Ayush **Agrawal**

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Education

Birla Institute of Technology and Sciences, Pilani — *Pilani, India*

B.E. in Electronics And Instrumentation Engineering | CGPA: 7.66/10 — *August. 2018 - August 2022*

Teaching Assistant: Microprocessor & Interfacing Lab

New Green Field Public Academy, Indore — *Indore, India*

CGPA - 10 (X Standard) ; Percentage - 89.9 (XII Standard) — *2016 - 2018*

Publications

Sequence Agnostic Multi-Object Navigation — *ICRA 2023*

IEEE International Conference on Robotics and Automation — *Accepted*

Ayush Agrawal*, Ahana Datta*, Nandiraju Gireesh*, Snehasis Banerjee, Mohan Sridharan, Brojeshwar Bhowmick, Madhava Krishna

CLIPGraphs: Multimodal Graph Networks to Infer Object-Room Affinities | — *RO-MAN 2023*

IEEE International Conference on Robot and Human Interactive Communication — *Under Review*

Ayush Agrawal*, Raghav Arora*, Ahana Datta, Snehasis Banerjee, Brojeshwar Bhowmick, Krishna Murthy Jatavallabhula, Mohan Sridharan, Madhava Krishna

Research Experience

Robotics Research Center, IIIT Hyderabad — *Hyderabad,India*

Research Assistant, Guide: *Dr. Madhav Krishna , Dr. Mohan Sridharan* — *June. 2022- Present*

- Collaborating with TCS Research, Kolkata, India to enhance the performance of embodied agents in object navigation, multi-object navigation, and household tidying-up tasks.
- Proposed Sequence Agnostic Multi-Object Navigation (SAM) task, wherein the agent is neither provided nor forced to compute a global order in which it locates instances of multiple target objects.
- Proposed a GCN encoder leveraging Foundation Models for generating object-room co-occurrence affinities that align well with Human CommonSense (CLIPGraphs)
- Currently working on a framework, where, an embodied agent must tidy a house by rearranging misplaced objects using scene graphs and CLIPGraphs Affinities

University of New South Wales, Canberra — *Canberra, Australia*

Undergraduate Thesis, Supervisor : *Dr. Sridhar Ravi* Results: *Thesis Link , Conference PPT* — *November 2021- May 2022*

- Worked on my undergraduate thesis on the topic : Obstacle Avoidance in drones Using Bee Vision inspired Algorithms
- Implemented Deep Learning techniques to model the relationship between Geometric Optic Flow and Obstacle Avoidance in Bees, curated real honeybee trajectory dataset, and proposed an LSTM+CNNs model achieving 75% accuracy.
- Successfully tested the model in custom tunnels with multiple obstacles, resulting in avoiding obstacles each time.

Indian Institute of Technology, Bombay — *Bombay,India*

Remote Research Intern, Guide: *Dr. Arpita Sinha* Results: *GitHub* — *June. 2021- August 2021*

- Successfully implemented a Decentralized Multi-Drone Terrain Exploration algorithm on ROS and Gazebo using PX4 drones, ensuring complete exploration in a limited number of steps
- Utilized an incidence matrix as a mode of communication between robots and vertex, eliminating the need for inter-robot communication
- Tools Used: Python, ROS, Gazebo, MATLAB

References

Dr. K Madhava Krishna, E-Mail | Webpage | Full Professor at IIIT-H

Dr. Mohan Sridharan, E-Mail | Webpage | Reader at University of Birmingham

Dr. Krishna Murthy Jatavallabhula, E-Mail | Webpage | Post Doc at MIT

Dr. Brojeshwar Bhowmick, E-Mail | Webpage | Principal Scientist, TCS Research Kolkata, India

Patents

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

Projects

Image Denoising for UAV Imagery

BITS Pilani

SUPERVISOR : *Dr. Meetha Shenoy* RESULTS : *Github Link* | *Project Report*

Jan 2021 - May 2021

- Reviewed various denoising, deblurring, super-resolution, marker detection methods using GANS and CNN's.
- Created a new dataset by adding commonly occuring UAV noises, to judge the level of denoising, Metrics chosen : PSNR, SSIM
- Tools Used: TensorFlow, Keras, PIL, Wand

Bio-inspired Source Localization Drone

Pilani, India

CO-SUPERVISOR : *Dr. Sujan Yenuganti*, *Dr. Puneet Mishra* RESULTS : *Project Report*

September 2021- May 2022

- Worked on making a Bio-inspired Odor/Light Source Localization Drone
- Interfaced Gas/LDR Sensors with a Micro-Controller attached to a DJI Tello to publish the signals in real time to a ROS topic
- Developed a ROS Program to process these signals and guide the DJI Tello to reach the odor/light source
- *Fully Sponsored by AUGSD BITS Pilani*

Crop Advisory System using Novel Nitrogen Sensor and IoF Framework

BITS Pilani, India

GUIDE : *Dr. Puneet Mishra* RESULTS : *Project PPT*

August 2021 - January 2022

- Developed an architecture for soil sensing and visualization using ESP32 and AWS
- Researched about micro-controllers,types of sensors, whole system architecture and interfaced it all together to send data at regular intervals to AWS Database
- This was a Department Of Biotechnology, Government Of India Sponsored Project

Competitions

E-Yantra Robotics Competition

IIT Bombay,India

FINISHED IN TOP 30 OUT OF 500 TEAMS | *Final Submission Video*

Sept 2020 - April 2021

- Designed and Simulated a parcel distribution drone with Discrete PID Controller
- Successfully Executed Marker Detection, QR code-based scanning, path planning, obstacle avoidance, scheduling of delivery/pickup to maximize the revenue
- Tools Used: Python, ROS, Gazebo, Plotjuggler, OpenCV

University Physics Competition 2021

BRONZE MEDAL | *Certificate*

November 2021

- Researched about Asteroid's minimum mass to cause a substantial damage to a 1000 Km away coastal city
- Presented our findings in form of a Research Paper in a span of 48 Hours.

IRDC(International Rover Design Challenge)

The Mars Society

Team Website | *Certificate*

July 2021- September 2021

- Part of a 65 Member Team.
- Contributed in researching various low light imaging techniques using Deep Learning & Standard Image Processing

Relevant Coursework

David Silver RL | Linear Algebra | Probability And Statistics | Pattern Recognition | Image Processing | Neural Network And Fuzzy Logic | Deep Learning Specialization (Online) | Discrete Mathematics | Object Oriented Programming

Technical Skills

- **Languages :**, Python, C/C++
- **Developer Tools:**, Git, VS Code, Google Colab
- **Libraries:**, Pandas, NumPy, Matplotlib, Wand, PIL, OpenCV
- **Softwares:**, MATLAB, SIMULINK, Gazebo, ROS
- **Frameworks:**, TensorFlow, Keras, PyTorch

Honors & Awards

2018 **96.07 percentile out of 0.15 million applicants**, IIT Joint Entrance Examination Advanced, 2018

2021 **Awarded INR 50,000 as UG Project Funding for Autonomous Odor Drone**, AUGSD BITS PIALNI *BITS Pilani*