Yun Chang

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I'm a PhD student in the SPARK (Sensing, Perception, Autonomy, and Robot Kinetics) Lab at the Laboratory of Information and Decision Systems, MIT. My experience includes robotics, computer vision, optimization, localization and mapping, multi-agent systems, and semantic scene understanding. My research interest is in improving the scalability and robustness of multi-agent perception systems, along with semantic 3D scene understanding and high-level representations for mapping to enable robots to carry out complex tasks autonomously. I have experience both in theoretical optimization and machine learning research for robotics perception and also in code development and field testing to deploy perception systems on mobile robots.

Education

2021 – Ongoing	**Massachusetts Institute of Technology, Cambridge, MA** *PhD in Autonomy. Advisor: Luca Carlone.*
2019 – June 2021	**Massachusetts Institute of Technology, Cambridge, MA** *MS in Aerospace Engineering. Advisor: Luca Carlone. Thesis: Robust and Lightweight Localization and Dense Mapping for Multi-Robot Systems.* GPA: 5.0/5.0
2015 – 2019	**Massachusetts Institute of Technology, Cambridge, MA** *BS in Aerospace Engineering. Advisor: Brian Williams.* GPA 5.0/5.0

Experience & Projects

2021 – Ongoing	**Kimera-Multi Library** Co-author of the Kimera-Multi Library, a system for distributed multi-robot dense metric-semantic mapping. Contributed to all parts of the system and led field experiments to deploy the system on real-robots in various test sites. [github](#)
2021 – Ongoing	**Hydra Library** Developed the Hydra library, a system to incrementally build 3D Dynamic Scene Graphs in real-time with camera input. My contribution was mainly focused on the components related to the optimization and update of the scene graph upon detection of a loop closure. [github](#)
2019 – Ongoing	**Kimera Library** Part of the team that developed Kimera, a C++ library for real-time metric-semantic simultaneous localization and mapping. My focus is on the components related to the backend and loop closure detection, and also the creation and update of the 3D metric-semantic mesh. [github](#)
2019 – 2021	**DARPA Subterranean Challenge** Built and maintained a lidar-based multi-robot simultaneous localization and mapping (SLAM) system for team CoSTAR as part of the system supporting a team of heterogeneous robots competing in the DARPA Subterranean Challenge: a competition where a team of robots have to autonomously find and localize objects in a GPS denied underground environment. [website](#) [github](#)

2016 – 2019	**Undergraduate Researcher in the Model-based Embedded and Robotic Systems Group** Implemented risk-aware planning algorithms and assisted in the integration and deployment of the algorithms on quadcopters and turtlebots for experiments and data collection.
2018 – 2018	**Perception Intern at Aurora Flight Sciences** Designed an on-board system for an autonomous fixed wing aircraft to accurately track nearby air traffic by fusing received ADS-B air traffic control signals with visual aircraft detection from a pan-tilt camera.
2017 – 2017	**Research Intern in the Imperial College London Aerial Robotics Group** Developed and tested RGBD SLAM for aerial construction drones designed to demonstrate the possibility to 3D print buildings and disaster shelters using additive manufacturing techniques.
2015 – 2017	**Undergraduate Researcher in the Aerospace Controls Lab** Contributed to the Mobility on Demand project, which looked into ways to deploy shared autonomous vehicles to maximize service quality for customers. Helped with the maintenance of sensors on a fleet of golf carts for both localization and mapping and also to collect ride-data from the customers.

Leadership and Teaching Experience

2023 – 2024	**Teaching Assistant for Aeroverse (Aerospace Engineering in Extended Reality)** Worked with Professor Luca Carlone and Professor Olivier de Weck to design and teach MIT 16.S684, an experimental course that investigates whether AR / VR technologies improve the teaching of aerospace engineering concepts.
2020 – 2020	**Teaching Assistant for VNAV (Visual Navigation for Autonomous Vehicles)** Worked with Professor Luca Carlone to teach MIT 16.485, a course about the mathematical foundations of visual navigation (spanning from geometry to optimization), state-of-the-art algorithms, and software packages.

Awards & Honors

2023	**The MIT Prize for Open Data** Honorable Mention. Kimera-Multi Dataset [7]
2023	**IEEE Transactions on Robotics King-Sun Fu Memorial Best Paper Award** "Kimera-Multi: Robust, Distributed, Dense Metric-Semantic SLAM for Multi-Robot Systems" vol. 38, no. 4, pp. 2022-2038, August 2022 [13]
2020	**DARPA Subterranean Challenge** First place in the Urban circuit.
2019	**The Henry Webb Salisbury Award for Superior Academic Performance** Awarded by the MIT Department of Aeronautics and Astronautics for superior and multiple-dimensional academic achievements in the undergraduate program.
2019	**The Andrew G. Morsa Memorial Award** Awarded by the MIT Department of Aeronautics and Astronautics for exemplary work at the boundary between computation, algorithms, and aerospace engineering and for supporting teammates with dedication and technical ingenuity.

Skills

Programming Language
C++, Python, Rust, MATLAB

Libraries
OpenCV, GTSAM, CVX, YALMIP, CGAL, Open3D, OpenGV, PyTorch, ROS

Languages
English, Mandarin Chinese

Field Robotics
Sensor hardware, System integration, Basic networking

Publications

2024

1. Ebadi, K. *et al.* Present and Future of SLAM in Extreme Environments: The DARPA SubT Challenge. *IEEE Trans. Robotics* (2024).

2. Maggio, D., Chang, Y., Hughes, N., Trang, M., Griffith, D., Dougherty, C., Cristofalo, E., Schmid, L. & Carlone, L. *arXiv preprint: 2404.13696* (2024).

3. Schmid, L., Abate, M., Chang, Y. & Carlone, L. Khronos: A Unified Approach for Spatio-Temporal Metric-Semantic SLAM in Dynamic Environments. *arXiv preprint: 2402.13817* (2024).

2023

4. Chang, Y., Ballotta, L. & Carlone, L. D-Lite: Navigation-Oriented Compression of 3D Scene Graphs under Communication Constraints. *IEEE Robotics and Automation Letters (RA-L)* (2023).

5. Chang, Y., Hughes, N., Ray, A. & Carlone, L. *Hydra-Multi: Collaborative Online Construction of 3D Scene Graphs with Multi-Robot Teams* in *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)* (2023).

6. Hughes, N., Chang, Y., Hu, S., Talak, R., Abdulhai, R., Strader, J. & Carlone, L. Foundations of Spatial Perception for Robotics: Hierarchical Representations and Real-time Systems. *arXiv preprint: 2305.07154* (2023).

7. Tian, Y., Chang, Y., Quang, L., Schang, A., Nieto-Granda, C., How, J. & Carlone, L. *Resilient and Distributed Multi-Robot Visual SLAM: Datasets, Experiments, and Lessons Learned* in *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)* (2023).

2022

8. A. Agha et al. NeBula: TEAM CoSTAR's Robotic Autonomy Solution that Won Phase II of DARPA Subterranean Challenge. *Field Robotics* **2,** 1432–1506 (2022).

9. Chang, Y., Ebadi, K., Denniston, C., Ginting, M. F., Rosinol, A., Reinke, A., Palieri, M., Shi, J., A, C., Morrell, B., Agha-mohammadi, A. & Carlone, L. LAMP 2.0: A Robust Multi-Robot SLAM System for Operation in Challenging Large-Scale Underground Environments. *IEEE Robotics and Automation Letters (RA-L)* **7** (2022).

10. Denniston, C., Chang, Y., Reinke, A., Ebadi, K., Sukhatme, G., Carlone, L., Morrell, B. & Agha-mohammadi, A. Loop Closure Prioritization for Efficient and Scalable Multi-Robot SLAM. *IEEE Robotics and Automation Letters (RA-L)* (2022).

11. Hughes, N., Chang, Y. & Carlone, L. *Hydra: A Real-time Spatial Perception Engine for 3D Scene Graph Construction and Optimization* in *Robotics: Science and Systems (RSS)* (2022).

12. Reinke, A., Palieri, M., Morrell, B., Chang, Y., Ebadi, K., Carlone, L. & Agha-mohammadi, A. LOCUS 2.0: Robust and Computationally Efficient LiDAR Odometry for Real-Time Underground 3D Mapping. *IEEE Robotics and Automation Letters (RA-L)* **7,** 9043–9050 (2022).

13. Tian, Y., Chang, Y., Arias, F. H., Nieto-Granda, C., How, J. & Carlone, L. Kimera-Multi: Robust, Distributed, Dense Metric-Semantic SLAM for Multi-Robot Systems. *IEEE Trans. Robotics* (2022).

2021

14. Chang, Y., Tian, Y., How, J. & Carlone, L. *Kimera-Multi: a System for Distributed Multi-Robot Metric-Semantic Simultaneous Localization and Mapping* in *IEEE Intl. Conf. on Robotics and Automation (ICRA)* (2021).

15. Rosinol, A., Violette, A., Abate, M., Hughes, N., Chang, Y., Shi, J., Gupta, A. & Carlone, L. Kimera: from SLAM to Spatial Perception with 3D Dynamic Scene Graphs. *Intl. J. of Robotics Research* **40,** 1510–1546 (2021).

2020

16. Ebadi, K., Chang, Y., Palieri, M., Stephens, A., Hatteland, A., Heiden, E., Thakur, A., Morrell, B., Carlone, L. & Aghamohammadi, A. *LAMP: Large-Scale Autonomous Mapping and Positioning for Exploration of Perceptually-Degraded Subterranean Environments* in *IEEE Intl. Conf. on Robotics and Automation (ICRA)* (2020).

17. Lajoie, P., Ramtoula, B., Chang, Y., Carlone, L. & Beltrame, G. DOOR-SLAM: Distributed, Online, and Outlier Resilient SLAM for Robotic Teams. *IEEE Robotics and Automation Letters (RA-L)* **5,** 1656–1663 (2020).

18. Rosinol, A., Abate, M., Chang, Y. & Carlone, L. *Kimera: an Open-Source Library for Real-Time Metric-Semantic Localization and Mapping* in *IEEE Intl. Conf. on Robotics and Automation (ICRA)* (2020).