

Aryaman Gupta

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RESEARCH OBJECTIVE

My research focuses on developing safe autonomous systems through failure-guided, closed-loop learning, and delivering safety guarantees via lightweight, context-aware guardrails at runtime. Building on my prior work in unsupervised LLM-driven robot failure analysis and safety monitoring for high-speed perception-driven systems, I now aim to create advanced safety-reasoning models that generalize across embodiments and enhance the robustness and scalability of large embodied robot foundation models and vision-language-action (VLAs) models.

EDUCATION

- **Stanford University** Stanford, CA
Ph.D. in Aeronautics and Astronautics; Advisor: Somil Bansal; GPA: 4.00/4.00 Jan 2025 – Present
- **Stanford University** Stanford, CA
M.S. in Aeronautics and Astronautics; GPA: 4.00/4.00 Jan 2025 – Dec 2026 (exp.)
- **Indian Institute of Technology (BHU)** Varanasi, India
B.Tech. in Electronics Engineering; Advisor: Om Jee Pandey; GPA: 9.42/10.00 Nov 2020 – May 2024

PUBLICATIONS

- [1] **Aryaman Gupta***, Yusuf Umut Ciftci*, Somil Bansal, “From Perception Logs to Failure Modes: Language-Driven Semantic Clustering of Failures for Robot Safety”, *Under Review*
- [2] **Aryaman Gupta***, Kaustav Chakraborty*, Somil Bansal, “Detecting and Mitigating System-Level Anomalies of Vision-Based Controllers”, *ICRA’24*
- [3] Kaustav Chakraborty, **Aryaman Gupta**, Somil Bansal, “Enhancing Safety and Robustness of Vision-Based Controllers via Reachability Analysis”, *Under Review*
- [4] A.M. Ali, **Aryaman Gupta**, H.A. Hashim, “Deep Reinforcement Learning for Sim-to-Real Policy Transfer of VTOL-UAVs Offshore Docking Operations”, *Applied Soft Computing Journal*
- [5] Neha Sharma, **Aryaman Gupta**, Sivala Deepak, Om Jee Pandey, “Node Fault Prediction Assisted Small-World IoT Networks Using ML Frameworks”, *IEEE ANTS’24* [Best Paper Award]

*Equal Contribution

EXPERIENCE

- **Safe and Intelligent Autonomy Lab** Stanford, CA
Graduate Student | Prof. Somil Bansal Aug 2024 - Present
 - **Research Area:** Safe and robust generalist robot policies through failure-guided closed-loop learning.
 - Developed multimodal LLM-based unsupervised methods to identify and interpret robot failure modes from deployment data, enabling continual policy improvement and enhanced runtime safety monitoring.
 - Worked on safeguarding high-speed systems, such as F1-Tenth cars and drones operating under visuomotor policies, solely through perception inputs (LiDAR/camera) and no privileged information.
- **University of Southern California** Los Angeles, CA
Research Internship | Prof. Somil Bansal May 2023 - Aug 2024
 - **Goal:** Provide safety guarantees on vision-based controllers leveraging knowledge of their failures.
 - Mined failure modes of an aircraft taxiing system by computing Neural Reachable Tubes (NRTs).
 - Developed a runtime vision-based failure monitor and fallback mechanisms, reducing failures by 42%.
 - Fine-tuned policy on augmented failure dataset, reducing failures by 20% and prediction error by 10%.
 - Applied Conformal Prediction for probabilistic safety guarantees enabling deployment under uncertainty.

- **Carleton University** Ottawa, Canada
Jan 2023 - Dec 2023
 - *Research Internship | Prof. Hashim Mohamed*
 - **Goal:** Develop docking mechanism for VTOL-UAVs on offshore charging platforms using Deep-RL.
 - Built a custom environment for UAV landing with JONSWAP model-based hydrodynamic disturbances (waves) acting on the docking station, making it oscillate on the water surface.
 - Implemented DQN and PPO algorithms to compare performance among value and policy-based agents.
 - Agents successfully learnt to land precisely and safely through a carefully designed reward function.

 - **Indian Institute of Science** Bengaluru, India
May 2022 - July 2022
 - *Research Internship | Prof. Bharadwaj Amruthur*
 - **Goal:** Develop centralized multi-agent exploration and vision-aided dynamic collision avoidance systems.
 - Implemented RRT-exploration algorithm and map merging on a multi-robot fleet for collective SLAM.
 - Performed real-time map updates, detecting obstacles with 3D Object Detection through infrastructure cameras and using Gradient Descent to optimize obstacles' 3D real-world position for avoidance.
 - Developed ROS packages that can be configured and implemented on custom hardware testbeds.

 - **Changwon National University** Changwon, South Korea
Mar 2022 - July 2022
 - *Research Internship | Prof. Oh-Seol Kwon*
 - **Goal:** Develop a deep learning architecture for efficient object detection in low-resolution aerial images.
 - Combined Faster R-CNN, Edge Enhanced Network, and SRGAN architectures for the joint task.
 - Performed End-to-End Training of the entire pipeline, feeding detector's loss to SRGAN network.
 - Obtained testing accuracies of 95.5% on COWC and 83.2% on OGST datasets.
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- SELECTED ACHIEVEMENTS**
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| • Annenberg Scholarship, USC | 2024 |
| • Best Paper Award – IEEE Advanced Networks and Telecommunication Systems | 2024 |
| • Best Undergraduate Thesis – among 146 students in ECE IIT BHU | 2024 |
| • IUSSTF-Viterbi Scholarship – among top 15 students selected across India | 2023 |
| • DAAD-WISE Scholarship | 2023 |
| • Mitacs GRI Scholarship | 2023 |
| • Honourable Mention by IIT BHU for technical achievements, leadership, and student mentorship | 2023 |
| • 2nd Position – All IITs Robotics Association Challenge | 2021 |
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- SELECTED PROJECTS**
- **Multi-Agent Warehouse Cleaning**
 - **Goal:** Develop a Multi-Agent Coverage and Cleaning system for unknown terrains using ground robots. [\[Link\]](#)
 - Built a swarm of Omnidrive Robots and mapped the terrains using RRT-based Multi-Aobot Exploration.
 - Distributed terrain among multiple agents by computing Voronoi Cells using Fortune's Algorithm.
 - Used Polygon Planners for computing Boustrophedon Paths for each agent for complete coverage.

 - **UAV Swarming**
 - **Goal:** Develop PID Position Control for a swarm of multiple drones. [\[Link\]](#)
 - Used ArUco marker and Time of Flight (TOF) Lidar sensor for pose estimation with Kalman Filter for correction.
 - Implemented Cascaded PID for 3D position control and Python-based socket communication.
 - Used Flocking Algorithm for implementing swarm motion of drones in PyBullet simulation software.

 - **Multi-Purpose Household Robot (Supervised by Prof. Shyam Kamal, IIT BHU)**
 - **Goal:** Design a Compact Ground Robot that can perform household tasks like Cleaning and Child-Care. [\[Link\]](#)
 - Designed a CAD model and integrated ROS autonomy packages for Exploration, Navigation, and Coverage.
 - Used Computer Vision for tasks like threat detection and child tracking for child care in households.
 - Developed prototype with Jetson Nano and STM Microcontroller and using Intel Realsense for perception.

RELEVANT COURSEWORK

- **Graduate Courses:** AA-276 (Principles of Safety-Critical Autonomy), AA-228V (Validation of Safety-Critical Systems), AA-203 (Optimal and Learning Based Control), AA-228 (Decision Making Under Uncertainty), ENGR-205 (Introduction to Control Design Techniques), AA-242A (Classical Dynamics)
- **Undergraduate Courses:** MA-101 (Real Analysis), MA-102 (Linear Algebra), MA-202 (Probability and Statistics), CSO-102 (Data Structures and Algorithms), CSO-332 (Ubiquitous Computing), CSO-458 (Soft Computing)

SKILLS AND INTERESTS

- **Languages and Libraries:** Python, C++, MATLAB, Julia, JAX, Hugging Face, PyTorch, TensorFlow, Keras, scikit-learn, OpenCV, OpenAI Gym, X-Plane, CARLA
- **Technologies and Tools:** ROS, ROS2, Flightmare, AutowareAI, Open3D, Linux, Git, Docker, L^AT_EX

COMMUNITY SERVICES AND INVOLVEMENTS

- Reviewer – CoRL (2025), T-RO (2025), RA-L (2025)
- Working Group Member – Stanford Center for AI Safety
- Technical Lead – RoboReG, a student-led robotics research group at IIT BHU

STUDENT MENTORSHIP

- Joyce Yang (Cornell BS CS), Tito Rosas (UCLA BS ME)