PENG GAO

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RESEARCH INTEREST

The central theme of my research focuses on **collaborative perception to enable team awareness for multi-robot and human-autonomy teaming** with the vision for autonomous robots to understand both unstructured environments and their human and robotic teammates, so that humans and robots can build shared team awareness and collaboratively complete complex tasks as a team. My theoretical research is highly related on graph theory, deep learning, and regularized optimization. My broad research interests include connected autonomous driving, collaborative SLAM, cooperative manufacturing, AR/VR-assisted human-robot cooperation, and lifelong robot navigation and adaptation.

EDUCATION

Colorado School of Mines, Golden, CO *Sep 2017 - August 2022*
PhD in Computer Science. Advisor is Prof. Hao Zhang.
Thesis on "Collaborative Perception for Multi-Robot Team Awareness".
Southeast University, China *Sep 2012 - Jun 2015*
Master of Engineering, Automation.
Chongqing University, China *Sep 2008 - Jun 2012*
Bachelor of Engineering, Automation.

PROFESSIONAL EXPERIENCE

University of Maryland, College Park *August 2022 - present*
Postdoc Associate. Advisor is Prof. Ming C. Lin.
Maryland Robotics Center, College Park, MD.
Colorado School of Mines *Sep 2018 - August 2022*
Research Assistant, Department of Computer Science, Golden, CO.
Toyota Motor North America *Jun 2019 - Sep 2019*
Research Internship, Toyota InfoTechnology Center, San Francisco, CA.
Colorado School of Mines *Sep 2017 - Sep 2018*
Teaching Assistant, Department of Computer Science, Golden, CO.
IBM, China *Aug 2015 - Mar 2017*
Software Engineer, China Systems and Technology Lab (CSTL), Beijing.

HONORS AND AWARDS

1. Postdoc Associate Fellowship, Maryland Robotics Center, University of Maryland, College Park (2022).
2. Outstanding Graduate Student Research Award, Colorado School of Mines (2021).
3. Graduate Student Government Travel Grants, Colorado School of Mines (2020).
4. AAAI Student Scholarship, Association for the Advancement of Artificial Intelligence (2020).
5. Second Prize in National Graduate Contest of Mathematical Modeling, Southeast University (2013).
6. Outstanding Student Award, Chongqing University (2012).

PUBLICATION

Conference Papers

1. **Peng Gao**, Sriram Siva, Anthony Micciche, and Hao Zhang. Collaborative Scheduling with Adaptation to Failure for Heterogeneous Robot Teams. in *IEEE International Conference on Robotics and Automation* (ICRA), 2023.

2. **Peng Gao**, Qingzhao Zhu, Hongsheng Lu, Chuang Gan, and Hao Zhang. Deep Masked Graph Matching for Correspondence Identification in Collaborative Perception. in *IEEE International Conference on Robotics and Automation* (ICRA), 2023.
3. **Peng Gao**, Brian Reily, Rui Guo, Hongsheng Lu, Qingzhao Zhu and Hao Zhang. "Asynchronous Collaborative Localization by Integrating Spatiotemporal Graph Learning with Model-Based Estimation." in *IEEE International Conference on Robotics and Automation* (ICRA), 2022.
4. **Peng Gao** and Hao Zhang. "Bayesian Deep Graph Matching for Correspondence Identification in Collaborative Perception." in *Robotics Science and System* (RSS), 2021.
5. **Peng Gao**, Rui Guo, Hongsheng Lu, and Hao Zhang. "Multi-view Sensor Fusion by Integrating Model-based Estimation and Graph Learning for Collaborative Object Localization." in *IEEE International Conference on Robotics and Automation* (ICRA), 2021.
6. **Peng Gao**, Rui Guo, Hongsheng Lu, and Hao Zhang. "Regularized Graph Matching for Correspondence Identification under Uncertainty in Collaborative Perception." in *Robotics Science and System* (RSS), 2020.
7. **Peng Gao**, and Hao Zhang. "Long-Term Loop Closure Detection through Visual-Spatial Information Preserving Multi-Order Graph Matching." in *AAAI Conference on Artificial Intelligence.* (AAAI), 2020.
8. **Peng Gao**, Ziling Zhang, Rui Guo, Hongsheng Lu, and Hao Zhang. "Correspondence identification in collaborative robot perception through maximin hypergraph matching." in *IEEE International Conference on Robotics and Automation* (ICRA), 2020.
9. **Peng Gao**, and Hao Zhang. "Long-term Place Recognition through Worst-case Graph Matching to Integrate Landmark Appearances and Spatial Relationships." in *IEEE International Conference on Robotics and Automation* (ICRA), 2020.
10. **Peng Gao**, Brian Reily, Savannah Paul, and Hao Zhang. "Visual reference of ambiguous objects for augmented reality-powered human-robot communication in a shared workspace." in *International Conference on Virtual, Augmented and Mixed Reality* (VAMR), 2020, invited paper.
11. Rui Guo, Hongsheng Lu, **Peng Gao**, Ziling Zhang, and Hao Zhang."Collaborative localization for occluded objects in connected vehicular platform." in *IEEE Vehicular Technology Conference* (VTC), 2019.

Journal Papers

1. **Peng Gao**, and Hao Zhang. "Correspondence identification for Human-Robot Collaborative Assembly through Bayesian Deep Graph Matching ." in *Autonomous Robots* (AuRo), 2022, invited paper.
2. **Peng Gao**, Rui Guo, Hongsheng Lu, and Hao Zhang. "Correspondence identification for collaborative multi-robot perception under uncertainty." in *Autonomous Robots* (AuRo), 1-16, 2021, invited paper.
3. Brian, Reily, **Peng Gao**, Fei Han, Hua Wang, and Hao Zhang. "Real-Time Recognition of Team Behaviors by Multisensory Graph Embedded Robot Learning." in *International Journal of Robotics Research* (IJRR), 2021.

Workshop

1. Sriram Siva, **Peng Gao**, Yiming Deng, Hao Zhang, Multisensory Internal Pipe Threat Prediction Using Inline Inspection Robots, in *IEEE International Conference on Robotics and Automation* (ICRA), Abstract-Only Poster, 2018.

Under Review

1. Yu Shen, Xijun Wang, **Peng Gao**, and Ming C. Lin, Auxiliary Modality Learning with Generalized Curriculum Distillation, in *International Conference on Machine Learning* (ICML), 2023.

SERVICE

Organizing Workshop

1. Co-Organizer for the workshop "Bridging the Gap between Cognitive Science and Robot Learning in the Real World: Progresses and New Directions" in ICML Workshop, 2023 (under review).

Associate Editor

1. IEEE Robotics and Automation Letters (**RAL**), 2022-2023

Reviewer

1. IEEE International Conference on Robotics and Automation (**ICRA**), 2020, 2021, 2022.
2. IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), 2019, 2020, 2021.
3. AAAI International Conference on Automated Planning and Scheduling (**ICAPS**), 2021
4. IEEE Vehicular Technology Conference (**VTC**), 2021.
5. IEEE International Conference on Humanoid Robots (**Humanoids**), 2019.
6. IEEE Robotics and Automation Letters (**RAL**), 2019, 2020, 2021.
7. The ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (**IMWUT**), 2022.
8. Elsevier Robotics and Autonomous Systems (**RAS**), 2021.
9. Elsevier Intelligent Service Robotics, 2021
10. Elsevier Journal of Visual Communication and Image Representation, 2021
11. ASME Journal of Dynamic Systems Measurement and Control, 2021

MENTORSHIP

University of Maryland, College Park, 2022-present

1. Sanghyun Son (Ph.D.): collaborative SLAM in multi-robot systems.
2. Jing Liang (Ph.D.): collaborative SLAM in multi-robot systems.

Colorado School of Mines, 2019-2021

1. Pheobe Wu (high school): understanding the basic operations of a mobile robot, 2021.
2. Mehmet Yilmaz (undergraduate): building the unmanned ground vehicle (UGV) system, 2020-2021.
3. Luc Lafave (undergradudate): building human-robot collaboration system, with VR glasses and a Baxter robot, 2021.
4. Carl Schader (undergraduate): theoretical design of robot vision system, 2018-2019.
5. Evan Lim (gradudate): configuring the unmanned aerial vehicle UAVsystem, 2021.
6. Ziling Zhang (graduate): building collaborative perception system, with mixture of ground robots and drones, 2018-2019.

TEACHING AND OUTREACH EXPERIENCE

Teaching Assistant, Colorado School of Mines, 2017-2018

1. CSCI-101: Introduction of Computer Science, Fall 2017.
2. CSCI-573: Human-Centered Robotics, Spring 2018.
3. CSCI-598: Robot Planning and Manipulation, Spring, 2018.

Outreach, Colorado School of Mines, 2019-2020

1. Graduate mentor for PROGRESS (Program for Robotics Outreach on Gender and Racial Equity in School and Society), providing laboratory tours and robot demonstrations to K-12 students and teachers, who come from local schools.
2. Student representative to delegate external visiting committee for the evaluation of computer science department in Colorado school of mines.

PROFESSIONAL AFFILIATIONS

The Member of IEEE and AAAI.