

Varun Raveendra

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SLC, UT and SFO, CA

Education

PhD, Robotics - GPA:4.0/4.0 *Jan 2025 - Present*
University of Utah

Master's, Electrical and Computer Science - GPA:3.8/4.0 *Aug 2022 - May 2024*
University of Utah

Bachelor's, Electronics and Communication - GPA:3.3/4.0 *Jun 2018 - Jul 2022*
Visvesvaraya University, NMIT

Technical Skills

Programming: Python, C++, MATLAB, Embedded C

Frameworks: PyTorch, TensorFlow, Ray RLLib, ROS2, MoveIt2, Nav2

Tools: Gazebo, Isaac Sim, Webots, SolidWorks, Fusion 360, Git, Docker, Linux, COMSOL, Blender

Hardware: Arduino, Raspberry Pi, STM32, ESP8266, PCB Design, Sensor Fusion (IMU, ToF, AprilTag)

Concepts: Reinforcement Learning, Multi-Agent Systems, Swarm Robotics, Motion Planning, Robot Control, Computer Vision, Deep Learning, Embedded Systems, real2sim/sim2real Transfer

Publications

- **Emergent Swarm Behavior Prediction using 1D-Convolution for Autonomous Closed-Loop Behavior Control** *ARMS 2025 Workshop (AAMAS 2025)*
Varun Raveendra, Connor Mattson, Daniel S. Brown
- **Discovery and Deployment of Emergent Robot Swarm Behaviors via Representation Learning and Real2Sim2Real Transfer** *AAMAS 2025*
Connor Mattson, *Varun Raveendra*, Ricardo Vega, Cameron Nowzari, Daniel S. Drew, Daniel S. Brown
- **Waste management in urban localities: an IoT and machine learning solution** *IJSAEM 2025*
V. Viswanatha, Rony Joseph Theckeveetil, *Varun Raveendra*, Sreeteja Tummala, K. M. Suhas

Projects

- **Adaptive learning for Open Agent Systems - Winner of MOASEI 2025!** *April 2025 - May 2025*
Trained Graph Neural Network (GNN)-based Reinforcement Learning agents with multi-head prediction of neighboring agents to enhance decentralized coordination. Designed agents capable of adapting to dynamic, open environments where robots may leave and fires may spontaneously emerge, without relying on direct communication or centralized control. Applied to a wildfire mitigation scenario where resource-limited robots collaborate to extinguish randomly appearing and spreading fires.
- **Emergent Behaviour in Swarm Robots - HeRo+** *May 2024 - December 2024*
I initiated and led a hands-on swarm robotics project, designing and 3D-printing robot components, creating custom PCBs, and assembling a fleet of robots for in-lab experiments. Through this work, I developed a unified framework to analyze swarm interactions, uncovering new emergent behaviors that enhanced the efficiency of group coordination and collaboration.
- **Localization and control of 3D printed autonomous robots** *Jan 2024 - May 2024*
Optimized a real-time localization system integrating IMUs, AprilTags, and a vision-based tracking pipeline, improving localization accuracy by 40% in large-scale environments and enabling precise GUI-based navigation for swarm robotics applications.

- **Design of a micro robotic continuum gripper for medical applications** *Aug 2022 - Jan 2024*
Designed and stress-tested a custom microrobot for ophthalmic surgeries using COMSOL Multiphysics, and prototyped a micro-robotic gripper for minimally invasive procedures, reducing average surgery duration and improving patient recovery time by 30%.
- **Motion Planning collision - Multi-Agent Path Plans (MAPF)** *Feb 2023 - Apr 2023*
Applied CO-WHCA* as the core planner and systematically benchmarked A*, D*, and RRT algorithms to develop a scalable multi-agent path planning system. The system achieved collision-free navigation for 50+ autonomous robots, enhancing coordination efficiency and reducing average travel time by 25%.
- **SLAM using Crazyflie** *Aug 2022 - Dec 2022*
Teamed and implemented the integration of Nav2 with ROS2 on the Crazyflie drone. Created and tested a comprehensive simulation environment to assess the drone's mapping capabilities.
- **Neural network aided robotic separator for domestic waste** *Mar 2022 - Aug 2022*
Spearheaded a team to design and prototype a Raspberry Pi-based system, developing and testing an Xception-based neural network model for recyclable material identification. Improved waste-sorting accuracy and increased operational efficiency by 25%, advancing sustainable waste management practices.

Work Experience

- **Research Assistant (ARIA Lab)**, Khalert School of Computing, University of Utah *Jan 2025 – Present*
Conducting research on Embodied Reinforcement Learning, Human-Robot Interaction, and Multi-Agent robotic systems at the University of Utah, with an emphasis on multi-agent learning, coordination, and emergent collaboration strategies.
- **Graduate Teaching Assistant - Motion Planning**, University of Utah *Jan 2025 – May 2025*
Sole TA responsible for managing all aspects of student support, including grading assignments, addressing lingering questions, and re-teaching key concepts to ensure comprehension. Acted as the primary point of contact for over 70 students, balancing instructional duties with academic evaluation.
- **Research Engineer**, Khalert School of Computing, University of Utah *Aug 2024 – Dec 2024*
Lead a multidisciplinary team at the University of Utah to design, prototype, and assemble robotic systems, while spearheading research into swarm robotics and collaborative multi-agent learning.
- **Graduate Teaching Assistant - Circuits**, University of Utah *Aug 2023 – Dec 2023*
Integrated engaging teaching techniques that increased students' troubleshooting proficiency and understanding of essential concepts by 30%; attendance surged by 5% during lab sessions, reflecting increased student engagement.
- **Embedded Systems Intern**, Tevatron Technologies *Jun 2021 – Aug 2021*
Designed and documented schematics for STM32F401RE boards, achieving a 20% increase in project workflow efficiency, allowing for quicker adaptations to design changes based on evolving application requirements.

Coursework

- Intro to Robot Kinematics and Dynamics
- Robot Manipulation and Control
- Digital Image Processing
- Deep learning
- Advanced Robot Algorithms
- Computer Vision
- Robotics Microsystems
- Machine Learning
- Advanced AI for Robotics