

## RESEARCH INTERESTS

Navigation, Mapping, Localization, Planning, Exploration

## 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

Best Paper and Best Student Paper Finalist, 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. 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.
2. 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.
3. J. Zhang and S. Singh. Low-drift and Real-time Lidar Odometry and Mapping. *Autonomous Robots*. vol. 41, no. 2, pp. 401–416, 2017.
4. 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.
5. 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.
6. M. Bergerman, S. Maeta, J. Zhang, G. Freitas, B. Hamner, S. Singh and G. Kantor. Robot Farmers: Autonomous Orchard Vehicles Help Tree Fruit Production. *IEEE Robotics and Automation Magazine*. vol. 22, no. 1, pp. 54–63, 2015.

### Conference Papers

1. 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 Paper and Best Student Paper Finalist.**
2. 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.

3. 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.
4. 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.**
5. 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.
6. 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.
7. 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.
8. 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.
9. 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.
10. 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.
11. 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.
12. 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.
13. J. Zhang and S. Singh. LOAM: Lidar Odometry and Mapping in Real-time. Robotics: Science and Systems Conference (RSS). Berkeley, CA, July 2014.
14. 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.
15. 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.
16. 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.
17. 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 K. Dowling. Aligning Measured Signal Data with SLAM Localization Data and Uses Thereof. U.S. Patent 10989542, issued April 27, 2021.

2. J. Zhang, S. Singh, and K. Dowling. Laser Scanner with Real-Time, Online Ego-motion Estimation. U.S. Patent 10962370, issued March 30, 2021.

## **INVITED TALKS**

1. Efficient Autonomous Exploration in Large and Complex Environments, The 7th IEEE World Forum on the Internet of Things, 07.2021.
2. Autonomous Exploration in the Wild, AAAI Spring Symposium on Machine Learning for Mobile Robot Navigation, 03.2021.
3. Efficient Autonomous Exploration in Large and Complex Environments, National Robotics Engineering Center, Carnegie Mellon University, 08.2020.
4. 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, 2021-2022

Associate Editor, IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS), 2021-2022

### **Organizer**

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