1 Major Publications

[1] **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.

Impact: This work introduces the first complete solution for simultaneous Multi-LiDAR SLAM and online extrinsic calibration, establishing a foundational architecture for multi-sensor autonomy. It provides a robust framework featuring sliding-window odometry and uncertainty-aware mapping, demonstrating state-of-the-art accuracy in diverse, large-scale environments. Recognized as a representative system in the field, M-LOAM has achieved significant community adoption, reflected by nearly *500 GitHub stars* and *144 citations*.

[2] **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.

Impact: This work presents a foundational, automatic, and target-free extrinsic calibration system for multi-LiDAR rigs, critical for robust autonomous vehicles. It overcomes the limitations of manual initialization and controlled scenes by employing a novel two-stage framework: motion-based (hand-eye) initialization combined with appearance-based refinement. The method consistently achieves high precision (rotation error $< 0.04rad$; translation error $< 0.1m$), significantly boosting calibration efficiency. This high-impact geometric methodology has been integrated into MATLAB's LiDAR Toolbox[2].

[3] Peng Yin*, **Jianhao Jiao***, Shiqi Zhao, Lingyun Xu, Guoquan Huang, Howie Choset, Sebastian Scherer, Jianda Han, General Place Recognition Survey for Modern Robotic Systems: Towards the Real-World Autonomy Age, IEEE Transactions on Robotics (**T-RO**), 2025.

Impact: This paper defines the *SLAM 2.0*, establishing Place Recognition (PR) as the critical foundation for achieving scalable, lifelong robotic autonomy. It provides a comprehensive, structured framework classifying multi-modal PR solutions (vision, LiDAR, text) and clearly articulate five core challenges limiting real-world deployment: appearance change, viewpoint difference, generalization, efficiency, and uncertainty estimation. This work serves as the essential technical roadmap and theoretical basis for engineering robust, long-term navigation systems for complex field operations.

[4] 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, The International Journal of Robotics Research (**IJRR**), 2024.

Impact: This paper establishes the highly influential, open-source FusionPortableV1-V2 multi-sensor SLAM benchmark. It provides comprehensive, multi-modal data (vision, LiDAR, IMU) across diverse platforms, including wheeled and legged robots, featuring over $42.7km$ of trajectory data and 10+ challenging environments. The dataset serves as the standard for benchmarking generalization and robustness in real-world scenarios, bridging the validation gap between lab algorithms and field applications. It has accumulated over 86 citations (2023-now), demonstrating its role in the community.

[5] **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 Mecha-

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

tronics (**T-Mech**), 2023.

Impact: This paper resolves the challenging multi-modal calibration and data association problem essential for robust LiDAR-Camera-Event (LCE) fusion. It proposes an automatic, checkerboard-based method featuring an uncertainty-aware data association scheme and integrating a globally optimal solution. Achieving high-precision extrinsic parameters (*cm*-level translation), LCE-Calib enables the seamless fusion required for reliable perception, fundamentally overcoming ambiguity issues and laying the groundwork for subsequent uncertainty-aware autonomous systems.