Manisha Natarajan

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Education

Georgia Institute of Technology
Atlanta, GA

Ph.D. in Robotics, School of Interactive Computing
Aug. 2020 - Aug 2025 (Expected)

- **Advisor:** Dr. Matthew Gombolay, CORE Robotics Lab.
- **Primary Research Interests:** Artificial Intelligence; Human-Robot Interaction.

M.S. in Electrical and Computer Engineering
Aug. 2017 - May 2019

- **Graduate Coursework:** Artificial Intelligence; Machine Learning; Human-Robot Interaction; Advanced Programming Techniques; Graphical Models in Machine Learning; Convex Optimization; Advanced Digital Signal Processing (GPA: 3.85/4.0).

Ramaiah Institute of Technology
Bangalore, India

B.E. in Electrical and Electronics
Aug. 2013 - Jun 2017

- **Undergraduate Coursework:** Analog and Digital Electronics; Embedded Systems; Control Systems; Power Systems; Digital Signal Processing; Digital Image Processing; Nano Fabrication; Linear Integrated Circuits, (GPA: 9.58/10.0).

Research Experience

Georgia Institute of Technology
Atlanta, GA

Graduate Research Assistant
Aug 2020 - Present

- Creating assistive robots that can optimize human-robot team performance by modeling user behavior with data-driven and model-based methodologies in sequential decision-making tasks [**Publications C4, W2**].
- Developed new deep learning architectures incorporating Graph Neural Networks and Diffusion Models to predict future trajectories of adversarial agents in large-scale, partially observable environments, improving prediction accuracy by 31.7% [**Publications C2, C3**].
- Assessed users' trust and dependence on robots providing decision-support in sequential decision-making tasks [**Publication J3**].
- Designed a novel task scheduling algorithm for multi-agent human-robot teams. The algorithm empowers robots to actively estimate human task completion times in assembly line settings, and generate robust task schedules for each worker. Our approach demonstrated a remarkable 44.8% reduction in overall schedule completion time for human-robot teams while improving users' trust in the robot [**Publication J1**].

Georgia Institute of Technology
Atlanta, GA

Research Scientist
Jun 2019 - May 2020

- Conducted a large-scale user study to examine how users trust various robots providing decision support under time pressure. First user study to assess the combined influence of multiple robot attributes, such as anthropomorphism and behavior, on user trust [**Publication C1**].
- Examined the effects of varying stress and workload levels on user performance while teleoperating robots, unveiling that the majority of users adhered to the Yerkes-Dodson Law in the context of task performance [**Publication J2**].

Indian Institute of Technology - Bombay
Mumbai, India

Summer Research Fellow
May 2016 - Aug 2016

- Devised a novel cleaning strategy using Sinusoidal Pulse Width Modulation for solar panel cleaning with small, mobile robots.
- Enhanced cleaning of persistent dirt (e.g., bird waste) on solar panels and extended the battery life of robots by 22.5%.

Industry Experience

Honda Research Institute
San Jose, CA

Summer Intern
May 2021 - Aug 2021

- **Inventor on Patent** for Adaptive Trust Calibration in Self-Driving Vehicles (Patent Number: 12,017,679).
- Developed an adaptive algorithm that autonomously adjusts a self-driving car's driving style or aggressiveness to cater to different users.
- Validated the effectiveness of the adaptive algorithm through a user study – showcasing its ability to align with user driving preferences, ultimately resulting in increased trust and user satisfaction [**Publication W1**].

Magic Leap Inc.
Plantation, FL

Machine Vision Intern
May 2018 - Aug 2018

- Automated the testing framework for identifying anomalies in 3D application rendering on the Magic Leap Mixed Reality device.
- Leveraged transfer learning techniques with pre-trained ResNets to enhance anomaly identification accuracy, achieving a success rate of 96%.
- Created a user-friendly Flask API to inform developers about errors in rendering various applications on the Magic Leap device.

R-DEX Systems   *Atlanta, GA*
ROBOTICS INTERN   *Aug 2018 - Dec 2018*

- Successfully implemented a novel path planner by combining Potential Fields and Timed Elastic Band approach.
- Facilitated the safe navigation of a large Ackermann vehicle within a warehouse with dynamic and static obstacles (ROS, C++).

Selected Publications

JOURNAL PUBLICATIONS

- **[J3]** **Natarajan, M.**, and Gombolay, M., 2024. Trust and Dependence on Robotic Decision Support. *IEEE Transactions on Robotics (T-RO)* (Accepted: Sept. 2024; Status: To be published).
- **[J2]** Yi Ting, S.*, Hedlund-Botti, E.*, **Natarajan, M.***, Heard, J., and Gombolay, M., 2024. The Impact of Stress and Workload on Human Performance in Robot Teleoperation Tasks. *IEEE Transactions on Robotics (T-RO)* (Accepted: Sept. 2024; Status: To be published).
- **[J1]** Liu, R.*, **Natarajan, M.*** and Gombolay, M.C., 2021. Coordinating Human-Robot Teams with Dynamic and Stochastic Task Proficiencies. *ACM Transactions on Human-Robot Interaction (THRI), 11(1), pp.1-42.*

CONFERENCE PUBLICATIONS

- **[C4]** **Natarajan, M.***, Xue, C.*, van Waveren, S., Feigh, K., and Gombolay, M., 2024. Mixed-Initiative Human-Robot Teaming under Suboptimality with Online Bayesian Adaptation. In *International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*.
- **[C3]** Ye, S., **Natarajan, M.**, Wu, Z., 2024. Diffusion based Multi-Agent Adversarial Tracking. In IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS).
- **[C2]** Ye, S.*, **Natarajan, M.***, Wu, Z., Paleja, R., Chen, L., and Gombolay, M., 2023. Learning Models of Adversarial Agent Behavior under Partial Observability. In *International Conference on Intelligent Robots and Systems (IROS)*.
- **[C1]** **Natarajan, M.** and Gombolay, M., 2020. Effects of Anthropomorphism and Accountability on Trust in Human-Robot Interaction. In *ACM/IEEE International Conference on Human-Robot Interaction (HRI)*.

WORKSHOP PUBLICATIONS

- **[W2]** **Natarajan, M.***, Xue C.*, Gombolay M., 2023. Mixed-Initiative Human-Robot Teaming under Suboptimality. In *AAAI-HRI Fall Symposium Series* [**Best Paper Nominee**].
- **[W1]** **Natarajan, M.**, Akash, K. and Misu, T., 2022. Adaptive Driving Styles for Automated Driving with Users' Trust and Preferences. In *ACM/IEEE International Conference on Human-Robot Interaction (HRI): Late-Breaking Report.*

Skills

- **Programming Languages:** Python; C++; C#; R; JavaScript; MATLAB.
- **Tools:** PyTorch; Tensorflow; Git; Docker; Visual Studio; ROS; AWS; GCP.
- **Methods:** Machine Learning; Reinforcement Learning; Deep Learning (Self-Supervised Learning, Graph Networks, Large Language Models, Computer Vision Models); Generative AI (Diffusion Models, GANs); Probabilistic Graphical Models; User Studies.

Honors & Awards

2024	**Georgia Robotics Fellowship**, Received $5000 (USD) for excellence in scholarship during PhD.	*Atlanta, GA*
2024	**Travel Grant**, Received $1575 (USD) travel grant from NSF to attend the AAMAS Conference in New Zealand.	*USA*
2024	**Outstanding Volunteer**, e-Vidyaloka: Among the top 2% from 3000+ volunteers tutoring children in India.	*India*
2019	**Winner**, BrainHack ATL: Secured first place in Neuroscience Deep Learning Hackathon.	*Atlanta, GA*
2017	**Gold Medalist**, Ramaiah Institute of Technology: Graduated top of the class with honors.	*Bangalore, India*
2017	**Best Outgoing Student**, Ramaiah Institute of Technology.	*Bangalore, India*
2016	**Undergraduate Summer Research Fellowship**, Indian Academy of Sciences.	*India*

Teaching and Leadership Experience

- **Graduate Teaching Assistant:** Interactive Robot Learning (CS 7648); Robot Intelligence Planning (CS 7649); Machine Learning (OMSCS 7641).
- **Volunteer Teacher, e-Vidyaloka (2020 - Present):**
    - Online English tutor for middle school children in rural India.
- **Advising and Mentorship:**
    - Shufei Chen, (MS Robotics'25), Katie McIntyre (MS HCI'24), Chunyue Xue, (MS CS'23)
- **President, RoboGrads, Georgia Tech (2023 - 2024):**
    - Student organization to facilitate the academic and professional development of all robotics graduate students.
    - Responsible for the fair treatment of all robotics graduate students and organizing bi-weekly seminars and flash talks to help students promote their research ideas within the Georgia Tech community.
- **President, Asha for Education – Atlanta (2021 - 2022):**
    - Fundraising organization to promote the education of underprivileged children and women empowerment.
    - Provide support for bicycles, food rations, educational tablets, and direct online teaching to students across five projects in rural India.