

# Jack Kolb

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## Education

**Georgia Institute of Technology**, Atlanta, GA

*PhD in Robotics*

2020 - Present

*MS in Computer Science*

2023

Advisor: Karen Feigh

Committee: Julie Adams, Sonia Chernova, Harish Ravichandar, Alan Wagner

**University of California at Riverside**, Riverside, CA

*BS in Mechanical Engineering (Cum Laude, Honors)*

2020

## Research Experience

**Cognitive Engineering Center**, *Georgia Tech*

Atlanta, GA

*Graduate Research Assistant*

Sept 2022 - present

- Investigating how household robots can estimate a co-located user's world belief state to intelligently support user queries and construct a shared mental model.
- Developing autonomous aircraft wingment using reinforcement learning to support human pilots in collaborative high-risk missions.
- Structuring shared human-AI decision-making processes to enhance user situational awareness and decision outcomes.
- Leveraging physiological sensors for passively estimating user workload in real-time and adapting autonomy in aircraft autopilot systems.
- Wrote and awarded an \$80k grant from Amazon Consumer Robotics.

**Robot Autonomy and Interactive Learning Lab**, *Georgia Tech*

Atlanta, GA

*Graduate Research Assistant*

Sept 2020 - May 2022

- Applied user cognitive skills to predict teleoperation task performance and inform role assignment for multi-human multi-robot teaming.
- Explored safe reinforcement learning techniques to improve sample efficiency in "pick-and-place" robot manipulation.
- Contributed to quarterly reports for grant sponsors (Army Research Lab).
- Gave research talks to ARL officials and the broader consortium every few months.

**Sundararajan Venkatadriagaram Research Group**

Riverside, CA

*Undergraduate Research Assistant*

Mar 2018 - June 2020

- Designed and prototyped an intelligent sensor network to record and analyze vibrations of electric motors to identify motor damage and predict mechanical failure.
- Tried system on university campus ventilation and water infrastructure, worked with university to commercialize system.

## Conference Proceedings

11. **Learning Complex Non-Rigid Image Edits from Multimodal Conditioning**  
N. Warner, **J. Kolb**, M. Hahn, J. Huang, I. Essa, V. Birodkar.  
*Under review.*
10. **Constructing Team Mental Models in Human-Robot Teams**  
**J. Kolb**, K. Feigh.  
*Under review.*
9. **Inferring Belief States in Partially-Observable Human-Robot Teams**  
**J. Kolb**, K. Feigh.  
*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2024.*
8. **Human-AI Collaboration in Autonomous Aerial Vehicles for ISR: Experience, Trust, and Perception**  
R. Agbeyibor, V. Ruia, **J. Kolb**, K. Feigh.  
*HFES International Annual Meeting (ASPIRE), 2024.*

7. **Towards Safe Collaboration Between Autonomous Pilots and Human Crews for Intelligence, Surveillance, and Reconnaissance**  
R. Agbeyibor, V. Ruia, **J. Kolb**, C. Cortes, T. Mancao, S. Coogan, K. Feigh.  
*IEEE/AIAA Digital Avionics Systems Conference (DASC)*, 2024.
6. **Run Time Assurance and Human AI Fluency in Manned Autonomous Intelligence Surveillance and Reconnaissance**  
R. Agbeyibor, V. Ruia, C. Cortes, **J. Kolb**, S. Coogan, K. Feigh.  
*AIAA Aviation Forum and Exposition*, 2024.
5. **Impact of Abstraction Levels of Context Information on AI-Advised Decision Making for an Entry Descent and Landing Task**  
D. Srivastava, **J. Kolb**, K. Feigh.  
*AIAA SciTech Forum and Exposition*, 2024.
4. **The Effects of Robot Motion on Comfort Dynamics of Novice Users in Close-Proximity Human-Robot Interactions**  
P. Howell, **J. Kolb\***, Y. Liu\*, H. Ravichandar.  
*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2023.
3. **The Effects of Inaccurate Decision-Support Systems on Structured Shared Decision-Making for Human-Robot Teams**  
**J. Kolb**, D. Srivastava, K. Feigh.  
*IEEE Intl. Conf. on Robot & Human Interactive Communication (RO-MAN)*, 2023.
2. **Leveraging Cognitive States in Human-Robot Teaming**  
**J. Kolb**, H. Ravichandar, S. Chernova. [Best Student Paper Finalist]  
*IEEE Intl. Conf. on Robot & Human Interactive Communication (RO-MAN)*, 2022.
1. **Predicting Individual Human Performance in Human-Robot Teaming**  
**J. Kolb**, M. Kishore, K. Shaw, H. Ravichandar, S. Chernova  
*IEEE Intl. Conf. on Robot & Human Interactive Communication (RO-MAN)*, 2021.

**Symposium &  
Workshop  
Proceedings**

4. **A Framework for Inferring Belief States in Partially-Observable Human-Robot Teams**  
**J. Kolb**, K. Feigh.  
*40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40)*, 2024.
3. **Safe Dexterous Manipulation Using Geometric Boundary Constraints**  
A. Jain\*, **J. Kolb\***, H. Ravichandar.  
*Safe Reinforcement Learning Workshop at the International Joint Conference on Artificial Intelligence (IJCAI)*, 2022.
2. **Evaluating the Effectiveness of Corrective Demonstrations and a Low-Cost Sensor for Dexterous Manipulation**  
A. Jain\*, **J. Kolb\***, J. Abbess, H. Ravichandar.  
*Machine Learning in Human-Robot Collaboration Workshop at the International Conference on Human-Robot Interaction (HRI)*, 2022.
1. **Predicting Individual Human Performance in Human-Robot Teaming**  
**J. Kolb**, M. Kishore, H. Ravichandar, S. Chernova  
*Workshop Your Study Design Workshop at the International Conference on Human-Robot Interaction (HRI)*, 2021.

Work Experience	<b>Gatik AI</b>	Mountain View, CA
	<i>Robotics Engineer (Intern)</i>	May 2022 - Aug 2022
	<ul style="list-style-type: none"> <li>Identified business-competitive research opportunities for Gatik’s platform (autonomous vehicle for short-haul middle mile deliveries).</li> <li>Designed and prototyped a novel graph neural network architecture for forecasting surrounding vehicle trajectories, tailored to Gatik’s operational design domain.</li> <li>Presented design recommendations for improving Gatik’s prediction module in a company-wide talk.</li> </ul>	
	<b>NextGen Assistive Technologies</b>	Petaluma, CA
	<i>Software Engineer</i>	May 2020 - Aug 2020
	<ul style="list-style-type: none"> <li>Developed the complete minimum viable product for a sensor-based smart home remote caregiving system, now deployed in 100+ homes.</li> <li>Integrated sensor event intake, video conferencing, and event resolution, enabling each caregiver to support 10+ clients.</li> </ul>	
	<b>UC Riverside Marine Robotics (RoboSub)</b>	Riverside, CA
	<i>Project Lead</i> ('18-20)	Sept 2016 - Aug 2020
	<i>Mechanical Team Lead</i> ('17-18)	
	<i>Mechanical Team Member</i> ('16-17)	
	<ul style="list-style-type: none"> <li>Led 25+ members in the development of two autonomous marine robot platforms for aquatic navigation and interaction tasks.</li> <li>Researched and implemented systems for underwater autonomy, navigation, vision, mission control, and object interaction.</li> <li>Designed and manufactured physical hardware and systems architectures, wrote field test plans and procedures, and managed relationships with sponsors.</li> <li>Competed in the international RoboSub competition (2018, 2019, 2020).</li> <li>Awarded “Best Large-Scale Student Project” by UC Riverside (2019).</li> </ul>	
Professional Activities	<b>Advising</b>	
	<i>Formal mentoring of students on research projects.</i>	
	<ul style="list-style-type: none"> <li>Ryan Bowers (MS at GaTech) 2024 - Present</li> <li>Alagappan Swaminathan (MS at GaTech → PhD at GaTech) 2023 - Present</li> <li>Richard Agbeyibor (PhD at GaTech) 2022 - Present</li> <li>Sanya Doda (PhD at GaTech) 2022 - Present</li> <li>Rohan Shrivastava (Lovett School) 2024</li> <li>Pranav Gopalabhatla (BS at Purdue) 2023</li> <li>Sia Godika (BS at MIT) 2023</li> <li>Mayank Kishore (MS at GaTech → Founder at Mirage ML) 2021 - 2022</li> </ul>	
	<b>Teaching</b>	
	<i>Teaching Assistant.</i>	
	<ul style="list-style-type: none"> <li>CS6476: Computer Vision (Graduate Level) Spring 2024</li> <li>CS6262: Network Security (Graduate Level) Summer 2024</li> </ul>	

## Reviewing

- HFES ASPIRE (conference) 2023, 2024
- IEEE BioRob (conference) 2024
- IEEE/ACM HRI (conference) 2024
- IEEE RO-MAN (conference) 2024

## Awards

### Amazon Consumer Robotics Grant (\$80k), 2022

*Awarded to support my dissertation research to make robots estimate a user's belief state in household human-robot teaming domains.*

### IEEE RO-MAN – Best Student Paper Finalist (3/237, 1.2%), 2022

*For my work on applying user cognitive skills to inform role assignment for robot teleoperation tasks.*

### HackGT – Winner, 2021

*Awarded for RoboVR: a multi-user platform for teleoperating 10+ real-world robots in virtual reality.*

### UC Riverside – Best Large-Scale Student Project, 2019

*Accepted on behalf of UCR Marine Robotics, for our work in designing and developing autonomous underwater vehicles.*

### CutieHack – Best UI/UX Award, 2019

*Awarded for Schedulio: a collaborative platform for large-scale projects to schedule meetings and visualize availability.*

### CitrusHack – Winner, EquipoVision's Choice, 2018

*Awarded for BlindSight: a hat that enabled "feeling" the proximity of surrounding objects through localized and directioned haptic vibrations.*

## Leadership & Involvement

### Georgia Tech's Robotics Graduate Student Association (RoboGrads)

*Robotics PhD VP ('23-24)* 2021 - 2024

*President ('22-23)*

*Treasurer ('21-22)*

- Led RoboGrads' support of the academic, professional, and social development of GaTech's robotics research community.
- Supported graduate students by hosting student-led research seminars, mock qualifying exams, academia and industry panels, new student orientations, career and academic Q/A panels, and community socials.
- Worked with industry and academic partners to support Georgia Tech's robotics research and facilitate access to the robotics student talent pool.
- Represented graduate student interests to the robotics institute's administration.

### UC Riverside's Department of Residential Life

*Resident Advisor* 2018 - 2020

- Supported students in residential communities as their primary point-of-contact.
- On-call first responder for fire, medical, mental, and safety crises for 1,200 residents.
- Conducted conflict resolution, emergency response, intentioned programming, engagement with resident diversity, long-term strategy for at-risk residents, and individual support of resident mental and academic health.
- Directly supported 250+ first-year undergraduate students through mentorship, community programming, and targeted community building.
- Peer-awarded MVP for the '18-19 and '19-20 academic years.

### UC Riverside's IEEE Student Chapter

*Projects Chair ('19-20)*

2018 - 2020

*RoboSub Liaison ('18-20)*

- Hosted technical workshops for students: Python, Linux/Raspberry Pi, Arduino, Soldering, SolidWorks, 3D Printing, IOT, Circuit Design, ROS, Flask (webservers), Product Pitching.
- Oversaw four large-scale student projects to review project sustainability and design feasibility.
- Led large-scale community outreach events for 1,000+ community members, including an annual Boy Scout Merit Badge Day, Electrical and Computer Engineering Day, and various Hackathons.

### **Hackathons**

- **Judge:** Prototypical '22, RoseHack '21-22
- **Mentor:** RoseHack '20, CitrusHack '19, CutieHack '18
- **Attendee:** VandyHacks '21, ShellHacks '21, HackGT '20-21, CutieHack '17-19, HackUCI '19, HackSC '19, BioHack '19, HackTech '18, HackIOT '18, CitrusHack '16-18, Enginuity '17