

Matthew B. Luebbers

PhD Student / Research Assistant
University of Colorado Boulder
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Updated Sep 2023

Education

- University of Colorado Boulder**; Boulder, CO Aug 2018 – Present
Doctor of Philosophy, Computer Science
Advisor: Prof. Bradley Hayes
Collaborative AI and Robotics Lab (CAIRO)
- University of Colorado Boulder**; Boulder, CO Aug 2018 – May 2021
Master of Science, Computer Science
- Cornell University**; Ithaca, NY Aug 2014 – May 2018
Bachelor of Arts, Computer Science
Internal Concentration: Artificial Intelligence & Robotics
External Concentration: Psychology

Professional Experience

- NASA Jet Propulsion Laboratory**; Pasadena, CA Jun 2023 – Aug 2023
Spacecraft Operations Engineering Intern, Instrument Data Systems (398)
Designed and developed VIBE (VR Image Browsing Extension), building off and improving the VR prototype I developed in the summer of 2019 for use driving the Mars rover Perseverance. Also participated in rover driving shifts for Perseverance and Curiosity, helping operate both vehicles on Mars.
- NASA Jet Propulsion Laboratory**; Pasadena, CA Jun 2020 – Aug 2020
Research Technologist Intern, Robotics (347)
Created the composite terrain generation pipeline for a Monte-Carlo simulation tool to enable statistical analysis of plans generated by the Perseverance rover's ENav system for autonomous navigation.
- NASA Jet Propulsion Laboratory**; Pasadena, CA Jun 2019 – Aug 2019
Robotic Systems Engineering Intern, Robotics (347)
Designed a prototype virtual reality application for stereo image viewing with 3D drive plan overlay for the Rover Sequencing & Visualization Program (RSVP). Intended for use in rover driving activities for the Mars rovers Curiosity & Perseverance. Also participated in tactical rover driving shifts for Curiosity, learning to sequence and operate the vehicle while helping command its drives to scientific targets.
- NASA Jet Propulsion Laboratory**; Pasadena, CA Jun 2018 – Aug 2018
Software Systems Engineering Intern, Instrument Data Systems (398)
Continued work on the Common Workflow Service (CWS), including creation of a web-based BPMN process modeler to contain all CWS functionality within a single webapp.
- NASA Jet Propulsion Laboratory**; Pasadena, CA Jun 2017 – Aug 2017
Software Systems Engineering Intern, Instrument Data Systems (398)
Continued work on the Common Workflow Service (CWS), including adaptation work for the Instrument Data Systems pipelines of the Mars 2020 mission.
- NASA Jet Propulsion Laboratory**; Pasadena, CA Jun 2016 – Aug 2016
Software Systems Engineering Intern, Instrument Data Systems (398)
Worked on the Common Workflow Service (CWS), a cloud-based workflow-management system for NASA's Advanced Multi-Mission Operations System (AMMOS).

Teaching & Research Assistantships

Army Research Lab STRONG Program University of Colorado Boulder ; Boulder, CO Research Assistant, Prof. Bradley Hayes	Aug 2020 – Present
CSCI 5302 (Advanced Robotics) University of Colorado Boulder ; Boulder, CO Course Manager, Prof. Bradley Hayes	Aug 2021 – Dec 2021
CSCI 5722 (Computer Vision) University of Colorado Boulder ; Boulder, CO Teaching Assistant, Prof. Ioana Fleming	Jan 2020 – May 2020
CSCI 1300 (Introduction to Computer Science) University of Colorado Boulder ; Boulder, CO Teaching Assistant, Prof. Ioana Fleming	Aug 2019 – Dec 2019
Dean’s Graduate Fellowship University of Colorado Boulder ; Boulder, CO Research Assistant, Prof. Bradley Hayes	Aug 2018 – May 2019
CS 4700 (Foundations of Artificial Intelligence) Cornell University ; Ithaca, NY Teaching Assistant, Prof. Bart Selman	Aug 2017 – Dec 2017
CS 3410 (Computer System Organization & Programming) Cornell University ; Ithaca, NY Teaching Assistant, Prof. Anne Bracy	Aug 2016 – May 2017
CS 2110 (Object-Oriented Programming & Data Structures) Cornell University ; Ithaca, NY Course Consultant, Profs. David Gries, Nate Foster, & Ross Tate	Aug 2015 – May 2016

Publications

Asterisk (*) denotes shared first authorship

Papers in Submission

- [S1] Yi-Shiuan Tung, Matthew B. Luebbers, Alessandro Roncone, and Bradley Hayes. ***Title Omitted for Blind Review***. In submission: ACM/IEEE International Conference on Human-Robot Interaction (HRI 2024). Boulder, Colorado, USA.
- [S2] Matthew B. Luebbers*, Aaquib Tabrez*, Kanaka Samagna Talanki, and Bradley Hayes. **Recency Bias in Task Performance History Affects Perceptions of Robot Competence and Trustworthiness**. In submission: IEEE International Conference on Robotics and Automation (ICRA 2024). Yokohama, Japan.

Journal Papers

- [J1] Aaquib Tabrez, Matthew B. Luebbers, and Bradley Hayes. (2020). **A Survey of Mental Modeling Techniques in Human-Robot Teaming**. In Current Robotics Reports. Springer-Nature.

Conference Papers

- [C1] Matthew B. Luebbers*, Aaquib Tabrez*, Kyler Ruvane*, and Bradley Hayes. (2023). **Autonomous Justification for Enabling Explainable Decision Support in Human-Robot Teaming**. In Proceedings of Robotics: Science and Systems (RSS 2023). Daegu, South Korea. *Acceptance Rate: 31%*

- [C2] Christine T. Chang, Matthew B. Luebbers, Mitchell Hebert, and Bradley Hayes. (2023). **Human Non-Compliance with Robot Spatial Ownership Communicated via Augmented Reality: Implications for Human-Robot Teaming Safety**. In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA 2023). London, England, UK. *Acceptance Rate: 43%*.
- [C3] Matthew B. Luebbers*, Aaquib Tabrez*, and Bradley Hayes. (2022). **Descriptive and Prescriptive Visual Guidance to Improve Shared Situational Awareness in Human-Robot Teaming**. In Proceedings of the International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2022). Auckland, New Zealand. *Best Student Paper Runner-Up (Top 2 of 629 submissions). Acceptance Rate: 26%*.
- [C4] Matthew B. Luebbers, Connor Brooks, Carl L. Mueller, Daniel Szafir, and Bradley Hayes. (2021). **ARC-LfD: Using Augmented Reality for Interactive Long-Term Robot Skill Maintenance via Constrained Learning from Demonstration**. In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA 2021). Xi'an, China. *Acceptance Rate: 48%*.

Workshops, Symposia, & Posters

- [W1] Carl L. Mueller, Matthew B. Luebbers, Aaquib Tabrez, and Bradley Hayes. (2023). **Augmented Reality and Proxy Grippers Improve Demonstration-based Robot Skill Learning**. In Proceedings of the Workshop on Life-Long Learning with Human Help (L3H2 2023). London, England, UK.
- [W2] Breanne Crockett*, Kyler Ruvane*, Matthew B. Luebbers, and Bradley Hayes. (2023). **Effective Human-in-the-loop Control Handover via Confidence-Aware Autonomy**. In Proceedings of the Workshop on Life-Long Learning with Human Help (L3H2 2023). London, England, UK.
- [W3] Yi-Shiuan Tung, Matthew B. Luebbers, Alessandro Roncone, and Bradley Hayes. (2023). **Improving Human Legibility in Collaborative Robot Tasks through Augmented Reality and Workspace Preparation**. To appear in Proceedings of the Workshop on Virtual, Augmented and Mixed Reality for Human Robot Interaction (VAM-HRI 2023). Stockholm, Sweden.
- [W4] Matthew B. Luebbers*, Maciej K. Wozniak*, Christine T. Chang*, Bryce Ikeda*, Michael E. Walker*, Eric Rosen*, and Thomas Groechel*. (2023). **Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)**. To appear in Companion for the ACM/IEEE International Conference on Human-Robot Interaction (HRI 2023). Stockholm, Sweden.
- [W5] Matthew B. Luebbers*, Aaquib Tabrez*, and Bradley Hayes. (2022). **Augmented Reality-Based Explainable AI Strategies for Establishing Appropriate Reliance and Trust in Human-Robot Teaming**. In Proceedings of the Workshop on Virtual, Augmented and Mixed Reality for Human-Robot Interaction (VAM-HRI 2022). Sapporo, Japan.
- [W6] Matthew B. Luebbers*, Christine T. Chang*, Aaquib Tabrez*, Jordan Dixon*, and Bradley Hayes. (2021). **Emerging Autonomy Solutions for Human and Robotic Deep Space Exploration**. In Proceedings of SpaceCHI: Human-Computer Interaction for Space Exploration (SpaceCHI 2021). Yokohama, Japan.
- [W7] Matthew B. Luebbers*, Aaquib Tabrez*, and Bradley Hayes. (2020). **Automated Failure-Mode Clustering and Labeling for Informed Car-To-Driver Handover in Autonomous Vehicles**. In Proceedings of the Workshop on Assessing, Explaining, and Conveying Robot Proficiency for Human-Robot Teaming. Cambridge, England, UK.
- [W8] Matthew B. Luebbers, Connor Brooks, Minjae John Kim, Daniel Szafir, and Bradley Hayes. (2019). **Augmented Reality Interface for Constrained Learning from Demonstration**. In Proceedings of the Workshop on Virtual, Augmented and Mixed Reality for Human-Robot Interaction (VAM-HRI 2019). Daegu, South Korea.
- [W9] Matthew B. Luebbers, Ramchandran Muthukumar, Madeleine Udell, and Ross A. Knepper. (2017). **Planning Aerial Survey Missions using Low Rank Approximation**. Presented: Northeast Robotics Colloquium (NERC 2017). Boston, Massachusetts, USA.

Further Experience

Workshop Leadership

- Organizing Committee, “Virtual, Augmented and Mixed Reality for Human-Robot Interaction (VAM-HRI)”, HRI 2023.
- Organizing Committee, “Exploring Applications for Autonomous Non-Verbal Human-Robot Interactions (nHRI)”, HRI 2021.

Conference & Journal Review

- Robotics and Automation Letters (RA-L)
- IEEE/RSJ International Conference on Intelligent Robotics and Systems (IROS)
- IEEE International Conference on Robotics and Automation (ICRA)
- ACM/IEEE International Conference on Human-Robot Interaction (HRI)
- IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)

Research Mentoring

- **Nathan Howard**, *Masters student*, University of Colorado Boulder
- **Kyler Ruvane**, *Masters student*, University of Colorado Boulder
- **Kanaka Samagna Talanki**, *Masters student*, University of Colorado Boulder
- **Karthik Siddaramanna**, *Masters student*, University of Colorado Boulder
- **Aditi Periyannan**, *Undergraduate student*, Tufts University
- **Xinyu Cassie Cao**, *Masters student*, University of Colorado Boulder
- **Minjae John Kim**, *Undergraduate student*, University of Colorado Boulder

Additional Projects of Interest

Self-Driving RC Car

Aug 2019 – Dec 2019

Designed and built a self-driving RC car capable of racing around indoor tracks. Created in a team of five as a semester-long project for CSCI 5302 – Advanced Robotics.

Multiple Asteroid Flyby Mission Formulation

Jan 2019 – May 2019

Formulated a NASA Discovery-class mission concept for a robotic spacecraft to perform multispectral remote sensing of three main-belt asteroids to gain valuable understanding of planetary migration and solar system formation. Delivered a formal, cost-constrained proposal, and presented a PDR (Preliminary Design Review). Created in a team of ten as a semester-long project for ASEN 5148 – Spacecraft Design. I was responsible for the CDH (Command & Data Handling), and FSW (Flight Software) subsystems.

Autonomous Solar-Powered Airship

Sep 2016 – May 2018

Group project within Cornell's Robotic Personal Assistants Lab (RPAL) to design and build an airship capable of flying autonomously. A lightweight solar power system and robust autonomy extend the range of the airship, enabling it to perform long-duration aerial survey missions for ecological monitoring.