Curriculum Vitae - **Ayush Agrawal**

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Education

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

Publications

<div align="right">J=Journal, C=Conference</div>

[J.1]   **Physical Reasoning and Object Planning for Household Embodied Agents** [🔗][⊕]
Ayush Agrawal, Raghav Prabhakar, Anirudh Goyal, Dianbo Liu
Transactions on Machine Learning Research   **[TMLR 2024]**

[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

Feb 2024 **June 2023**	**National University Of Singapore (NUS)** *Research Intern | Advisors: Dr. Dianbo Liu, Dr. Anirudh Goyal* Developed a framework to analyse and improve physical commonsense reasoning in embodied agents.	**Remote / Singapore**
June 2023 **May 2022**	**International Institute Of Information Technology (IIIT) | Robotics Research Center** *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	**Hyderabad**
May 2022 **Nov 2021**	**University of New South Wales (UNSW) | Bio-Engineering Lab** *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	**Remote / Canberra, Australia**
Aug 2021 **June 2021**	**Indian Institute Of Technology (IIT) | ARMS Lab** *Summer Intern | Advisor: Dr. Arpita Sinha* Developed a Decentralized Multi-Drone Terrain Exploration algorithm using PX4 drones on ROS and Gazebo.	**Remote/ Mumbai, India**

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* [🌐]