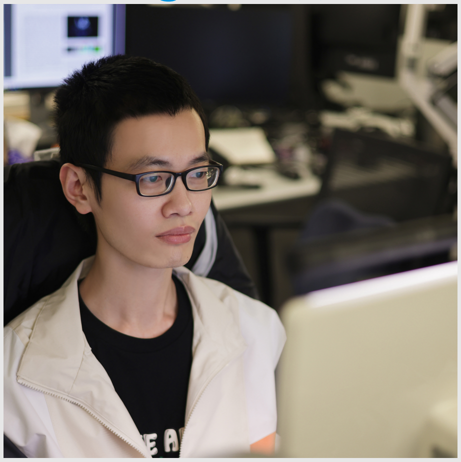
Jiarong Lin 林家荣



Ph.D. candidate in **Robotics**
Sensor fusion; 3D reconstruction

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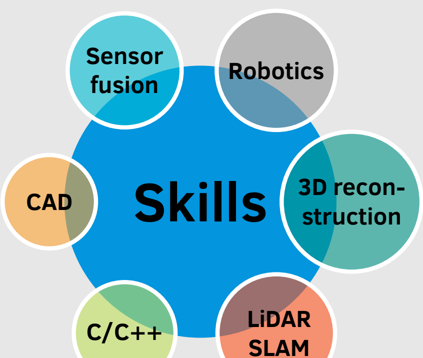
https://github.com/ziv-lin

Ziv-Lin-LJR

Skills



Github (All 5.1 K★)

- r3live ★ 1305
- fast-lio2 ★ 1256
- loam_livox ★ 1198
- r2live ★ 609
- ImMesh ★ 222
- decentralized_loam ★ 170
- Others works ★ 349

Education

2019 - 2023 (Expected) **Ph.D. candidate** — **The University of Hong Kong (HKU)**
Hong Kong SAR, China
Specialization: Robotics; LiDAR SLAM; Sensor fusion.
Advisor: Fu Zhang

2018 - 2019 **Ph.D. student** — **The Hong Kong University of Science and Technology (HKUST)**
Hong Kong SAR, China
Specialization: Robotics; UAV control; Deep reinforcement learning

2011 - 2015 **B.S.** — **University of Electronic Science and Technology of China (UESTC)**
Cheng Du, China
Specialization: Optical Information Science and Technology

Work Experience

2015-2018 **Employees** — **Da Jiang Innovations (DJI)**
Computer vision engineer

- **Phantom 4, Mavic, Inspire 2, and Spark**: In these projects, I am mainly responsible for the vision calibration modules, and have built a factory production line for automatic massive drone production.
- **Mavic Air, Spark, Tello, Mavic pro II**: In these projects, I am responsible for gesture control and visual marker detection algorithms.

2014 **Internship** — **Da Jiang Innovations (DJI)**
Computer vision engineer

- **RoboMaster robotics competition**: Join as a member of the company's team. I developed the embedded control system of the shooting robots.
- **DJI Guidance**: In this project, I am responsible for the self-testing modules, and have developed a self-calibration program for online calibrating the stereo-camera automatically.

Research Experience

2019 - Now **Ph.D. Student** — **The University of Hong Kong (HKU)**
<u>MARS LAB</u>

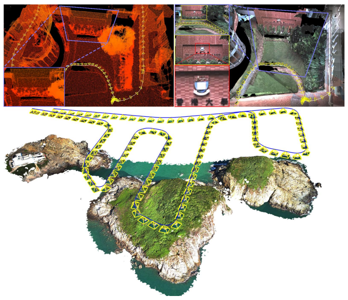
- **LiDAR slam**: I worked on developing the localization and mapping algorithms based on LiDAR sensors, especially for those LiDARs (i.e. MEMS and solid-state LiDAR) with small FoV.
- **LiDAR-Inertial-Visual sensors fusion**: Worked on the research on sensor fusion, which tightly-coupled fuse LiDAR, IMU, and camera sensors to achieve the robust, real-time state estimation and mapping.

2018 - 2019 **Ph.D. Student** — **The Hong Kong University of Science and Technology (HKUST)**
<u>Robotics Institute</u>

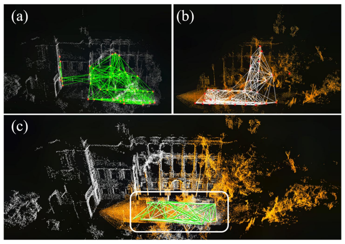
- **Motion planning and control of UAV**: I worked on developing the autonomous drones navigation systems, including the efficient motion planning and robust control of UAVs.
- **Deep reinforcement learning for robotics**: I worked on deep learning for robotics, and have proposed a framework based on reinforcement learning to improve the performance of imitation learning for robotics.

Publications

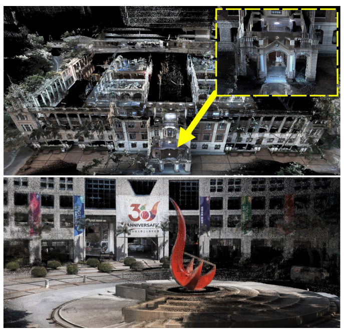
I am the **first author** of 6 **R-AL, IROS, ICRA** paper and 2 under review **T-PAMI, T-RO** journal. For submitted manuscripts, please go to the next page or **click here for Google scholar**



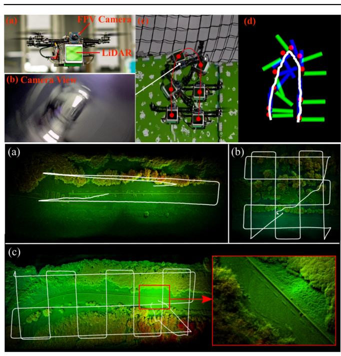
ImMesh: An Immediate LiDAR Localization and Meshing Framework (Under review)
Author: **Jiarong Lin**, Chongjiang Yuan, Yixi Cai, Haotian Li, Yuying Zou, Xiaoping Hong, and Fu Zhang
Github: https://github.com/hku-mars/ImMesh (222 ★)
Introduction: In this work, we propose a novel LiDAR(-inertial) odometry and mapping framework to achieve the goal of simultaneous localization and meshing in real-time. ImMesh comprises four tightly-coupled modules: receiver, localization, meshing, and broadcaster. The localization module utilizes the pre-possessed sensor data from the receiver, estimates the sensor pose online by registering LiDAR scans to maps, and dynamically grows the map. Then, our meshing module takes the registered LiDAR scan for incrementally reconstructing the triangle mesh on the fly. Finally, the real-time odometry, map, and mesh are published via our broadcaster.



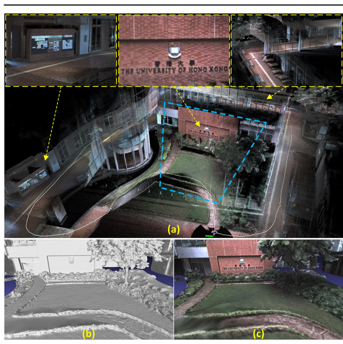
STD: Stable Triangle Descriptor for 3D place recognition. (ICRA2023)
Author: Chongjiang Yuan*, **Jiarong Lin***, Zuhao Zou, Xiaoping Hong, Fu Zhang
Github: https://github.com/hku-mars/std (114 ★)
Introduction: In this work, we present a novel global descriptor termed *stable triangle descriptor (STD)* for 3D place recognition. We first design an algorithm to efficiently extract local key points from the 3D point cloud and encode these key points into triangular descriptors. Then, place recognition is achieved by matching the side lengths (and some other information) of the descriptors between point clouds. Finally, the point correspondence obtained from the descriptor matching pair can be further used in geometric verification, which greatly improves the accuracy of place recognition.



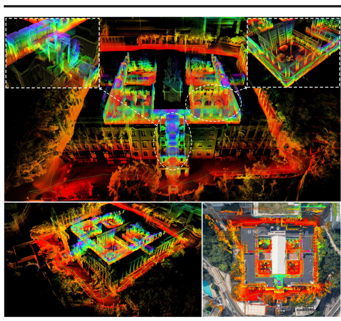
R^3LIVE++: A Robust, Real-time, RGB-colored, LiDAR-Inertial-Visual tightly-coupled state Estimation and mapping package (Under review)
Author: **Jiarong Lin** and Fu Zhang
Github: https://github.com/hku-mars/r3live (1305 ★)
Introduction: In this work, we proposed a LiDAR-inertial-visual fusion framework termed R3LIVE++ to achieve robust and accurate state estimation while simultaneously reconstructing the radiance map on the fly. R3LIVE++ is developed based on R3LIVE and further improves the accuracy in localization and mapping by accounting for the camera photometric calibration (e.g., non-linear response function and lens vignetting) and the online estimation of camera exposure time. Our quantitative and qualitative results show that our proposed system has significant improvements over others in both accuracy and robustness.



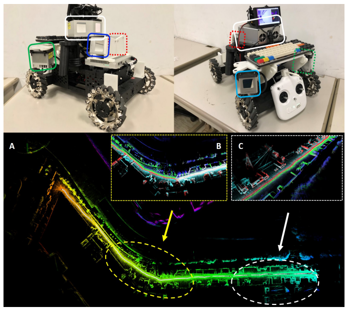
FAST-LIO2: Fast Direct LiDAR-inertial Odometry (Transaction on robotics (TRO 2022))
Author: Wei Xu, Yixi Cai, Dongjiao He, **Jiarong Lin** and Fu Zhang
Github: https://github.com/hku-mars/FAST_LIO (1256 ★)
Introduction: In this paper. we propose a fast, robust, and versatile LiDAR-inertial odometry framework termed FAST-LIO2, which is built upon a highly efficient tightly-coupled iterated Kalman filter and is fast with two key novelties: the direct use of raw point and an incremental k-d tree data structure. FAST-LIO2 is computationally-efficient (e.g., up to 100 Hz odometry and mapping in large outdoor environments), robust (e.g., reliable pose estimation in cluttered indoor environments with rotation up to 1000 deg/s), versatile (i.e., applicable to both multi-line spinning and solid-state LiDARs, UAV and handheld platforms, and Intel and ARM-based processors), while still achieving higher accuracy than existing methods.



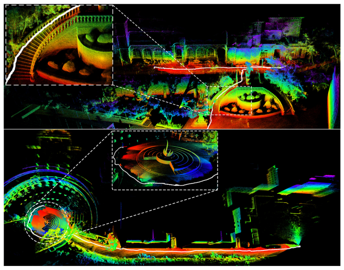
R3LIVE: A Robust, Real-time, RGB-colored, LiDAR-Inertial-Visual tightly-coupled state Estimation and mapping package (ICRA 2022)
Author: **Jiarong Lin** and Fu Zhang
Github: https://github.com/hku-mars/r3live (1305 ★)
Introduction: In this letter, In this letter, we propose a novel LiDAR-Inertial-Visual sensor fusion framework termed R3LIVE, which is developed based on our previous work R2LIVE. R3LIVE is a versatile and well-engineered system toward various possible applications, which can not only serve as a SLAM system for real-time robotic applications but can also reconstruct the dense, precise, RGB-colored 3D maps for applications like surveying and mapping. Moreover, we also develop a series of offline utilities for reconstructing and texturing meshes for various of 3D applications.



R^2LIVE: A Robust, Real-time, LiDAR-Inertial-Visual tightly-coupled state Estimator and mapping (Robotics and Automation Letters (RA-L 2021))
Author: **Jiarong Lin**, Chunran Zheng, Wei Xu and Fu Zhang
Github: https://github.com/hku-mars/r2live (609 ★)
Introduction: In this letter, we propose a robust, real-time tightly-coupled multi-sensor fusion framework, which fuses measurement from LiDAR, inertial sensor, and visual camera to achieve robust and accurate state estimation. Our framework estimates the state within the framework of error-state iterated Kalman-filter, and further improves the overall precision with our factor graph optimization. Taking advantage of measurement from all individual sensors, R2LIVE is robust enough to various visual failure, LiDAR-degenerated scenarios, and is able to run in real-time on an on-board computation platform.



A decentralized framework for simultaneous calibration, localization and mapping with multiple LiDARs (IROS 2020)
Author: Jiarong Lin, Xiyuan Liu, Fu Zhang
Github: https://github.com/hku-mars/decentralized_loam (170 ★)
Introduction: In this paper, we propose a framework for multiple LiDARs fusion, within this framework, we can not only address the problem of localization and mapping but can also online calibrate the extrinsic of 6-DoF. Our framework is based on an extended Kalman filter but is specially formulated for decentralized implementation. In our experiments, we achieved the accuracy of localization up to 0.2% on the two datasets we collected.



Loam_livox: A fast, robust, high-precision LiDAR odometry and mapping package for LiDARs of small FoV (ICRA 2020)
Author: Jiarong Lin and Fu Zhang
Github: https://github.com/hku-mars/loam_livox (1198 ★)
Introduction: In this paper, we present a robust, real-time LOAM algorithm for LiDARs with small FoV and irregular samplings. By taking effort on both frontend and back-end, we address several fundamental challenges arising from such LiDARs (i.e. small FoV, irregular LiDAR scanning pattern, motion compensation, and etc), and achieve better performance in both precision and efficiency compared to existing baselines.

Flying through a narrow gap using neural network: an end-to-end planning and control approach (IROS 2019)
Author: Jiarong Lin, Luqi Wang, Fei Gao, Shaojie Shen, Fu Zhang
Github: https://github.com/hku-mars/crossgap_il_rl (33 ★)
Introduction: In this paper, we propose an end-to-end policy network, which is imitated from the traditional pipeline and is fine-tuned using reinforcement learning. Our proposed method is an end-to-end approach that takes the flight scenario as input and directly outputs thrust-attitude control commands for the quadrotor. In our experiments, we show that reinforcement learning can improve the performance of imitation learning, and the potential to achieve higher performance over the model-based method.