

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,” in *Companion of the 2023 ACM/IEEE International Conference on Human-Robot Interaction*. 2023, pp. 736–738, <https://doi.org/10.1145/3568294.3579969> 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)

- Lectured on a range of topics related to Human-Computer Interaction, including design

techniques and evaluation methods, as well as current practices and exploratory approaches

- Designed 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 - 2023

- Organized and led a mentorship dinner and lunches with CS and ECE faculty to foster community and promote outreach among female students in CS, ECE, and related majors

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, 2024)

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