

# 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**, 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>
2. **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,” to be presented at *2023 AAAI Workshop on User-Centric Artificial Intelligence for Assistance in At-Home Tasks*. 2023.
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.
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*

- 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

## PROFESSIONAL MEMBERSHIPS

Institute for Electrical and Electronics Engineers (IEEE)