HARIHARAN RAVICHANDRAN

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EDUCATION				
Carnegie Mellon University (CMU) - School of Computer Science			Pittsburgh, PA	
Master of Science in Robotic Systems Development GPA: 4.06/4.0			May 2024	
Coursework: Deep Reinforce	ement Learning Pla	nning for Robotics Optimal Cor	ntrol Computer Vision Systems Engineering	
Indian Institute of Technology Kharagpur (IITKGP)			Kharagpur, India	
Bachelor (Honors) and Master of Technology in Aerospace Engineering			May 2022	
Coursework: Modern Contro	ol Theory Linear Al	gebra Deep Learning Probabil	ity & Statistics Data Structures & Algorithms	
SKILLS				
Programming Languages	C++, Python, MA	+, Python, MATLAB, Julia, JavaScript, HTML		
Libraries & Frameworks	PyTorch, OpenCV, Eigen, CasADi, ACADO, PyPose, PyBullet, AsynclO, Scikit-Learn, Flask			
Software & Tools	ROS 2, Docker, Kubernetes, MuJoCo, Gazebo, CMake, Git, Protobuf, SolidWorks			
EXPERIENCE				
HEBI Robotics			Pittsburgh, PA	
Robotics Software Engineer			Jun 2024 - Present	
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- Designed and implemented a ROS-based software stack for a modular multi-arm mobile robotic system, enabling automatic arm detection, real-time control reconfiguration through Flask-based web application for seamless plug-and-play functionality
- Engineered HEBI Simulator, a MuJoCo plugin to simulate HEBI actuators, modeling their dynamics and low-level control while emulating the modules as virtual devices on the network for seamless control through existing HEBI APIs

Robotics Software Intern

• Developed a monocular visual odometry system for pose estimation in feature-sparse environments, achieving sub-5mm accuracy and real-time on-device tracking at **30 FPS** on embedded hardware by parallelizing OpenCV image processing algorithms

AirLab, Carnegie Mellon University

Machine Learning Researcher (Part-time) under Wenshan Wang and Prof. Sebastian Scherer

- Developed a learning-based motion planner for off-road vehicles, optimizing path generation in complex terrains by integrating a custom loss function that balances distance to goal, path smoothness, curvature, and terrain traversability
- Enabled self-supervised learning by backpropagating over a differentiable costmap, eliminating the need for explicitly labeled data

ACADEMIC PROJECTS

Autonomous Construction on Lunar-like Terrain | Prof. Red Whittaker [Website] [Demo] [Code] Aug 2022 - Apr 2024

- Prototyped an autonomous excavator based on NASA's RASSOR platform, capable of excavating 8 kgs in under 45 seconds
- Implemented a bilevel planning stack, combining A* search with a TSP-based heuristic for task planning and hybrid-A* search for path planning, optimizing energy consumption while adhering to worksite constraints
- Designed a cascaded controller utilizing motor current feedback for continuous excavation while maintaining low traction forces
- Architected a scalable, open-source software stack using ROS 2 and C++14, collaborating with other team members for system integration, verification, and validation of the system

Zero-shot Sim2Real model-based RL for Autonomous Racing | Prof. John Dolan [Report] [Demo]

- Augmented DreamerV3, a model-based reinforcement learning algorithm with a reward function that incorporated lap progress, speed, and action regularization to promote smooth racing behavior
- Achieved successful sim-to-real transfer without hyperparameter tuning, validating the model's generalization capabilities

Autonomous Driving System for F1Tenth Racing [Videos]

- Engineered the complete autonomy stack for the F1Tenth racing platform, including trajectory optimization for the race line and an adaptive pure pursuit controller for tracking, resulting in first place with a lap time less than half of the second-place
- Incorporated Model Predictive Control for overtaking maneuvers, incorporating opponent vehicles as collision constraints

Multi-Agent Path Finding for Collaborative Robot Fleets in Dynamic Environments [Report]

- Proposed 3 novel algorithms for multi-agent pathfinding in dynamic environments, building upon CBS and Prioritized Planning
- Achieved a 91.6% success rate with a computation time of under 100 ms in multi-agent scenarios involving 20+ agents

PATENTS & PUBLICATIONS

- H. Ravichandran, et al., "LunAR-X: Lunar Autonomous Regolith Excavator," NASA 2024 LSIC Spring Meeting
- Hariharan R., Hota S., "Collision Avoidance with Optimal Path Replanning of Unmanned Aerial Vehicles," AIAA JCCD 2021 [Paper]

Jan 2024 - Present

Mar 2024 - Apr 2024

Jan 2024 - Apr 2024

Jan 2023 - Apr 2023

May 2023 - Aug 2023

Pittsburgh, PA