Aditya **Prakash**

BT-MT (Dual Degree)
Department of Aerospace Engineering
Indian Institute of Technology Kanpur

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Education

Indian Institute of Technology Kanpur 2019 – 2024
BT-MT, Aerospace Engineering **8.9 (UG), 8.5 (PG)/10.0**

BNS DAV Public School, Giridih 2019
CBSE - XII **97.6%**

BNS DAV Public School, Giridih 2017
CBSE - X **10.0/10.0**

Scholastic Achievements

- Recipient of prestigious **Honda YES'21 Award** by Honda Foundation granted to 14 exceptional students across all IITs
- Awarded **Academic Excellence Award** for exceptional academic performance in **2021** and **2022** by IIT Kanpur
- Received **A* grade** for exceptional performance in **3** courses (Aerospace and Humanities) in the 3rd year at IIT Kanpur

Research Works

Journal Publication

Aditya Prakash, Dipak Kumar Giri, Shashi Ranjan Kumar, "Dynamic velocity error based trajectory tracking for space robotic manipulator", in **Aerospace Science and Technology**, Vol. 126, 2022, pp. 107650

Conference Presentations

Aditya Prakash, Dipak Kumar Giri, "Coordinated Control using Multi-Agent Reinforcement Learning for transfer of payload between skyhook and launch vehicle", **AIAA Sci-Tech Forum**, Florida, USA, 8-12 January 2024

Aditya Prakash, SPEG, "The Feasibility of Conducting Commercial Asteroid Exploration", **74th International Aeronautical Congress** (IAC), Baku, Azerbaijan, 2-6 October 2023

Aditya Prakash, "Interstellar Exploration Using "EXPLORER" Spacecraft - Building The Foundation", **74th International Aeronautical Congress** (IAC), Baku, Azerbaijan, 2-6 October 2023

Nitika Jaggi, **Aditya Prakash**, Gaurav Kumar, Priyank Dubey, Dipak Kumar Giri, "MagLev based 3-DOF experimental Platform for Autonomous Spacecraft Rendezvous and Docking", **73rd International Aeronautical Congress** (IAC), Paris, France, 18-22 September 2022

Research Experiences

Short Term Trainee | Space Robotics Lab, Tohoku University (Japan) June'23 – July'23

Objective	- Collaborate with a team of 6 members to create **Moonbot**, a **reconfigurable** four-legged rover - Design and implement optimized control system to demonstrate Moonbot's **modularity** and **movement**
Approach	- Employed **evolutionary and genetic algorithms** to **optimize** walking gait patterns and enhance **limb design** - Devised and implemented a **multi-threaded** ROS architecture using ROS 2, Python for seamless communication - Implemented **real-time** limb detection mechanisms to ensure **self-perception** for modularity
Impact	- Demonstrated the Moonbot's modularity, i.e., movement in **4** different configurations

Research Intern (MITACS) | Human Robot Interaction Lab, UNB (Canada) May'22 – July'22

Objective	- Design a grasping user interface for teleoperating a Kinova robotic arm using shared autonomy - Conduct user study centered at understanding the role of **authority vs autonomy** in UI Design
Approach	- Developed a mathematical model using **difference vector** to predict user intentions in realtime - Designed a **shared autonomy** control system using model predictions aimed at reducing human effort - Utilized ROS, Python to implement and test the model and the control system on a Kinova Robotic Arm - Designed a case study based on NASA TLX to understand **autonomy vs authority** in robotic teleoperation
Impact	- Demonstrated shared autonomy control, reducing grasping time by 10% and human effort by 30% - Documented the entire design process and case study setting the foundation for future research

Student Research Associate | Space Dynamics and Flight Control Laboratory, IIT Kanpur January'22 – Present

Objective	- Collaborate in a team to create a magnetic levitation based 3-D low gravity simulator (first in the world) - Design and implement efficient thruster system for the simulator using blowers to minimize mass of the simulator
Approach	- Conducted in-depth research to understand existing low gravity simulators in the world and optimize our design - Optimized the thruster system by redesigning the configuration through CFD analysis and optimizing blower - Implemented control system to minimize the disturbance due to blowers and achieve a robust simulation platform - Used ROS to implement control modules for force control, bang-bang control, velocity control and path planning
Impact	- Created a $<$ **10 kg** simulation platform which can be used for testing multiple spacecraft operations - Experimentally validated the thruster system achieving an accuracy of **95%** with a settling time of **2s** - Designed the ROS architecture with code to support different control modules to be used by various researchers

Research Intern | SURGE, IIT Kanpur May'21 – July'21

Objective	- Design a simple and robust control design for trajectory tracking for space robotic manipulator
Approach	- Conducted literature review to understand space robotics and existing trajectory tracking control - Defined **dynamic velocity error (DVE)** and designed control system to minimise the same through PD control - Performed the analytical and numerical analysis to prove the and validate stability of the algorithm
Impact	- Designed a simple control system using DVE and PD control method with a maximum error of **1.41%** - Published the results in a prestigious Aerospace journal, **Aerospace Science and Technology** (citations: 4)

Leadership Experience

Project Lead | Asteroid Mining, SPEG, SGAC January'23 – July'23

Leadership	- Proposed a project under SPEG, SGAC to study the feasibility of conducting commercial Asteroid mining - Interviewed interested candidates and built a team of 5 members from different countries with required skills - Created the roadmap for the project and handled work distribution with regular meetings and discussions
Impact	- Proposed a commercial infrastructure for asteroid mining based on Asteroid Transfer at Sun-Earth L4 point - Conducted in-depth research of space policies to understand commercialisation and its impact on world economy - Summarised the result to be presented at 74th International Aeronautical Congress, Baku, Azerbaijan

Coordinator and Project Mentor | Brain and Cognitive Society, IITK May'21 – May'22

Leadership	- Managed a group of 15 secretaries to organise several BCS activities including introductory lectures, workshops - Invited proficient researchers in the field of AI and Neuroscience as a speaker for journal meetings for students - Started a project under Science and Technology Council to analyse Steinmetz dataset during summer - Mentored a group of 5 students through regular tutorials, assignments and doubt clearing sessions

Technical Skills

Programming Languages: C++, MATLAB, JavaScript, Python, C

Libraries: Numpy, Tensorflow, PyTorch, OpenCV

Web: React, Node.js, MongoDB, Flask, Canvas

Utilities: Git, LaTeX, LabView, ROS, Simulink, Siemens NX, AutoCAD, Fusion 260, Autodesk CFD, ROS2

Coursework

Machine Learning `(Online Courses)` and **Algorithms**

Deep Learning Specialization	Natural Language Processing	Data Structures and Algorithms

Aerospace and Robotics Courses

Optimal Space Flight Control	Space Dynamics	Aircraft Control Systems
Nonlinear and Adaptive control	Introduction to Robotics	Applied Numerical Methods
Turbulence	Aeroacoustics	Computational Fluid Dynamics

Extra-curricular Activities

- Provided academic and career guidance to **60+** junior students of aerospace department through counselling sessions

- Volunteered at Shiksha Sopan led by **Padma Shri HC Verma** teaching high school students Mathematics

- Volunteered at University of New Brunswick to conduct summer game development camp for primary school students

Additional Projects

Facial Emotion Recognition | *Brain and Cognitive Society, IIT Kanpur* July'20

- Extracted human faces (using OpenCV haar-cascade) from a camera stream and preprocessed them
- Implemented CNN classifier and trained it on FER2013 dataset and got an accuracy of 97% on JFFE test dataset
- Designed model for emotion recognition in video using CNN-RNN and C3D hybrid networks

Decoding relation b/w voxels & pixels | *Neuromatch (Online)* July'20

- Worked in a team of 4 members to decode semantic features from ROIs of the visual cortex
- Extracted semantic features using last layers of different classifier DNN, Resnet50 & VGG16
- Tried dimensionality reduction and clustering techniques to find clusters in voxel responses

PETcat (vision) | *Robotics Club, IIT Kanpur* April'20

- Developed vision modules of a user-friendly cat bot for gesture recognition using OpenCV
- Implemented Haar Cascade trainer and used it to train a model to detect complex objects and built ROS package

Facebook Hateful Memes Challenge | *Self Project* Sep'20

- Extracted visual features using pretrained CNN classifier models, namely ResNet and Incetionv3
- Used LSTM, Word Embeddings and Attention Models to learn textual features
- Implemented different multi-modal models to learn relation between textual and visual features