

Rahul Rustagi

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Education

Georgia Institute of Technology 2024–2026 (*Exp*)
Master of Science in Electrical and Computer Engineering

- GPA: 4.0/4.0
- Advisors: Sonia Chernova and Glen Chou
- Research: Safe Human Robot Interaction

Indian Institute of Technology, Kanpur 2020–2024
Bachelor of Technology in Aerospace Engineering

- GPA: 9.18/10 (eq. to 3.8/4.0) : *2nd Best Outgoing Departmental Student*
- Advisor: Dr. Abhishek
- B.Tech Thesis: [Autonomous Landing of an Unmanned Aerial Vehicle on an Oscillating Platform](#)
- Certificates / Minors: Machine Learning, Computer Systems, English Literature

Summary

My current focus is tackling problems at the intersection of robotics, perception, and machine learning particularly for building strong reasoning engines using perception. I carry a strong skill set in controls and ML with implementation on hardware that allow me to understand optimization on edge-inference devices.

Industry Experience

Symbotic Summer 2025
Machine Learning Intern, Perception Team

- Engineered an automated ETL pipeline to curate 700 images from warehouse sites, creating high-fidelity depth ground truth from syncing Amazon Ion telemetry logs to overcome data scarcity.
- Finetuned MonoCD and MonoDETR monocular depth estimator KITTI-pretrained weights, and integrated DINOv2 embeddings with ResNet-50 backbone for robustness.
- Validated the MonoDINO-DETR architecture, achieving 98.9% accuracy and 98.1% recall in predicting collision-triggering events (within 1ft error), significantly enhancing perception reliability.

Research Experience

Trustworthy Robotics Lab, Georgia Tech Aug 2025–Present
Graduate Researcher | *Project: Uncertainty-Aware Active Planning in Learned Latent Space*

- Quantified scene ambiguity using conformal prediction on continuous scene representation (CSR), providing a rigorous measure of uncertainty to prevent unsafe decisions.
- Enhanced semantic perception by utilizing a DINOv3 foundation model on AI2THOR dataset, creating object embeddings that capture contextual relationships better than pre-trained models.
- Finetuned Qwen2.5-7B Instruct VLM on a custom collected dataset using LoRA to infer context-aware constraints that can be used to avoid obstacles.

Robot Autonomy and Interactive Learning (RAIL) Lab, Georgia Tech

2025

Graduate Researcher | *Project: Semantic Proactive Assistance for Households*

- Built an end-to-end scene understanding system on Stretch RE2 robot enabling reasoning for assistance.
- Enhanced scene reconstruction by fine-tuning HRNet and EfficientNet segmentation models on the ADE20K dataset, achieving high-fidelity semantic understanding of complex indoor scenes.
- Enabled real-time 4D mapping by integrating ORB-SLAM3 with the *Khronos* system, generating Spatio-Temporal Scene Graphs that track how objects move and change over time.
- Authored a [featured article](#) in the Hello Robot Newsletter, releasing the system's architecture.

Intelligent Vision and Automation Laboratory (IVALab), Georgia Tech

Fall 2024

Graduate Researcher | *Project: HeirOSLAM (Hierarchical Visual Odometry SLAM)*

- Architected a multi-modal sensor fusion framework, integrating IMU, LiDAR, and RGB streams to ensure robust state estimation in complex, GPS-denied environments.
- Optimized pose controllability by analyzing the Hessian matrix of the GTSAM factor graph, identifying and resolving unobservable directions in the visual-inertial system.
- Engineered a hierarchical state estimator coupling high-frequency DSOL visual odometry with global ORB-SLAM2 loop closures, balancing low-latency control with global consistency.

Helicopter and VTOL Laboratory, IIT Kanpur

2024

Undergraduate Researcher | *Project: Vision-Based Autonomous Quadrotor Landing*

- Authored a deep-learning-based control pipeline for autonomous ship deck landing, predicting 6-DoF platform motion to enable safe trajectory planning under uncertainty.
- Implemented high-speed pose estimation (60Hz) using Fractal ArUco markers, ensuring robust detection and localization with feedback in PX4 control block during rapid descent.
- Trained a lightweight LSTM network to learn the dynamics of ship-sea interactions using SCONE dataset and predict future states of the ship-landing platform at 20Hz with 98% accuracy.

Publications

Journals

- A. Singh, **R. Rustagi**, and R. M. Hegde, "[Lifetime Improvement in Rechargeable Mobile IoT Networks Using Deep Reinforcement Learning](#)," *IEEE Transactions on Circuits and Systems II: Express Briefs*, 2024.

Conferences

- C. Prachand, **R. Rustagi**, R. Shankar, J. Singh, A. Abhishek, and K. S. Venkatesh, "[Vision-Based Autonomous Ship Deck Landing of an Unmanned Aerial Vehicle Using Fractal ArUco Markers](#)," *AIAA SciTech*, 2025.
- A. Singh, **R. Rustagi**, S. Redhu, and R. M. Hegde, "[Mobile Energy Transmitter Scheduling in Energy Harvesting IoT Networks using Deep Reinforcement Learning](#)," *IEEE 8th World Forum on Internet of Things (WF-IoT)*, 2022.

Highlighted Projects

- Compressing Redundant 3D-Gaussian Splats (Georgia Tech ECE8803) Fall 2025
 - **Integrated** nerf-acc with spatially-adaptive regularization during 3DGS optimization
 - Achieved x25 compression with 26.2 PSNR, 0.91 SSIM and 0.141 LPIPS compared to 3DGS
- VLM-Based Action Planning (Research Competition) Fall 2025
 - An end-to-end **robotics pipeline** that translates natural-language instructions into precise pick-and-place actions using a VLM-based planner
- Resolving Stereo Disparity in 2D (Georgia Tech ECE 6560) Spring 2025
 - **Formulated** variational energy functional for optical flow enhancing motion estimation.
- Pick-n-Place using UAV (IIT Madras Tech Competition) Spring 2023
 - **Implemented** a hardware solution for search and grasping colored boxes using UAV
- MPC-Guided Landing of UAV (IIT Kanpur CS637) Fall 2022
 - **Implemented** an integration of MPC with RotorS UAV in Gazebo for position control

Teaching

- Graduate Teaching Assistant, Intro to Perception & Robotics (Georgia Tech CS 3630) Fall 2025
 - Held weekly office hours, prepared projects, graded exams working with Prof. Frank Dellaert
- Graduate Teaching Assistant, Intro to Perception & Robotics (Georgia Tech CS 3630) Spring 2025
 - Held weekly office hours, prepared projects, graded exams working with Prof. Sonia Chernova

Leadership & Mentoring

- Team Head, Aerial Robotics, IIT Kanpur 2022-2023
 - Lead the team to secure Silver and Bronze medals at the national Inter-IIT Robotics Challenges.
 - Mentored 10+ recruits in control theory and embedded systems by organizing projects.
- Student Counseling Service, IIT Kanpur 2022
 - Mentored 5 junior students during undergraduate for academic and emotional support

Awards & Honors

- **Recipient of MITACS GRI Research Grant** (2023): Awarded to top 1% of global applicants.
- **Academic Excellence Awards** (2021, 2022, 2023, 2024):
 - **Awarded** by IIT Kanpur for exceptional performance (Top 10% in the entire cohort)
- **Bronze Medal**, Drona Aviation Challenge at Inter IIT Tech Meet 11.0 (2023).
 - Awarded for **implementing** a robust industry approved solution for pattern formation using drones
- **Recipient of MCM Scholarship at IIT Kanpur:** (2021, 2022, 2023, 2024)
 - Awarded by IIT Kanpur to top meritorious students overall.
- **Recipient of Shriram Scholarship at CMI:** (2020)
 - **Awarded** by Chennai Mathematical Institute (CMI) to top 50 students in India CMI Examination

Skills

- **Programming:** Python, C++, MATLAB, LaTeX
- **Robotics Middleware:** ROS1/ROS2, Webots, Gazebo, IsaacSim, Unity3D, PyBullet, MoveIt, PX4
- **Algorithms & Libraries:** PyTorch, OpenCV, GTSAM, ORB-SLAM2/3, VIO, SfM, SAM, DINOv2