JACK KOLB

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EDUCATION

Ph.D. *Robotics — in progress* *Aug 2020 - present*
Advisor: Karen Feigh
Georgia Institute of Technology (Georgia Tech)
Dissertation Topic: Applying user cognitive state in human-robot teams for predictive and adaptive interactions.

M.S. *Computer Science* *Aug 2020 - May 2023*
Georgia Tech

B.S. *Mechanical Engineering (cum laude)* *Sep 2016 - Jun 2020*
University of California at Riverside (UC Riverside)
Capstone Title: "An Autonomous Robot Capable of Scaling a Self-Built Structure."

RESEARCH EXPERIENCE

Cognitive Engineering Center, *Georgia Tech* *Sep 2022 - present*
Measuring and applying real-time user cognitive state for adaptive human-robot interactions.
- Investigating how household robots can estimate user world state understanding to intelligently support user queries, construct a shared mental model, and improve interaction fluency.
- Investigating how shared human-AI decision-making processes can be restructured to enhance user situational awareness and overall decision outcomes.
- Investigating the use of physiological sensors for objectively estimating user workload in human-robot collaborations; targeting applications of adaptive autonomy for aircraft autopilot systems.

Robot Autonomy and Interactive Learning Lab, *Georgia Tech* *Sep 2020 - May 2022*
Considering heterogeneous agent capabilities as predictive measures in multi-human multi-robot teaming.
- Investigated the predictive effect of human cognitive skills on teleoperation task performance.
- Applied cognitive skills to role assignment to improve multi-human multi-robot teaming.
- Applied machine learning and reinforcement learning techniques for "pick-and-place" robot manipulation.
- Published and presented research at two international research conferences.
- Contributed to quarterly progress reports and regularly presented to sponsors (Army Research Lab).

Sundararajan Venkatadriagaram Research Group, *UC Riverside* *Mar 2018 - Jun 2020*
Predicting electric motor failure by analyzing motor vibrations.
- Designed and prototyped an intelligent sensor network to record and analyze the vibrations of electric motors to identify motor damages and predict mechanical failure.
- Trialed system on university campus ventilation and water infrastructure, slated for commercialization.

TECHNICAL SKILLS

Programming Languages: Python, C#, C++, HTML/CSS/JavaScript

Frameworks & Tools: ROS1, ROS2, PyTorch, OpenCV, Flask, WeBots, Gazebo, Azure, Heroku, Firebase/GCP, CAD, Unity3D, Git, MATLAB/Simulink, *nix

Coursework: Intelligent Control, Human-Robot Interaction, Reinforcement Learning, Natural Language Processing, Human Factors, Machine Learning, Interactive Robot Learning, Robot Kinematics and Planning, Computer Vision

PUBLICATIONS

Pierce Howell, **Jack Kolb**, Yifan Liu, Harish Ravichandar. “The Effects of Robot Motion on Comfort Dynamics of Novice Users in Close-Proximity Human-Robot Interactions.” *Under review at IROS ‘23*, 2023.

Jack Kolb, Harish Ravichandar, Sonia Chernova. “Leveraging Cognitive States in Human-Robot Teaming.” *IEEE Int. Conference on Robot & Human Interactive Communication*, 2022. **[Best Student Paper finalist!]**

Jack Kolb, Mayank Kishore, Kenneth Shaw, Harish Ravichandar, and Sonia Chernova. "Predicting Individual Human Performance in Human-Robot Teaming." *IEEE Int. Conference on Robot & Human Interactive Communication*, 2021.

Abhineet Jain, **Jack Kolb**, and Harish Ravichandar. "Safe Dexterous Manipulation Using Geometric Boundary Constraints." *Safe Reinforcement Learning Workshop at IJCAI ‘22,* 2022.

Abhineet Jain*****, **Jack Kolb***, J.M. Abbess IV*, and Harish Ravichandar. "Evaluating the Effectiveness of Corrective Demonstrations and a Low-Cost Sensor for Dexterous Manipulation." *MLHRC Workshop at ACM/IEEE HRI ‘22,* 2022.

WORK EXPERIENCE

Gatik AI

Robotics Engineer (intern) *May 2022 - Aug 2022*

Autonomous vehicle platform for short-haul middle mile deliveries.

- Conducted a literature review on surrounding vehicle trajectory prediction algorithms.
- Prototyped a novel graph neural network architecture specific to Gatik’s operational design domain.
- Presented design recommendations for improving Gatik’s prediction module to company leadership.

NextGen Assistive Technology

Software Engineer (intern) *Jun 2020 - Sep 2020*

Sensor-driven remote caregiving to support communities with developmental disabilities.

- Developed a sensor-based smart home remote caregiving system, now deployed in over 100 homes.
- Integrated video conferencing and event resolution, enabling each caregiver to support 10+ clients.
- Leveraged Microsoft Azure’s Event Grid, Power Apps, and IOT Hub platforms for IOT capabilities.

UC Riverside Autonomous Underwater Vehicles (UCR RoboSub)

Project Lead (‘18-’20), *Mechanical Team Lead* (‘17-’18), *Mechanical Team* (‘16-’17) *Sep 2016 - Aug 2020*

Marine robots to autonomously complete aquatic naval tasks in international competitions.

- Led 25+ members in the development of two autonomous marine robot platforms for RoboSub ‘18-’20.
- Researched and implemented systems for autonomy, navigation, vision, mission control, object interaction.
- Awarded “Best [Large-Scale Student] Project” (2019) by UC Riverside’s College of Engineering.

EXTRACURRICULARS

RoboGrads, Georgia Tech

President (‘22-’23), *Treasurer* (‘21-’22) *May 2021 - present*

Professional and community development for Georgia Tech’s robotics graduate students.

- 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.
- Developed industry partnerships 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 and faculty.