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
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

PROFESSIONAL MEMBERSHIPS

Institute for Electrical and Electronics Engineers (IEEE)