

Varun Rayamajhi

✉ varun.rayamajhi@richmond.edu

in 10varun17

🌐 <http://varunrayamajhi.com/>

Research Interests

📌 Safe Reinforcement Learning, Optimal Control, Safety-critical Control, Multi-agent Systems

Education

Aug 2023 – May 2027

📌 **B.Sc. Computer Science, University of Richmond**, Richmond, VA, USA.

GPA: 4.0/4.0 | Richmond Scholar | Dean's List (All Semesters)

Relevant Coursework: Artificial Intelligence/Machine Learning in Robotics, Algorithms, Data Structures, Software Development, Probability, Linear Algebra, Multivariate Calculus, Classical Mechanics, Mathematical Methods in Physics

Sep 2025 – May 2026

📌 **Full-year Visiting Student, University of Edinburgh**, Edinburgh, Scotland, UK.

US Equivalent GPA: 3.95/4.0 | School of Informatics

Coursework: Robot and Reinforcement Learning, Computer Vision, Accelerated Natural Language Processing, Control and Instrumentation Engineering, Sensor Networks and Data Analysis, Human-Computer Interaction, Computer Security

Research Experience

Jun 2026 – Present

📌 **Undergraduate Research Fellow**, Carnegie Mellon University, Robotics Institute, Pittsburgh, PA.

Advisor: Prof. Katia Sycara

Project Page: [Hierarchical Safe MARL-CBF for Persistent Multi-Robot Sensing](#)

- Developing safe **hierarchical multi-agent reinforcement learning** methods for persistent environmental sensing in the presence of spatiotemporal risks such as fire and smoke
- Integrating **Control Barrier Function** safety filtering with multi-robot policies for risk-aware persistent coverage

May 2025 – Present

📌 **Undergraduate Researcher**, University of Richmond, Robotics Lab, Richmond, VA.

Advisor: Dr. Patrick Martin

Project Page: [Adaptive CBFs for Proactive Human-Aware Robot Safety](#)

- Investigating whether evolving **Adaptive Control Barrier Function** penalty variables can forecast rising safety stress before a robot reaches a safety-critical state
- Developing feedback signals that give the autonomy stack time to slow down, yield, replan, or reconfigure proactively

Jun 2025 – Aug 2025

📌 **Research Software Engineering Intern**, The University of Chicago, Human-Computer Integration Lab, Chicago, IL.

Advisor: Dr. Pedro Lopes

Project Page: [Computer Vision-Based Downgaze Palsy Assessment](#)

- Developed the first **interactive mobile application** for systematic digital measurement of downgaze palsy in **Progressive Supranuclear Palsy** assessment, reducing evaluation time by 80%
- Developed a **three-stage computer vision pipeline** combining image processing, machine-learning techniques, and geometric analysis

Jan 2025 – May 2025

📌 **Machine Learning Research Assistant**, University of Richmond, Department of Physics, Richmond, VA.

Advisor: Dr. Jack Singal

Project Page: [Lagrangian and Hamiltonian NNs for Dissipative Systems](#)

- Investigated the applicability of **Lagrangian and Hamiltonian Neural Network** models to a **dissipative system** with explicit time dependence in its Lagrangian, Hamiltonian, and total energy
- Built an end-to-end **PyTorch** pipeline and presented the work at the **Edinburgh x Anthropic AI Expo 2026** after selection as one of 25 projects from 70 submissions

Research Experience (continued)

Jun 2024 – Aug 2024

■ **Undergraduate Robotics Researcher**, University of Richmond, Robotics Lab, Richmond, VA.

Advisor: Dr. Patrick Martin

Project Page: [A ROS2 framework for decentralized Multi-Agent formation control](#)

- Developed a **ROS 2** framework for decentralized multi-agent formation control and leader-follower coordination using action servers, clients, custom messages, and launch files
- Validated the controllers in simulation and on a physical system with three **Turtle-Bots**

Research Publications

Manuscripts in Preparation

- 1 **V. Rayamajhi** and J. Singal, "Lagrangian and Hamiltonian neural networks with a dissipative system," Manuscript in preparation, 2025.

Oral Presentations

- 1 **V. Rayamajhi** and J. Singal, "Lagrangian and Hamiltonian neural networks with a dissipative system," in *Edinburgh x Anthropic AI Expo 2026*, The University of Edinburgh, Mar. 2026.
- 2 **V. Rayamajhi** and P. Lopes, "Computer vision-based detection of downgaze palsy for PSP diagnosis," in *Data Science Institute Summer Research Symposium 2025*, The University of Chicago, Aug. 2025.

Poster Presentations

- 1 **V. Rayamajhi** and P. Martin, "A ros2 framework for decentralized multi-agent formation control and leader-follower coordination," in *Arts and Sciences Student Symposium*, University of Richmond, Apr. 2025.

Technical Skills

Programming	■ Python, C++, Java, Dart
Robotics & Reinforcement Learning	■ ROS 2, PyBullet, CasADi, Gymnasium, Stable-Baselines3, PyTorch, Scikit-Learn, OpenCV, MediaPipe
Scientific Computing	■ NumPy, SciPy, Pandas, Matplotlib, Mathematica
Development & Hardware	■ Git, Linux, Flutter, Arduino, Circuit Design, Sensor Integration

Selected Independent Projects

Mar 2026 – May 2026

■ **Project Page:** [On-Policy vs. Off-Policy Deep RL: PPO vs. SAC](#)

- Compared **PPO** and **SAC** on MuJoCo locomotion and robotic-manipulation tasks
- Evaluated sample efficiency, stability, hyperparameter sensitivity, final policy quality, and practical compute cost

Jan 2026 – Apr 2026

■ **Project Page:** [Tissue Segmentation and Nuclei Classification](#)

- Developed **U-Net**-based tissue segmentation models for class-imbalanced melanoma histopathology images, comparing end-to-end training with autoencoder pre-training
- Built an **EfficientNet-Bo** nuclei classifier and evaluated ImageNet initialization, SimCLR, and supervised contrastive pre-training

Jan 2026 – Feb 2026

■ **Project Page:** [From Dynamic Programming to Reinforcement Learning](#)

- Compared dynamic programming, MPC, iLQR, and tabular **Q-learning** for stabilization, disturbance recovery, computational efficiency, and model mismatch
- Studied value-function discretization, MPC horizon selection, Q-learning schedules, and pole-length generalization

Selected Independent Projects (continued)

	 Project Page: Cartpole Control: Breathing Sine-Wave Tracking with MPC - Designed an MPC controller for breathing sine-wave trajectory tracking while maintaining pole stability - Completed more than 200 tuning iterations and achieved position RMSE of approximately 0.024 m in the low-frequency experiment
Oct 2025 – Nov 2025	 Project Page: Transformer-Based German-English Neural Machine Translation - Trained an encoder-decoder Transformer and analyzed generalization to longer out-of-distribution sentences - Performed manual error analysis, attention-coverage analysis, BLEU and ChrF evaluation, and decoding-strategy optimization
Aug 2022 – Sept 2022	 Project Page: Rocket Motor Static Test Pad (STP) - Designed and simulated an integrated avionics and mechanical architecture for a rocket motor static test pad - Developed the sensing, remote-control, and circuit architecture using Arduino and Proteus

Miscellaneous

Honors and Awards

2023 – Present	 Richmond Scholar , University of Richmond. (1/25 selected from >11,000 applicants)
2024 – Present	 Robins Science Scholar , University of Richmond. (Awarded to <3% per class, merit-based)
2026	 Robert E. Loving Book Award , University of Richmond. (Awarded to juniors with top GPA in their class)
2024, 2025	 University of Richmond Summer Fellowship , University of Richmond.
All Semesters	 Dean's List , University of Richmond.

Leadership and Activities

Jan 2026 – Present	 Founder & President , Robotics Society, University of Richmond. - Establishing the university's first Robotics Society to grow the robotics and engineering community - Designing workshops on Imitation Learning (Behavior Cloning and DAgger), Model Predictive Control, and PID control
Oct 2025 – Mar 2026	 Reinforcement Learning Team Member , HumanEd, The University of Edinburgh. - Completed reinforcement-learning training and developed robotic-control agents with Stable-Baselines3 and PyBullet - Contributed to an SO-100 robotic-arm project for real-world reinforcement-learning deployment

References

Available on Request