

Brian J. Reily

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RESEARCH INTERESTS

My research interests focus on enabling more effective teaming between humans and multi-robot systems. Specifically, I'm interested in *representations for multi-robot structure* that make multi-robot systems easier to understand and analyze; *representations for multi-robot control* that enable efficient multi-robot movement and collaborative perception; and *representations for human-robot teaming* that enable robots to understand the behaviors and intents of their human teammates.

EDUCATION

Colorado School of Mines, Golden, Colorado

Ph.D. in Computer Science, GPA: 4.0/4.0

Jan 2018 - Present

DISSERTATION: "Representation Learning through Regularized Optimization for Human-Robot Teaming."

Colorado School of Mines, Golden, Colorado

M.S. in Computer Science, GPA: 4.0/4.0

Sep 2014 - May 2016

THESIS: "Human Activity Recognition and Gymnastics Analysis Through Depth Imagery."

University of Virginia, Charlottesville, Virginia

B.A. in Computer Science

Sep 2006 - May 2009

RESEARCH EXPERIENCE

Human-Centered Robotics Lab

Jan 2015 - Present

Department of Computer Science, Colorado School of Mines

- Developed novel methods based on multi-modal graph embedding and graph representation learning to understand the structure of multi-robot systems.
- Proposed new methods for multi-robot control utilizing game theory, regularized optimization, and sensor fusion.
- Developed new methods for human activity recognition, incorporating information from teammates relationships and nearby objects.
- Designed and built a multi-robot research platform, enabling the evaluation of methods to control and integrate sensing data of multiple robots.

Army Research Laboratory

May 2018 - Aug 2018, Nov 2020 - Present

Journeyman Research Fellow, Adelphi Laboratory

- Developed novel methods to model the internal structures of multi-robot systems based on multiple observation modalities.

AWARDS AND HONORS

- 2nd Place presentation (Computation and Electronics Session) at 2020 Graduate Research and Discovery Symposium (GRADS)
- Best poster finalist at CSM C-MAPP 2016
- Finalist at the Amazon Picking Challenge, ICRA 2015
- Honor Graduate of US Army Officer Candidate School
- Honor Graduate of US Army Basic Combat Training
- Distinguished Honor Graduate of US Army CBRN Operations School

PUBLICATIONS

- **Brian Reily**, Terran Mott and Hao Zhang. "Adaptation to Team Composition Changes for Heterogeneous Multi-Robot Sensor Coverage." *International Conference on Robotics and Automation (ICRA)*, 2021.
- **Brian Reily** and Hao Zhang. "Team Assignment for Heterogeneous Multi-Robot Sensor Coverage through Graph Representation Learning." *International Conference on Robotics and Automation (ICRA)*, 2021.

- Lyujian Lu, Hua Wang, **Brian Reily**, and Hao Zhang. “Robust Real-Time Group Activity Recognition of Robot Teams.” *Robotics and Automation Letters (RA-L)*, 2021.
- **Brian Reily**, Christopher Reardon and Hao Zhang. “Leading Multi-Agent Teams to Multiple Goals While Maintaining Communication.” *Robotics: Science and Systems (RSS)*, 2020.
- **Brian Reily**, Qingzhao Zhu, Christopher Reardon, and Hao Zhang. “Simultaneous Learning from Human Pose and Object Cues for Real-Time Activity Recognition.” *International Conference on Robotics and Automation (ICRA)*, 2020.
- **Brian Reily**, Christopher Reardon, and Hao Zhang. “Representing Multi-Robot Structure through Multimodal Graph Embedding for the Selection of Robot Teams.” *International Conference on Robotics and Automation (ICRA)*, 2020.
- 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.” *International Conference on Virtual, Augmented, and Mixed Reality (VAMR)*, 2020.
- **Brian Reily**, Qingzhao Zhu, and Hao Zhang. “Activity Recognition by Learning from Human and Object Attributes.” *Workshop of International Conference on Robotics and Automation (ICRA)*, 2019.
- **Brian Reily**, Christopher Reardon, and Hao Zhang. “Graph Embedding for the Division of Robotic Swarms.” *Workshop of International Conference on Robotics and Automation (ICRA)*, 2019.
- **Brian Reily**, Fei Han, Lynne Parker, and Hao Zhang. “Skeleton-Based Bio-Inspired Human Activity Prediction for Real-Time Human-Robot Interaction.” *Autonomous Robots (AuRo)*, vol. 42, pp. 1281-1298, 2018.
- **Brian Reily**, Hao Zhang, and William Hoff. “Real-Time Gymnast Detection and Performance Analysis With a Portable 3D Camera.” *Computer Vision and Image Understanding (CVIU)*, vol. 159, pp. 154-163, 2017.
- Fei Han*, **Brian Reily***, William Hoff, and Hao Zhang. “Space-Time Representation of People Based on 3D Skeletal Data: A Review.” *Computer Vision and Image Understanding (CVIU)*, vol. 158, pp. 85-105, 2017. *Contributed equally to this work.
- **Brian Reily**, Terran Mott and Hao Zhang. “Game Theoretic Decentralized and Communication-Free Multi-Robot Navigation.” *International Conference on Intelligent Robots and Systems (IROS)*, Submitted 2021.
- **Brian Reily** and Hao Zhang. “Simultaneous View and Feature Selection for Collaborative Multi-Robot Perception.” *International Conference on Intelligent Robots and Systems (IROS)*, Submitted 2021.
- **Brian Reily**, Peng Gao, Fei Han, Hua Wang, and Hao Zhang. “Real-Time Recognition of Team Behaviors by Multisensory Graph-Embedded Robot Learning.” *International Journal of Robotics Research (IJRR)*, Submitted October 2018.

REVIEWING
EXPERIENCE

AuRo <i>Autonomous Robots</i>	Feb 2021
ICAPS <i>International Conference on Automated Planning and Scheduling</i>	Jan 2021
ICRA <i>IEEE International Conference on Robotics and Automation</i>	Nov 2019, Dec 2020
RA-L <i>IEEE Robotics and Automation Letters</i>	Nov 2019, Nov 2020
ISR <i>Journal of Intelligent Service Robotics</i>	Oct 2020
TAAS <i>ACM Transactions on Autonomous and Adaptive Systems</i>	Nov 2019
Humanoids <i>IEEE International Conference on Humanoid Robots</i>	Sep 2018, Aug 2019
TIP <i>IEEE Transactions on Image Processing</i>	Aug 2019
SSRR <i>IEEE International Symposium on Safety, Security, and Rescue Robotics</i>	Jun 2019
ICIAP <i>International Conference on Image Analysis and Processing</i>	Jun 2019
IROS <i>IEEE/RSJ International Conference on Intelligent Robots and Systems</i>	May 2019
Sensors <i>Affective and Immersive HCI via Effective Sensor and Sensing</i>	Nov 2018
CVIU <i>Computer Vision and Image Understanding</i>	Nov 2016

TEACHING
EXPERIENCE

Teaching Assistant for CS498/598: Human Centered Robotics **Spring 2019**

- Assisted in teaching students how robots perceive and react to human behaviors through learning and 3D perception, utilizing ROS, Python, C++, and OpenCV.

Teaching Assistant for CS473/573: Robot Planning and Manipulation **Spring 2019**

- Assisted in teaching students robot kinematics and planning algorithms with symbolic logic, SAT planning, and Lisp.

OTHER WORK
EXPERIENCE

United States Army **2010 - 2013**
Transportation Officer - 82nd Airborne Division

BRIGADE TRANSPORTATION OFFICER

- Coordinated the movement of over 10000 soldiers in support of more than 150 training events around the world.
- Integrated assets from multiple brigades across the Army to successfully accomplish objectives.
- Supervised RFID tracking of more than \$100 million worth of equipment.
- Planned sustainment for 4 major training exercises; ensuring over 5000 soldiers were supplied with food, water, fuel, ammunition, and other essential supplies.

DISTRIBUTION PLATOON LEADER

- Supervised 25 employees and maintained accountability of over \$7 million worth of equipment, including more than 30 vehicles.
- Executed the successful issue and recovery of nearly \$5 million worth of supplies and ammunition to support training objectives.
- Managed over 50 successful convoys during simulated combat, transporting supplies through hostile territory.
- Tracked the arrival of over 300 pieces of equipment as the airfield control officer for 2 major training events.

ADDITIONAL TRAINING

- Officer Candidate School (Honor Graduate)
- Airborne Qualified
- Unit Movement Officer
- CBRN Operations Officer (Distinguished Honor Graduate)
- Environmental Compliance Officer