*, *IEEE Transactions on Intelligent Transportation Systems (TITS)*, *IEEE Transactions on Instrumentation and Measurement (TIM)*, *Neurocomputing*.
- Conference: *Robotics: Science and Systems (RSS)*, *International Conference on Intelligent Robots and Systems (IROS)*, *International Conference on Robotics and Automation (ICRA)*, *IEEE Intelligent Vehicles Symposium (IV)*, *IEEE International Conference on Intelligent Transportation Systems (ITSC)*, *IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshop (CVPRW)*, *European Conference on Computer Vision Workshop (ECCVW)*, *International Conference on Learning Representation Workshop (ICLRW)*.

³<https://www.roboarts.cn/>

⁴<https://avvision.xyz/eccv22>

⁵http://www.prcv.cn/?list_92

APPENDIX: OTHER CO-AUTHOR PUBLICATIONS

- [1] Bonan Liu, Guoyang ZHAO, **Jianhao Jiao**, Guang Cai, Chengyang Li, Handi Yin, Yuyang Wang, Ming Liu, Pan Hui, OmniColor: A Global Camera Pose Optimization Approach of LiDAR-360Camera Fusion for Colorizing Point Clouds, *IEEE International Conference on Robotics and Automation (ICRA)*, 2024.
- [2] Jin Wu, Yu Zheng, Zhi Gao, Yi Jiang, Xiangcheng Hu, Yilong Zhu, **Jianhao Jiao**, Ming Liu, Quadratic Pose Estimation Problems: Globally Optimal Solutions, Solvability/Observability Analysis and Uncertainty Description, *IEEE Transaction on Robotics (TRO)*, 2022.
- [3] Shuyang Zhang, Qingwen Zhang, Feiyi Chen, Jin Wu, **Jianhao Jiao**, Lujia Wang, A VT-HMM-based Framework for Countdown Timer Traffic Light State Estimation, *IEEE Transactions on Intelligent Transportation Systems (TITS)*, 2023.
- [4] Yang Yu, Peng Yun, Bohuan Xue, **Jianhao Jiao**, Ming Liu, Accurate and Robust Visual Localization System in Large-scale Dynamic Environments, *IEEE/ASME Transactions on Mechatronics*, 2022.
- [5] Huaiyang Huang, Yuxiang Sun, Wu Jin, **Jianhao Jiao**, Xiangcheng Hu, Linwei Zheng, Lujia Wang, Ming Liu, On Bundle Adjustment for Multiview Point Cloud Registration, *IEEE Robotics and Automation Letters (RAL)*, 2021.
- [6] Tianyu Liu, Qinghai Liao, etc, **Jianhao Jiao**, Ming Liu, Hercules: An Autonomous Logistic Vehicle for Contact-less Goods Transportation During the COVID-19 Outbreak, *IEEE Robotics and Magazine (RAM)*, 2020.
- [7] Wu Jin, Soheil Sarabandi, **Jianhao Jiao**, Huaiyang Huang, Bohuan Xue, Ruoyu Geng, Lujia Wang, Ming Liu, Completely Rational SO(n) Orthonormalization, *IEEE International Conference on Robotics and Automation (ICRA)*, 2023.
- [8] Bowen Yang, **Jianhao Jiao**, Lujia Wang, Ming Liu, Game-Theoretic Local Planner for Interactive Crowd Navigation, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022.
- [9] Feiyi Chen, Shuyang Zhang, Yutong Wang, Xupeng Xie, Qingwen Zhang, **Jianhao Jiao**, Ming Liu, Automatic Extrinsic Calibration for Multiple Cameras and LiDARs using a Checkerboard, *IEEE Intelligent Transportation Systems Conference (ITSC)*, 2022.
- [10] Sukai Wang, **Jianhao Jiao**, Peide Cai, Ming Liu, R-PCC: A Baseline for Range Image-based Point Cloud Compression, *IEEE International Conference on Robotics and Automation (ICRA)*, 2022.
- [11] M Usman Maqbool Bhutta, Shoaib Aslam, Peng Yun, **Jianhao Jiao**, Ming Liu, Smart-Inspect: Micro Scale Localization and Classification of Smart Phone Glass defects for Industrial Automation, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020.
- [12] Yilong Zhu, Dong Han, **Jianhao Jiao**, etc, Ming Liu, Rui Fan, Road Curb Detection Using A Novel Tensor Voting Algorithm, *IEEE International Conference on Robotics and Biomimetics (ROBIO)*, 2019. **Best Paper Finalist.**
- [13] Bohuan Xue, **Jianhao Jiao**, Yilong Zhu, etc, Ming Liu, Automatic Calibration of Dual-LiDARs Using Two Poles Stickered with Retro-Reflective Tape, *IEEE International Conference on Imaging Systems*

and Techniques (IST), 2019.

- [14] Rui Fan, Mohammud Bocus, **Jianhao Jiao**, Ming Liu, et al, Road Crack Detection Using Deep Convolutional Neural Network and Adaptive Thresholding, *IEEE Intelligent Vehicles Symposium (IV)*, 2019.
- [15] Han Ma, Yixin Ma, **Jianhao Jiao**, Rui Fan, Ming Liu, et al, Multiple lane detection algorithm based on optimised dense disparity map estimation, *IEEE International Conference on Imaging Systems and Techniques (IST)*, 2019.
- [16] **Jianhao Jiao**, Peng Yun, and Ming Liu, A Cloud-Based Visual SLAM Framework for Low-Cost Agents, *International Conference on Computer Vision Systems (ICVS)*, 2017.
- [17] Yun, Peng, **Jianhao Jiao**, and Ming Liu, Towards a Cloud Robotics Platform for Distributed Visual SLAM, *International Conference on Computer Vision Systems (ICVS)*, 2017.
- [18] Xiangcheng Hu, Jin Wu, **Jianhao Jiao**, Ruoyu Geng, Ming Liu, PA-SLAM: Robust Prior-assisted Ground Truth Trajectory Generation for Benchmarking, *IEEE International Conference on Robotics and Automation Workshop (ICRAW)*, 2023.
- [19] Rui Fan, **Jianhao Jiao**, Jie Pan, Huaiyang Huang, Shaojie Shen, Ming Liu, Real-Time Dense Stereo Embedded in An UAV for Road Inspection, *IEEE/CVF Conference on Computer Vision and Pattern Recognition, UAV Vision Workshop (CVPRW)*, 2019.