Soheil Habibian

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RESEARCH INTERESTS

machine learning • artificial intelligence • robot learning • human-robot collaboration.

EDUCATION

Virginia Polytechnic Institute and State University, Blacksburg, VA 2020–2024

Ph.D., Mechanical Engineering (AI & Robotics)
Dissertation: Exploring Communication-Driven Robot Learning for Human-Robot Collaboration

Relevant Coursework: Advanced Machine Learning, Deep Learning Specialization, Reinforcement Learning, Advanced Computer Vision, Human-Robot Interaction, Data Structures and Algorithms.

Bucknell University, Lewisburg, PA 2017–2020

M.Sc., Mechanical Engineering
Thesis: Analysis and Control of Fiber-Reinforced Elastomeric Enclosures

Qazvin Azad University, Qazvin, Iran 2009–2015

B.S., Mechanical Engineering
Honors Thesis: Design and Implementation of a Tele-operative Response Robot

SOFTWARE SKILLS

Programming Languages: Python, C++, MATLAB, R
ML/AI: PyTorch, TensorFlow, Keras, Hugging Face, Scikit-learn, Active Learning, Imitation Learning, Deep Learning, Reinforcement Learning, Computer Vision, Generative AI, Transfer Learning
Development Tools: PyBullet, Gymnasium, MuJoCo, Unity, ROS, OpenCV, SolidWorks, ABAQUS, Mastercam, Arduino, LabVIEW
Other Technical Skills: GitHub, LaTeX, Linux, SPSS, Amazon Mechanical Turk

RESEARCH EXPERIENCE

Visiting Researcher, Purdue University, West Lafayette, IN Nov 2024–*Present*

- Assisting students and researchers in the RAAD Lab with implementing learning and control algorithms on a Franka Emika robotic arm.

Graduate Research Assistant, Virginia Tech, Blacksburg, VA Dec 2020–Aug 2024
Collaborative Robotics Lab

- Developed an LLM-based proxy human model using retrieval-augmented generation to optimize the pre-training of robot agents for adaptive human-robot collaboration.
- Architected a saliency-based supervised learning model to enhance bi-directional communication via augmented reality in interactive robot learning scenarios.
- Developed a learning-from-demonstrations imitation learning algorithm to use haptics to enhance robot learning from human feedback.
- Implemented a representation learning approach with recurrent neural networks to transfer learning to collaborate with unseen users in long-term interactions.
- Created a Bayesian optimization approach for incorporating fairness and legibility in human-robot teams.
- Developed an online preference-based learning algorithm for efficient and transparent robot learning.

Reserach Intern, Honda Research Institue, San Jose, CA Jan 2023–May 2023
Human Factors and Ergonomics Group

- Developed an experimental framework to analyze human cognitive states during human-automation interactions in hybrid mobility environments.
- Created and validated tools to optimize system performance based on predicted human states.

Graduate Research Assistant, Bucknell University, Lewisburg, PA Aug 2017–Jan 2020
Integrated Design Manufacturing Robotics Lab

- Developed a dynamic lumped-parameter model and a finite element model to study the practicality of a fiber-reinforced soft robotic actuator for use in robotic arms.
- Developed a controller-based trajectory following algorithm for the soft actuator.
- Conducted workspace analysis for a module of multiple soft actuators using FEA.

Undergraduate Researcher, Qazvin Azad University, Qazvin, Iran Nov 2011–Jul 2017
Advanced Mobile Robotics Lab

- Managed projects and led an engineering team of 10+ to design and develop mobile response robots for real-life rescue missions.
- Designed and implemented a compact 7-DoF robot arm for dexterous mobile manipulation.
- Designed and implemented a tele-operative response robot for hazardous environments.
- Developed a lightweight throwable two-wheeled robot for reconnaissance missions.

JOURNAL PUBLICATIONS

S. Habibian, A. A. Valdivia, L. H. Blumenschein, and D. P. Losey, "A review of communicating robot learning during human-robot interaction," *International Journal of Robotics Research*, 2024.

A. A. Valdivia, **S. Habibian**, C. A. Mendenhall, F. Fuentes, R. Shailly, D. P. Losey, and L. H. Blumenschein, "Wrapping Haptic Displays Around Robot Arms to Communicate Learning," *IEEE Transactions on Haptics*, vol. 16, no. 1, pp. 57-72, 2023.

S. Habibian, A. Jonnavittula, D. P. Losey, "Here's What I've Learned: Asking Questions that Reveal Reward Learning," *ACM Transactions on Human-Robot Interaction*, vol. 11, no. 4, pp. 1-28, 2022.

S. Habibian, D. P. Losey, "Encouraging Human Interaction with Robot Teams: Legible and Fair Subtask Allocations," *IEEE Robotics and Automation Letters*, vol. 7, no. 3, pp. 6685-6692, 2022.

M. Dadvar, **S. Habibian**, "Contemporary Research Trends in Response Robotics," *ROBOMECH Journal*, vol. 9, no. 9, 2022.

S. Habibian, B. B. Wheatley, S. Bae, J. Shin, K. W. Buffinton, "Evaluation of Two Complementary Modeling Approaches for Fiber-Reinforced Soft Actuators," *ROBOMECH Journal*, vol. 9, no. 12, 2022.

S. Habibian, M. Dadvar, et al., "Design and Implementation of a Maxi-Sized Rescue Robot (Karo) for Rescue Missions," *ROBOMECH Journal*, vol. 8, no. 1, 2021.

REFEREED CONFERENCE PROCEEDINGS

S. A. Mehta, **S. Habibian**, and D. P. Losey, "Waypoint-based reinforcement learning for robot manipulation tasks," in *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2024.

S. Parekh, **S. Habibian**, "RILI: Robustly Influencing Latent Intent," in *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems*, Kyoto, Japan, 23-27 October, 2022.

K. W. Buffinton, B. B. Wheatley, **S. Habibian**, J. Shin, B. H. Cenci, and A. E. Christy, "Investigating the Mechanics of Human-Centered Soft Robotic Actuators with Finite Element Analysis," in *Proceedings of IEEE International Conference on Soft Robotics*, New Haven, CT, 15 May - 15 July, 2020.

THESIS AND DISSERTATION

S. Habibian, "Communication-Driven Robot Learning for Human-Robot Collaboration," *Dissertation submitted to the Faculty of the Virginia Polytechnic Institute and State University*, 2024.

S. Habibian, "Analysis and Control of Fiber-Reinforced Elastomeric Enclosures (FREEs)," *Master's thesis submitted to the Department of Mechanical Engineering of Bucknell University*, 2019.

CONFERENCE & WORKSHOP PRESENTATIONS

"Encouraging Human Interaction with Robot Teams: Legible and Fair Subtask Allocations," *IEEE International Conference on Robotics and Automation*, London, United Kingdom, 29 May - 2 June, 2023.

"Leveraging Roles in Robot Teams to Encourage Human Participation," *Southeast Controls Conference*, Blacksburg, VA, 29-30 November, 2021.

"Finite Element Analysis of Fiber Reinforced Elastomeric Enclosures," *Toyota Research Institute Workshop*, Ann Arbor, MI, 16-17 January , 2019.

HONORS & AWARDS

- **Best Application Paper Award**, IEEE Transactions on Haptics 2024
- **Awarded Runner Up**, Walter O'Brien Research Symposium, Virginia Tech 2024
  Received honorable mention for outstanding research presentation.
- **Full Scholarship**, Bucknell University 2017–2019
  Full-tuition scholarship with stipend to incoming master's students.
- **Summer Research Fellowship**, Bucknell University 2018
  A merit-based award to the top graduate research proposal.
- **3rd Place Award**, Rescue Robot League, RoboCup Competition, Japan 2017
- **2nd Place**, Rescue Robot League, RoboCup Competition, Germany 2016
- **Best-in-Class Exploration**, Rescue Robot League, RoboCup Competition, Germany 2016
- **1st Place**, Rescue Robot League, RoboCup Competition, China 2015
- **2nd Place**, Rescue Robot League, RoboCup Competition, Brazil 2014
- **Best-in-Class Mobility**, Rescue Robot League, RoboCup Competition, Brazil 2014
- **1st Place**, Rescue Robot League, RoboCup Competition, Mexico 2012

PROFESSIONAL AFFILIATIONS & ACTIVITIES

Technical Committee Member, IranOpen RoboCup Competitions 2015–2017
Co-organized competitions for objective performance evaluations of rescue robot teams.

Engineering Director, Advanced Mobile Robotics Lab 2014–2017
Organized projects and supervised trainee students to design and implement mobile robots.

Reviewer

- IEEE International Conference on Intelligent Robots and Systems (IROS)
- ACM/IEEE International Conference on Human-Robot Interaction (HRI)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE-RAS International Conference on Soft Robotics (RoboSoft)
- ACM Transactions on Human-Robot Interaction (THRI)
- IEEE Robotics and Automation Letters (RA-L)
- International Journal of Advanced Robotic Systems
- Journal of Intelligent & Robotic Systems
- Robotics and Autonomous Systems
- Artificial Intelligence Review
- Journal of Field Robotics
- ROBOMECH Journal Journal
- Nature Machine Intelligence

TEACHING EXPERIENCE

Teaching Assistant, Virginia Tech, Blacksburg, VA Fall 2020 – Spring 2021

- Mechanical Design Lab

Teaching Assistant, Bucknell University, Lewisburg, VA Fall 2017 – Spring 2019

- Mechanical Design
- Manufacturing Processes
- Renewable Energy Conversion

CAMPUS ACTIVITIES

Community Outreach Assistant, Pulaski Youth Center Outreach Program, Virginia Tech 2021
Engineering Counselor, Summer Engineering Camp Program, Bucknell University 2019
International Orientation Assistant, International Student Orientation, Bucknell University 2018
Journal Management Assistant, Bertrand Library, Bucknell University 2018