Ji Zhang Curriculum Vitae

RESEARCH INTERESTS

SLAM, Navigation, Planning, Scene Understanding

EDUCATION

Ph.D. Robotics, The Robotics Institute, Carnegie Mellon University, 2017

EMPLOYMENT

Systems Scientist, The Robotics Institute, Carnegie Mellon University, 09.2019–Present
Founder and Chief Scientist, Kaarta, 03.2015–08.2019

AWARDS

Test of Time Award, RSS 2024
Best Student Paper Award, IROS 2022
Most Sectors Explored Award on DARPA Subterranean Challenge, 2021
Best Paper and Best System Paper Awards, RSS 2021
Rank #1 on KITTI Odometry Benchmark, 01.2014–04.2021
Winner of Microsoft Indoor Localization Competition (3D Category), 2016, 2017

PUBLICATIONS

Journal Papers

1. H. Zhu, H. Bai, P. Ding, J. Zhang, D. Wu, Z. Du, W. Wang. Dual-stage planner for autonomous radioactive source localization in unknown environments. Robotics and Autonomous Systems. vol. 172, 2024.
2. C. Cao, H. Zhu, Z. Ren, H. Choset, and J. Zhang. Representation Granularity Enables Time-Efficient Autonomous Exploration in Large, Complex Worlds. Science Robotics. vol. 8, no. 80, 2023.
3. P. Yin, S. Zhao, H. Lai, R. Ge, J. Zhang, H. Choset, and S. Scherer. AutoMerge: A Framework for Map Assembling and Smoothing in City-scale Environments. IEEE Transactions on Robotics. vol. 39, no. 5, pp. 3686–3704, 2023.
4. P. Yin, I. Cisneros, S. Zhao, J. Zhang, H. Choset, and S. Scherer. iSimLoc: Visual Global Localization for Previously Unseen Environments with Simulated Images. IEEE Transactions on Robotics. vol. 39, no. 3, pp. 1893–1909, 2023.
5. J. Yan, X. Lin, Z. Ren, S. Zhao, J. Yu, C. Cao, P. Yin, J. Zhang, and S. Scherer. MUI-TARE: Cooperative Multi-Agent Exploration with Unknown Initial Position. IEEE Robotics and Automation Letters. vol. 8, no. 7, pp. 4299–4306, 2023.
6. S. Scherer, V. Agrawal, G. Best, C. Cao, K. Cujic, R. Darnley, R. DeBortoli, E. Dexheimer, B. Drozd, R. Garg, I. Higgins, J. Keller, D. Kohanbash, L. Nogueira, R. Pradhan, M. Tatum, V. Viswanathan, S. Willits, S. Zhao, H. Zhu, D. Abad, T. Angert, G. Armstrong, R. Boirum, A. Dongare, M. Dworman, S. Hu, J. Jaekel, R. Ji, A. Lai, Y. Lee, A. Luong, J. Mangelson, J. Maier, J. Picard, K. Pluckter, A. Saba, M. Saroya, E. Scheide, N. Shoemaker-Trejo, J. Spisak, J. Teza, F. Yang, A. Wilson, H. Zhang, H. Choset, M. Kaess, A. Rowe, S. Singh, J. Zhang, G. Hollinger, and M. Travers. Resilient and Modular Subterranean Exploration with a Team of Roving and Flying Robots. Field Robotics. vol. 2, pp. 678–734, 2022.

7. P. Yin, L. Xu, J. Zhang, and H. Choset. FusionVLAD: A Multi-view Deep Fusion Networks for Viewpoint-free 3D Place Recognition. IEEE Robotics and Automation Letters. vol. 6, no. 2, pp. 2304–2310, 2021.
8. J. Zhang, C. Hu, R. Gupta Chadha, and S. Singh. Falco: Fast Likelihood-based Collision Avoidance with Extension to Human-guided Navigation. Journal of Field Robotics. vol. 37, no. 8, pp. 1300–1313, 2020.
9. J. Zhang and S. Singh. Laser-visual-inertial Odometry and Mapping with High Robustness and Low Drift. Journal of Field Robotics. vol. 35, no. 8, pp. 1242–1264, 2018.
10. J. Zhang and S. Singh. Low-drift and Real-time Lidar Odometry and Mapping. Autonomous Robots. vol. 41, no. 2, pp. 401–416, 2017.
11. J. Zhang, M. Kaess, and S. Singh. A Real-time Method for Depth Enhanced Visual Odometry. Autonomous Robots. vol. 41, no. 1, pp. 31–43, 2017.
12. J. Zhang and S. Singh. Visual-Inertial Combined Odometry System for Aerial Vehicles. Journal of Field Robotics. vol. 32, no. 8, pp. 1043–1055, 2015.

Conference Papers

1. C. Cao, J. Xu, J. Zhang, H. Choset, and Z. Ren. Heuristic Search for the Orienteering Problem with Time-Varying Reward. The 17th Annual Symposium on Combinatorial Search (SoCS), Kananaskis, Canada, June 2024.
2. S. Zhao, Y. Gao, T. Wu, D. Singh, R. Jiang, H. Sun, M. Sarawata, W. Whittaker, I. Higgins, S. Su, Y. Du, C. Xu, J. Keller, J. Karhade, L. Nogueira, S. Saha, Y. Qui, J. Zhang, W. Wang, C. Wang, and S. Scherer. SubT-MRS Dataset: Pushing SLAM Towards All-weather Environments. IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR). Seattle, WA, June 2024.
3. S. Ancha, G. Pathak, J. Zhang, S. Narasimhan, and D. Held. Active Velocity Estimation using Light Curtains via Self-supervised Multi-armed Bandits. Robotics: Science and Systems Conference (RSS). Daegu, Republic of Korea, July 2023.
4. F. Yang, C. Cao, H. Zhu, J. Oh, and J. Zhang. FAR Planner: Fast, Attemptable Route Planner using Dynamic Visibility Update. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Kyoto, Japan, Oct. 2022. **Best Student Paper Award**.
5. X. Yao, J. Zhang, and J. Oh. RCA: Ride Comfort-Aware Visual Navigation via Self-supervised Learning. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Kyoto, Japan, Oct. 2022.
6. C. Cao, H. Zhu, F. Yang, Y. Xia, H. Choset, J. Oh, and J. Zhang. Autonomous Exploration Development Environment and the Planning Algorithms. IEEE Intl. Conf. on Robotics and Automation (ICRA). Philadelphia, PA, May 2022.
7. H. Zhu, C. Cao, S. Scherer, J. Zhang, and W. Wang. DSVP: Dual-Stage Viewpoint Planner for Rapid Exploration by Dynamic Expansion. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Prague, Czech, Sept. 2021.
8. C. Cao, H. Zhu, H. Choset, and J. Zhang. TARE: A Hierarchical Framework for Efficiently Exploring Complex 3D Environments. Robotics: Science and Systems Conference (RSS). Virtual, July 2021. **Best Paper Award and Best System Paper Award**.
9. P. Yin, L. Xu, J. Zhang, H. Choset, and S. Scherer. i3dLoc: Image-to-range Cross-domain Localization Robust to Inconsistent Environmental Conditions. Robotics: Science and Systems Conference (RSS). Virtual, July 2021.

10. C. Cao, H. Zhu, H. Choset, and J. Zhang. Exploring Large and Complex Environments Fast and Efficiently. IEEE Intl. Conf. on Robotics and Automation (ICRA). Xian, China, May 2021.
11. H. Yu, W. Zhen, W. Yang, J. Zhang, and S. Scherer. Monocular Camera Localization in Prior LiDAR Maps with 2D-3D Line Correspondences. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Las Vegas, NV, Oct. 2020.
12. P. Yin, F. Wang, A. Egorov, J. Hou, J. Zhang, and H. Choset. SeqSphereVLAD: Sequence Matching Enhanced Orientation-Invariant Place Recognition. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Las Vegas, NV, Oct. 2020.
13. C. Chao, J. Zhang, M. Travers, and H. Choset. Hierarchical Coverage Path Planning in Complex 3D Environments. IEEE Intl. Conf. on Robotics and Automation (ICRA). Paris, France, May 2020.
14. J. Zhang, C. Hu, R. Gupta Chadha, and S. Singh. Maximum Likelihood Path Planning for Fast Aerial Maneuvers and Collision Avoidance. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Macau, China, Nov. 2019.
15. J. Zhang, R. Gupta Chadha, V. Velivela, and S. Singh. P-CAL: Pre-computed Alternative Lanes for Aggressive Aerial Collision Avoidance. The 12th Intl. Conf. on Field and Service Robotics (FSR). Tokyo, Japan, Aug. 2019.
16. J. Zhang, R. Gupta Chadha, V. Velivela, and S. Singh. P-CAP: Pre-computed Alternative Paths to Enable Aggressive Aerial Maneuvers in Cluttered Environments. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Madrid, Spain, Oct. 2018.
17. J. Zhang and S. Singh. Aerial and Ground-based Collaborative Mapping: An Experimental Study. The 11th Intl. Conf. on Field and Service Robotics (FSR). Zurich, Switzerland, Sept. 2017.
18. J. Zhang and S. Singh. Enabling Aggressive Motion Estimation at Low-drift and Accurate Mapping in Real-time. IEEE Intl. Conf. on Robotics and Automation (ICRA). Singapore, May 2017.
19. J. Zhang, M. Kaess, and S. Singh. On Degeneracy of Optimization-based State Estimation Problems. IEEE Intl. Conf. on Robotics and Automation (ICRA). Stockholm, Sweden, May 2016.
20. J. Zhang and S. Singh. Visual-lidar Odometry and Mapping: Low-drift, Robust, and Fast. IEEE Intl. Conf. on Robotics and Automation (ICRA). Seattle, WA, May 2015.
21. J. Zhang, M. Kaess, and S. Singh. Real-time Depth Enhanced Monocular Odometry. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Chicago, IL, Sept. 2014.
22. J. Zhang and S. Singh. LOAM: Lidar Odometry and Mapping in Real-time. Robotics: Science and Systems Conference (RSS). Berkeley, CA, July 2014. **Test of Time Award on RSS 2024.**
23. J. Zhang, A. Chambers, S.Maeta, M. Bergerman, and S. Singh. 3D Perception for Accurate Row Following: Methodology and Results. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Tokyo, Japan, Nov. 2013.
24. J. Zhang and S. Singh. INS Assisted Monocular Visual Odometry for Aerial Vehicles. The 9th Intl. Conf. on Field and Service Robotics (FSR). Brisbane, Australia, Dec. 2013.
25. J. Zhang, G. Kantor, M. Bergerman, and S. Singh. Monocular Visual Navigation of an Autonomous Vehicle in Natural Scene Corridor-like Environments. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS). Vilamoura, Portugal, Oct. 2012.
26. J. Zhang, S. Singh, and G. Kantor. Robust Monocular Visual Odometry for a Ground Vehicle in Undulating Terrain. The 8th Intl. Conf. on Field and Service Robotics (FSR). Matsushima, Japan, July 2012.

PATENTS

1. J. Zhang and S. Singh. Limited-sensor 3D Localization System for Mobile Vehicle. U.S. Patent 11525697, issued Dec. 13, 2022.
2. J. Zhang, S. Singh, and K. Dowling. Laser Scanner with Real-Time, Online Ego-motion Estimation. International Patent 2018071416, issued April 19, 2018, U.S. Patent 11567201, issued Jan. 31, 2023, European Patent 3526626, issued May 27, 2020, Japanese Patent 2019532433, issued Nov. 7, 2019.
3. J. Zhang, E. Abramson, B. Boyle, and S. Huber. Methods and Systems for Processing and Colorizing Point Clouds and Meshes. U.S. Patent 11398075, issued July 26, 2022.
4. J. Zhang and K. Dowling. Aligning Measured Signal Data with SLAM Localization Data and Uses Thereof. International Patent 2019018315, issued Jan. 24, 2019, U.S. Patent 10989542, issued April 27, 2021, European Patent 3656138, issued May 12, 2021.
5. J. Zhang and S. Singh. Laser Scanner with Real-Time, Online Ego-motion Estimation. International Patent 2017155970, issued Sept. 14, 2017, U.S. Patent 10962370, issued March 30, 2021, European Patent 3427008, issued Sept. 7, 2022, Japanese Patent 6987797, issued March 12, 2021, Chinese Patent 109313024, issued June 17, 2022, Hong Kong Patent 1261850, issued Oct. 21, 2022.

INVITED TALKS

1. From Lidar SLAM to Full-scale Autonomy and Beyond, Guangdong-Hong Kong-Macao Greater Bay Area Indoor Positioning Youth Academic Seminar. 8.2024.
2. Autonomous Exploration and Navigation, Full Autonomy System, and Beyond, Microsoft Research Asia. 6.2024.
3. From Lidar SLAM to Full-scale Autonomy and Beyond, ICRA Workshop on Resilient Off-road Autonomy. 5.2024.
4. Autonomous Exploration, Navigation, and the Full Autonomy System, Singapore Defence Science and Technology Agency, 4.2024.
5. From Lidar SLAM to Full-scale Autonomy and Beyond, ROS and Gazebo Community. 3.2024.
6. Autonomous Exploration, Navigation, and the Full Autonomy System, University of Maryland, 3.2024.
7. Autonomous Exploration, Navigation, and the Full Autonomy System, West Virginia University, 10.2023.
8. From Lidar SLAM to Full-scale Autonomy and Beyond, ICCV Workshop on Robot Learning & SLAM, 10.2023.
9. How Can Autonomy Help: Autonomous Navigation Development Environment, ICRA Competition on General Place Recognition, 05.2022.
10. Efficient Autonomous Exploration in Large and Complex Environments, The 7th IEEE World Forum on the Internet of Things, 07.2021.
11. Autonomous Exploration in the Wild, AAAI Spring Symposium on Machine Learning for Mobile Robot Navigation, 03.2021.
12. Efficient Autonomous Exploration in Large and Complex Environments, National Robotics Engineering Center, Carnegie Mellon University, 08.2020.
13. A Lightweight Aerial Autonomy System with Limited Sensing, IROS Workshop on Challenges in Vision-based Drones Navigation, 11.2019.

SERVICE

Editor

Associate Editor, IEEE Robotics and Automation Letters, 2021–Present
Associate Editor, IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS), 2021–2022

Organizer

Program Committee, ACM Symposium on Applied Computing (SAC), Intelligent Robotics and Multi-Agent Systems Track, 2024
Session Co-chair, IEEE/ION Position, Location, And Navigation Symposium (PLANS), 2020
Session Chair, IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS), 2019