Aryaman Gupta

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Education

- **Stanford University** — Stanford, CA
  Doctor of Philosophy in Aeronautics and Astronautics; GPA: 4.00/4.00 — *January 2025 – Present*
- **Indian Institute of Technology (BHU)** — Varanasi, India
  Bachelor of Technology in Electronics Engineering; GPA: 9.42/10.00 — *November 2020 – May 2024*

Publication

1. **Aryaman Gupta***, Yusuf Umut Ciftci*, Somil Bansal, "Enhancing Robot Safety via MLLM-Based Semantic Interpretation of Failure Data", *In Submission* *[Link]*
2. **Aryaman Gupta***, Kaustav Chakraborty*, Somil Bansal, "Detecting and Mitigating System-Level Anomalies of Vision-Based Controllers", *IEEE ICRA'24* *[Link]*
3. Kaustav Chakraborty, **Aryaman Gupta**, Somil Bansal, "Enhancing Safety and Robustness of Vision-Based Controllers via Reachability Analysis", *Submitted to IEEE TRO* *[Link]*
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* *[Link]*
5. Neha Sharma, **Aryaman Gupta**, Sivala Deepak, Om Jee Pandey, "Node Fault Prediction Assisted Small-World IoT Networks Using ML Frameworks: Towards Performance Improvement", *IEEE ANTS'24* [Best Paper Award] *[Link]*

*Equal Contribution

Experience

- **University of Southern California** — Los Angeles, CA
  Research Internship | Prof. Somil Bansal — *May 2023 - August 2024*
  - **Goal:** Provide safety guarantees of vision-based controllers leveraging knowledge of their failure cases.
  - Prepared datasets containing failure samples labelled using Backward Reachable Tubes (BRTs).
  - Trained an Anomaly Detector to detect system failures and trigger Fallback Controller for safety.
  - BRT failure volume reduced by 40% on testing environments unseen during anomaly detector training.
  - Implemented Conformal Prediction to provide confidence guarantees on the anomaly detector.

- **Carleton University** — Ottawa, Canada
  Research Internship | Prof. Hashim Mohamed — *January 2023 - December 2023*
  - **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 initially accelerate downwards and then decelerate to land safely.

- **Indian Institute of Science** — Bengaluru, India
  Summer Research Internship | Prof. Bharadwaj Amrutur — *May 2022 - July 2022*
  - **Goal:** Develop centralized multi-agent exploration and vision-aided dynamic obstacle avoidance systems.
  - Implemented RRT-Exploration and Map Merge on multiple ground robots in unseen environments.
  - Performed real-time map updates using 3D Object Detection with multiple infrastructure cameras and used First-Order Gradient Descent for optimizing obstacle's 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
  Research Internship | Prof. Oh-Seol Kwon *March 2022 - July 2022*
  - **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.

Achievements

- Awarded the **Best Paper Award** in the IEEE Advanced Networks and Telecommunication Systems.
- Awarded the **Best Undergraduate Thesis Title** among 146 students in ECE department at IIT BHU.
- Among **Top-15** students selected across India for the **IUSSTF-Viterbi Scholarship 2023** to pursue a fully-funded summer research internship at the USC Viterbi School of Engineering.
- Awarded **DAAD-WISE Scholarship 2023** to pursue Research Internship in German Public Institutes.
- Awarded **Mitacs GRI Scholarship 2023** to pursue Research Internship in Canadian Institutes.
- Awarded **Honourable Mention** for my technical achievements and contribution in organizing competitions and workshops and mentoring students by the Science and Technology Council of IIT BHU.
- Stood **Second** in **All Indian Institutes of Technology Robotics Association 2021 Challenge** among all prestigious institutions in India for maximum coverage of warehouse using multiple agents.

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), ENGR-205(Introduction to Control Design Techniques)
- **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

- **Areas of Interest**: Safety Critical Control, Robotics, Self Driving, Reinforcement Learning, Computer Vision
- **Languages and Libraries**: Python, C++, MATLAB, OpenAI Gym, PyTorch, Tensorflow, X-Plane, Carla
- **Technologies**: ROS, ROS2, Deep Learning, Machine Learning, AutowareAI, Linux, Git, LaTeX

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-Robot Exploration.
  - Distributed terrain among multiple agents by computing Voronoi Cells using Fortune's Algorithm.
  - Used a polygon planner for computing Boustrophedon Paths for each agent for complete coverage.
- **UAV Swarming**
  - **Goal:** Develop UAV Position Control using PID controller and implement Swarm Motion 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 for manual control.
  - Used Flocking Algorithm for a 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 pckages for Exploration, Navigation, and Coverage.
  - Used Computer Vision for tasks like threat detection and child following for child care in households.
  - Developed prototype with Jetson Nano and STM Microcontroller and using Intel Realsense for perception.

Community Services and Involvements

- Reviewer in Conference on Robot Learning(CoRL) and Transactions on Robotics(T-RO)