Curriculum Vitae - **Ayush Agrawal**

ayush8120.github.io | ay.agrawal812@gmail.com | github.com/Ayush8120 | Google Scholar

Education

May 2022 | **Birla Institute of Technology and Science (BITS) Pilani** — **Pilani, India**
Aug 2018 | B.E. Electronics & Instrumentation | GPA: 7.66/10

Publications

S=In Submission, C=Conference

[S.1] **Physical Reasoning and Object Planning for Household Embodied Agents** [🔗][🌐]
Ayush Agrawal, Raghav Prabhakar, Anirudh Goyal, Dianbo Liu
[In Submission] [**TMLR**]

[C.1] **Sequence Agnostic Multi-Object Navigation** [🔗][📹]
Nandiraju Gireesh*, Ayush Agrawal*, Ahana Datta*, Snehasis Banerjee, Mohan Sridharan, Brojeshwar Bhowmick, Madhava Krishna (* = Equal Contribution)
IEEE International Conference On Robotics And Automation [**ICRA 2023**]

[C.2] **CLIPGraphs: Multimodal Graph Networks to Infer Object-Room Affinities** [🔗] [🌐] [📹]
Ayush Agrawal*, Raghav Arora*, Ahana Datta, Snehasis Banerjee, Brojeshwar Bhowmick, Krishna Murthy Jatavallabhula, Mohan Sridharan, Madhava Krishna (* = Equal Contribution)
IEEE International Conference On Robot And Human Interactive Communication [**RO-MAN 2023**]

Experience

Present / **June 2023** | **National University Of Singapore (NUS)** — **Remote / Singapore**
Research Intern | Advisors: Dr. Dianbo Liu, Dr. Anirudh Goyal
Leveraging LLMs and VLMs to equip Embodied Agents with human physical commonsense reasoning

June 2023 / **May 2022** | **International Institute Of Information Technology (IIIT) | Robotics Research Center** — **Hyderabad**
Research Assistant | Advisors: Dr. K. Madhava Krishna, Dr. Mohan Sridharan, Dr. Krishna Murthy
Developed computational methods inspired by human cognition to enhance the performance of embodied agents in object navigation, multi-object navigation, and household tidying-up tasks

May 2022 / **Nov 2021** | **University of New South Wales (UNSW) | Bio-Engineering Lab** — **Remote / Canberra, Australia**
Research Intern (Bachelor Thesis) | Advisor: Dr. Sridhar Ravi
Designed and implemented a Deep Learning model inspired by Honey Bee Vision to achieve effective obstacle avoidance for drones

Aug 2021 / **June 2021** | **Indian Institute Of Technology (IIT) | ARMS Lab** — **Remote/ Mumbai, India**
Summer Intern | Advisor: Dr. Arpita Sinha
Developed a Decentralized Multi-Drone Terrain Exploration algorithm using PX4 drones on ROS and Gazebo.

Select Research Projects

Physical Common Sense Reasoning June'23 - Present
Advisors: Dr. Dianbo Liu, Dr. Anirudh Goyal

- Formulated a 3-step architecture for demystifying the Human CommonSense Reasoning involved in decision-making when making object selection for Task Completion
- Created human preference datasets and analyzed abstract commonsense reasoning capabilities of LLMs when posed the same questions [In Submission]

Embodied Multi-Object Navigation May'22 - June'23
Advisors: Dr. K Madhava Krishna, Dr. Mohan Sridharan, Dr. Krishna Murthy

- Developed commonsense-oriented heuristics to optimize the search and retrieval task of multiple objects by framing the problem as a Contextual TSP.
- For static objects, developed a modular framework with an RL policy based on semantic inputs to output effective long-term goals thus enabling the robot to locate the list of objects in an optimized sequence agnostic manner[**ICRA'23**][Blog]
- For dynamic objects, developed a Graph Neural Network by processing Human Preference Dataset and CLIP Features to give better human commonsense aligned Object-Room Affinities and latent embeddings.[**RO-MAN'23**][Intuition]

Bio-Inspired Robotics Sept'21 - May'22

Advisors: Dr. Sridhar Ravi, Dr. Puneet Mishra, Dr. Sujan Yenuganti

- Developed a Deep Neural Network(LSTM+CNN) to model the relationship between Geometric Optic Flow and Honey Bee trajectories. Our developed obstacle avoidance algorithm achieved an accuracy of **75%** and was verified in various simulated multi-obstacle tunnels. [Thesis][Presentation]
- Proposed and Procured institute funding for developing Autonomous Source Localization Drone on a DJI Tello Drone utilizing the biologically inspired Run-Tumble Algorithm[Report]

Robotics & Electronics Jan'21 - Jan'22

Advisors: Dr. Arpita Sinha, Dr. Meetha Shenoy, Dr. Puneet Mishra,

- Implemented a Decentralized Multi-Drone Terrain Exploration algorithm on ROS and Gazebo using PX4 drones, ensuring complete exploration in a limited number of steps [Code][Video]
- Constructed a specialized dataset featuring common UAV noises and implemented a Deep Neural Network(GAN) for effective denoising of UAV-captured images [Report]
- Designed ESP32-AWS architecture for soil condition sensing by integrating microcontrollers and sensors to enable regular data transmission to AWS Database[Presentation]

Patents

Method And System For Multi-Object Tracking And Navigation Without Pre-Sequencing, 2023 | Patent Pending

Talks

"Bio-Mimicry"

- A Honey Bee's Attempt at Obstacle Avoidance [🔗] December 2021 (BITS Pilani)

Honours and Awards

OpenAI Researcher Access Program, 2023 [🌐] For studying Physical Commonsense Reasoning abilities in LLMs

BITS Pilani Undergraduate Project Funding, 2021 [🌐] For working on Autonomous Odor Localization Drone

Bronze Medal, Univeristy Physics Competition 2021 [🌐] For presenting our solution as a white paper in 48 hours

Competitions

E-Yantra Robotics Competition *Top 30 out of 500 teams* [📹] Sep'20 - Apr'21

- Designed and simulated a parcel distribution drone featuring a Discrete PID Controller.
- Successfully executed marker detection, QR code-based scanning, path planning, obstacle avoidance, and optimized delivery/pickup scheduling to maximize revenue.

International Rover Design Challenge *Core Member* [📄] Jul'21 - Sep'21

- Contributed to implementing various low-light imaging techniques using Deep Learning and Image Processing techniques for our institute's submission.

Skills

Languages	Python, C++, MATLAB
Frameworks	Pytorch, Tensorflow
Tools	Git, Visual Studio
Simulators	Habitat, AI2Thor, Virtual Home, Gibson, Gazebo
Relevant Coursework	Pattern Recognition, Probability & Statistics , Linear Algebra, Discrete Mathematics Neural Networks & Fuzzy Logic, Object Oriented Programming, Digital Image Processing
MOOC	RL by David Silver, Deep Learning Specialization by Andrew Ng

Academic Service

Reviewer IROS 2023

References

- Dr. Dianbo Liu ..... *Assistant Professor, NUS, Singapore* [🌐]
- Dr. K Madhava Krishna ..... *Professor, IIIT Hyderabad, India* [🌐]
- Dr. Mohan Sridharan ..... *Reader, University of Birmingham, UK* [🌐]
- Dr. Krishna Murthy Jatavallabhula ..... *PostDoc, MIT* [🌐]