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.
- Applying LLMs and vision models to reason over estimated user belief states and summarize state information in task-driven collaborative human-AI teams.
- Researching generative image manipulation of poses using text-guided instructions.
- Developing autonomous aircraft wingmen using deep reinforcement learning and constrained control to support human pilots in collaborative high-risk missions.
- Explored structuring shared human-AI decision-making processes to enhance user situational awareness and decision outcomes.
- Wrote and awarded an $80k grant from Amazon Consumer Robotics (Lab126).

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.
- Wrote quarterly reports and presented research talks to grant sponsors.

Sundararajan Venkatadriagaram Research Group Riverside, CA
Undergraduate Research Assistant Mar 2018 - June 2020

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

Work Experience

Gatik AI Mountain View, CA
Robotics Engineer (Intern) May 2022 - Aug 2022

- Designed and prototyped a novel graph neural network architecture for forecasting surrounding vehicle trajectories, tailored to Gatik's operational design domain.
- Identified business-competitive research opportunities for Gatik's platform (autonomous vehicles for short-haul middle mile deliveries).
- Presented design recommendations for improving Gatik's surrounding vehicle prediction module in a company-wide talk.

NextGen Assistive Technologies Petaluma, CA
Software Engineer May 2020 - Aug 2020

- Developed the complete minimum viable product for a sensor-based smart home remote caregiving system, now deployed in 100+ homes.
- Integrated sensor event intake, video conferencing, and event resolution, enabling each caregiver to support 10+ clients.

UC Riverside Marine Robotics (RoboSub) Riverside, CA
Project Lead ('18-20) Sept 2016 - Aug 2020
Mechanical Team Lead ('17-18)
Mechanical Team Member ('16-17)

- Led 25+ members in the development of two autonomous marine robot platforms for aquatic navigation and interaction tasks.
- Researched and implemented systems for underwater autonomy, navigation, vision, mission control, and object interaction.
- Designed and manufactured physical hardware and systems architectures, wrote field test plans and procedures, and managed relationships with sponsors.
- Competed in the international RoboSub competition (2018, 2019, 2020).
- Awarded "Best Large-Scale Student Project" by UC Riverside (2019).

Conference Proceedings

14. **Use of Simulated Mental Models and Active Replanning for Human-Robot Interaction**
J. Ren*, A. Swaminathan*, **J. Kolb**, Y. Zhao, S. Coogan, K. Feigh.
Under review.

13. **Investigating Human-AI Team Fluency in Autonomous Medical Evacuation: A Study of Novice Aviator Cognitive States and Human-AI Interface Design**
S. Doda, R. Agbeyibor, C. Cortes, **J. Kolb**, J. Magalhaes, K. Feigh.
Under review.

12. **Human-AI Interaction in Autonomous Medical Evacuation Helicopters**
S. Doda, R. Agbeyibor, C. Cortes, **J. Kolb**, J. Magalhaes, K. Feigh.
Under review.

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, A. Garg, N. Warner, 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 Conf. 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.

Professional Activities

Teaching
Teaching Assistant.
- CS6476: Computer Vision (Graduate Level) — Sp2024, Fa2024, Sp2025
- CS6262: Network Security (Graduate Level) — Su2024

Reviewing
- HFES ASPIRE (conference) — 2023, 2024
- IEEE BioRob (conference) — 2024
- IEEE/ACM HRI (conference) — 2024
- IEEE ICRA (conference) — 2025
- IEEE RO-MAN (conference) — 2024

Advising

Formal mentoring of students on research projects.

- Ryan Bowers (MS at GaTech) 2024 - Present
  Using deep reinforcement learning for controlling autonomous wingmen.
- Alagappan Swaminathan (MS at GaTech → PhD at GaTech) 2023 - Present
  User belief state estimation for human-swarm command & control.
- Richard Agbeyibor (PhD at GaTech) 2022 - Present
  Adaptive autonomy for human-AI systems and autonomous wingmen.
- Sanya Doda (PhD at GaTech) 2022 - Present
  Real-time cognitive workload assessment from biometric sensors.
- Rohan Shrivastava (Lovett School) 2024
  Identifying misinformation at internet-scale for computational anthropology.
- Pranav Gopalabhatla (BS at Purdue) 2023
  Predicting asthma prevalence from air quality and environmental factors.
- Sia Godika (BS at MIT) 2023
  Predicting malaria incidence in underdeveloped regions.
- Mayank Kishore (MS at GaTech → Founder at Mirage ML) 2021 - 2022
  Virtual human-robot command & control tasks.

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