

Gopika Ajaykumar

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RESEARCH OVERVIEW

I build programming support informed by user research and natural multimodal behaviors to help non-expert end-users program robots.

Keywords: Human-Robot Interaction, End-User Robot Programming

EDUCATION

Johns Hopkins University, Baltimore, MD

Ph.D. in Computer Science

2018 - present

M.S.E. in Computer Science

2021

The University of Texas at Austin

B.S. in Electrical and Computer Engineering

2018

Primary Concentration: Computer Architecture and Embedded Systems

Secondary Concentration: Data Science and Information Processing

AWARDS AND HONORS

Johns Hopkins Inaugural Engineering/Nursing Joint Fellowship

2019

\$5,000 support for patient bedside robot assistance project

Johns Hopkins Howard and Jacqueline Chertkof Endowed Fellowship

2018

Endowed fellowship awarded through departmental nomination

NSF Graduate Research Fellowship (Acceptance Rate: 17%)

2018

Three-year annual stipend of \$34,000 and \$12,000 cost of education allowance

University of Texas Graduating Honors

2018

Awarded for being in top 20% of Class of 2018 in Cockrell School of Engineering

Tenaris Roberto Rocca Scholarship

2018

\$2,500 award for demonstrated leadership potential and talent

University of Texas Braden Communication Scholarship

2017

\$500 award for being the most outstanding technical communicator in the Department of Electrical and Computer Engineering

University of Texas University Honors

2015 - 2017

Recognized in University Honors list for completing full course load and earning outstanding grades

University of Texas Academic Distinction Scholarship

2014

Complete support for tuition and fees and \$1,000 stipend

PUBLICATIONS

Peer-Reviewed Journal Articles

1. **G. Ajaykumar**, K.T. Pineda, and C.-M. Huang, "Older adults' expectations, experiences, and preferences in programming physical robot assistance," *International Journal of Human-Computer Studies*, vol. 180, p. 103127, 2023, <https://doi.org/10.1016/j.ijhcs.2023.103127>
2. **G. Ajaykumar**, M. Stiber, and C.-M. Huang, "Designing User-Centric Programming Aids for Kinesthetic Teaching of Collaborative Robots," *Robotics and Autonomous Systems*, vol. 145, p. 103845, 2021, <https://doi.org/10.1016/j.robot.2021.103845>

3. **G. Ajaykumar**, M. Steele, and C.-M. Huang, “A Survey on End-User Robot Programming,” *ACM Computing Surveys (CSUR)*, vol. 54, no. 8, pp. 1-36, 2021, <https://doi.org/10.1145/3466819>

Peer-Reviewed Conference Papers

1. J. Han*, **G. Ajaykumar***, Z. Li, and C.-M. Huang, “Structuring Human-Robot Interactions via Interaction Conventions,” in *29th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN’20)*. IEEE, 2020, pp. 341-348, <https://doi.org/10.1109/RO-MAN47096.2020.9223468> *equal contribution
2. Y. Wang, **G. Ajaykumar**, and C.-M. Huang, ““See What I See: Enabling User-Centric Robotic Assistance Using First-Person Demonstrations,” in *2020 ACM/IEEE International Conference on Human-Robot Interaction (HRI’20)*. 2020, pp. 639-648, <https://doi.org/10.1145/3319502.3374820> Acceptance Rate: 24%

Doctoral Consortia

1. **G. Ajaykumar**. “Supporting End-Users in Programming Collaborative Robots,” to appear in *Proceedings of the HRI Pioneers Workshop, 2023*. Acceptance Rate: 25%
1. **G. Ajaykumar**. “Assisted End-User Robot Programming,” in *23rd ACM International Conference on Multimodal Interaction (ICMI’21)*. 2021, pp. 797-801, <https://doi.org/10.1145/3462244.3481276>

Peer-Reviewed Workshop and Conference Short Papers

1. **G. Ajaykumar** and C.-M. Huang. “Investigating Older Adults’ Task Preferences for Robot Assistance in the Home,” in *2023 AAAI Workshop on User-Centric Artificial Intelligence for Assistance in At-Home Tasks*. 2023. <https://doi.org/10.48550/arXiv.2302.12686>
2. A. Mahmood, **G. Ajaykumar**, and C.-M. Huang. “How Mock Model Training Enhances User Perceptions of AI Systems,” in *2021 NeurIPS Workshop on Human-Centered AI*. 2021. <https://doi.org/10.48550/arXiv.2111.08830>
3. **G. Ajaykumar** and C.-M. Huang. “Multimodal Robot Programming by Demonstration: A Preliminary Exploration,” in *2021 RSS Workshop on Accessibility of Robot Programming and the Work of the Future*. 2021. <https://doi.org/10.48550/arXiv.2301.07189>
4. **G. Ajaykumar**, A. Mao, J. Brown, and C.-M. Huang. “FACT: A Full-body Ad-hoc Collaboration Testbed for Modeling Complex Teamwork,” in *2021 ICRA Workshop on Social Intelligence in Humans and Robots*. 2021, <https://doi.org/10.48550/arXiv.2106.03290>
5. **G. Ajaykumar** and C.-M. Huang. ‘User Needs and Design Opportunities in End-User Robot Programming,’ in *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction*. 2020, pp. 93-95, <https://doi.org/10.1145/3371382.3378300>

RESEARCH AND DEVELOPMENT EXPERIENCE

Graduate Research Assistant, Johns Hopkins University, Baltimore, MD 2018 - present
Intuitive Computing Lab, Advisor: Dr. Chien-Ming Huang

- Understanding older adults’ needs in programming physical robot assistance
 - Designed user study to study the potential implications and design requirements for enabling older adults to program physical assistance
 - Collected and analyzed interview data and field notes using qualitative methods

- Results of project inform future work in enabling physical robot assistance for older populations
- Structuring user learning in training end-users to program robots kinesthetically
 - Designed user study to evaluate the effect of different training practices on user performance in kinesthetic teaching of robots
 - Collected and analyzed multimodal, subjective, objective, and behavioral user data
 - Developed a learning curriculum informed by findings from pilot studies investigating user programming errors and suboptimalities and prior work on curriculum design
 - Results of project inform the development of educational tools for supporting initial user learning of robot programming
- Designing user-centric programming aids for kinesthetic teaching of cobots
 - Designed and executed user studies to evaluate the effectiveness of different end-user robot programming interfaces in enabling end-users to program collaborative robots
 - Developed a user interface with editing tools and visualizations to support users in removing errors from robot programs
 - Results of project inform the development of interactive tools to improve programming efficiency and mental models of end-users

Undergraduate Research Assistant, UT Austin, Austin, TX

2017 - 2018

Nuclear and Applied Robotics Group

- Modeled alignment process for radiographic weld inspection using a control system for a UR3 arm and image-based verification methods
- Assisted with development of radiation scanning sweep validation for Pioneer LX robot
- Designed and tested circuitry for robot power systems

Summer Intern, Dell, Round Rock, TX

2017

Operating Systems Infrastructure Software Engineering Team

- Modified server applications running on Windows to work with new persistent memory NVDIMM-N technology
- Developed testbed to measure performance enhancement
- Conducted tutorials on server application development for NVDIMM-N technologies to storage/memory teams at Dell
- Presented findings and recommendations on novel memory technologies to Dell executives

Undergraduate Researcher, Texas A&M University, College Station, TX

2016

Rockwell Automation Laboratory, Advisor: Dr. Sheng-Jen Hsieh

National Science Foundation Research Experiences for Undergraduates (REU)

- Developed web-based telecontrol system with joystick input for an articulated robot arm (for use in an internet-accessible lab for robotics education)
- Conducted study to evaluate user experience and system performance during teleoperation

Undergraduate Research Assistant, UT Dallas, Richardson, TX

2014 - 2015

Sensing, Robotics, Vision, Controls and Estimation Lab

- Assisted in development of vision-based lane detection algorithm for automated driver assistance and autonomous vehicles

TEACHING EXPERIENCE

Instructor, Johns Hopkins University, Baltimore, MD

Fall 2022

Introduction to Human-Computer Interaction

Teacher course evaluation: 4.20/5.00 (response: 26 out of 26 students)

- Lecture on a range of topics related to Human-Computer Interaction, including design techniques and evaluation methods, as well as current practices and exploratory approaches

- Design course content such as design projects and assessments

Teaching Institute Participant, Johns Hopkins University, Baltimore, MD 2022

Core Themes: Active Learning, Assessment, and Diversity

- Practiced teaching to engage and assess diverse students, learned evidence-informed teaching methods, and cultivated partnerships in teaching and learning
- Developed a peer-reviewed lesson plan and facilitated a micro-teaching exercise

Teaching Assistant, Johns Hopkins University, Baltimore, MD Fall 2019

Introduction to Human-Computer Interaction

- Gave guest lecture, graded projects and exams, and held one-on-one session to provide assistance and feedback on class projects.
- Hosted office hours to provide course assistance to students

LEADERSHIP, MENTORSHIP, AND OUTREACH EXPERIENCE

Graduate Association of Women in CS & ECE

Professional Development Chair 2022 - present

- Organize, lead, and advertise professional development events
- Engage in mentorship opportunities with undergraduates in CS/ECE and local schools

Speaker, Girl Scouts Robotics Workshop at Maryland Science Center 2019

- Presented Intuitive Computing Lab's research on designing robots that help people
- Answered questions and assisted girl scouts with robotics projects

PROFESSIONAL SERVICE

Conference Paper Referee

International Conference on Robotics and Automation (ICRA: 2022)

International Conference on Human-Robot Interaction (HRI: 2019, 2022)

International Symposium on Robot and Human Interactive Communication (RO-MAN: 2020)

Journal Article Referee

ACM Transactions on Human-Robot Interaction

IEEE Robotics and Automation Letters