Aryaman Gupta

https://aryamangupta.site/

Email : aryaman.gupta.ece20@itbhu.ac.in
Mobile : +91-97797-17444

Education

- **Indian Institute of Technology (BHU)** — Varanasi, India
  Bachelor of Technology in Electronics Engineering; GPA: 9.47/10 — *November 2020 – May 2024*

Skills and Interests

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

Publication

1. **Aryaman Gupta**, Kaustav Chakraborty, Somil Bansal, "**Detecting and Mitigating System-Level Anomalies of Vision-Based Controllers**", *Submitted to ICRA'24* *[Link]*
2. **Aryaman Gupta**, Ali Mohamed Ali, Hashim A.Hashim, "**Deep Reinforcement Learning for Sim2Real Policy Transfer in VTOL-UAVs Offshore Docking Operations**", *In Preparation*
3. **Aryaman Gupta**, Sivala Deepak, Neha Sharma, Om Jee Pandey, "**Joint Node-Fault Prediction and Data Routing in SW-IoT Networks using Actor-Critic RL**", *In Preparation*

Experience

- **University of Southern California** — Los Angeles, CA
  Summer Research Internship | Prof. Somil Bansal — *May 2023 - Present*
  - **Goal:** Improve visual navigation policies by leveraging knowledge of their failure cases.
  - Prepared datasets containig failure samples labelled using **Backward Reachable Tubes(BRTs)**.
  - Trained an **Anomaly Detector** that detect system failures and trigger **Fallback Controller** for safety.
  - BRT failure volume decreased by 12%(avg.) on testing environments unseen during classifier training.

- **Carleton University** — Ottawa, Canada
  Research Internship | Prof. Hashim Mohamed — *January 2023 - Present*
  - **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 with low velocity.

- **Indian Institute of Science** — Bengaluru, India
  Summer Research Internship | Prof. Bharadwaj Amrutur — *May 2022 - July 2022*
  - **Goal:** Develop decentralized multi-agent exploration and visual dynamic obstacle avoidance systems.
  - Implemented **Distributed RRT-Exploration** of unknown environments with multiple ground robots.
  - Performed real-time map updates using **3D Object Detection** on 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 joint task.
  - Performed **End-to-End Training** of the entire pipeline, feeding detector's loss to generator network.
  - Obtained testing accuracies of 95.5% on COWC and 83.2% on OGST datasets.

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**.
  - Implemented terrain distribution among multiple agents by computing **Voronoi Cells** using **Fortune's Algorithm** and a polygon planner to traverse **Boustrophedon Paths** for coverage.
- **Small World IoT Networks (Supervised by Prof. Om Jee Pandey, IIT BHU)**
  - **Goal:** Introduce Small-World Phenomenon in Wireless Sensor Networks and Detect Faulty Sensor Nodes. *[Link]*
  - Implemented **Soft Actor Critic(SAC)** algorithm for introducing long-range links in networks.
  - Prepared faulty sensory nodes dataset and used **DBSCAN** algorithm for detection after comparison.
  - Performed data routing and observed increased network lifetime and throughput with lowered energy consumption.
- **UAV Swarming**
  - **Goal:** Develop UAV Position Control using PID controller and Swarm Motion of multiple drones. *[Link]*
  - 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.
- **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.
  - Fabricated hardware using **Jetson Nano** and **STM Microcontroller** and used **Intel Realsense** for perception.
- **UAV Guided UGV Navigation**
  - **Goal:** UAV-assisted Exploration of mountainous terrains and UGV Navigation in snow-covered roads. *[Link]*
  - Performed UAV Localization by fusing IMU and GPS data using **Extended Kalman Filtering**.
  - Used **U-Net** for segmenting roads and **Frontier Exploration** on UAV for mapping using RGBD data.
  - Obtained UGV odometry using UAV camera feed and traversed the terrains using waypoint planning.

Relevant Coursework

- **Academic Courses**: MA-101(Real Analysis), MA-102(Linear Algebra), MA-202(Probability and Statistics), CSO101(Data Structures and Algorithms) CSO-332(Ubiquitous Computing), CSO-458(Soft Computing)
- **Online Courses**: ML and DL Fundamentals by Andrew NG, RL Specialization by UoA, Computer Vision by Stanford

Achievements

- Among **Top-15** students selected for the **IUSSTF-Viterbi Scholarship 2023** to pursue a fully-funded summer research internship at the USC Viterbi School of Engineering.
- Selected for **DAAD-WISE Scholarship 2023** to pursue Research Internship in German Public Institutes.
- Selected for **Mitacs GRI Scholarship 2023** to pursue Research Internship in Canadian Institutes.
- 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.
- Among **Top-10** teams in **National Robotics Competition** for developing a consumer-oriented innovative household robot capable of doing household chores and baby care.
- Secured **All India Rank 2400** in JEE Advanced Examination 2020 among one million applicants.

Leaderships and Community Involvements

- **Technical Lead** of **RoboReG**, a student research group working on Intelligent Robotics at IIT(BHU).
- **Senior Member** of **Robotics Club**, where I guide juniors and help in conducting events at IIT(BHU).