

Debajyoti Chakrabarti

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RESEARCH INTERESTS

Safe and reliable autonomous systems; reinforcement learning and world models; risk-sensitive decision making; motion planning and optimal control; multi-agent systems; learning-enabled control and sim-to-real robotics.

EDUCATION

University of California, Los Angeles (UCLA)

Ph.D. in Aerospace Engineering – Robotics and Control

Los Angeles, CA

2024 – Present; Expected 2030

- GPA: **4.0/4.0**; Advisor: Prof. Anushri Dixit

University of California, Los Angeles (UCLA)

M.S. in Aerospace Engineering

Los Angeles, CA

2024–2026

- GPA: **4.0/4.0**; Advisor: Prof. Anushri Dixit

Indian Institute of Space Science and Technology (IIST)

B.Tech. in Electronics and Communication Engineering (Avionics)

Kerala, India

2015 – 2019

- GPA: **9.20/10.0 (Class Rank: 2)**; merit-based full scholarship from the Department of Space, Government of India

RESEARCH AND INDUSTRY EXPERIENCE

Graduate Researcher, PRACTICE Lab, UCLA

Advisor: Prof. Anushri Dixit

Los Angeles, CA

Sept. 2024 – Present

- Built an **incentive-aware multi-agent motion planning framework** combining bilevel optimization, convex safe-corridor allocation, and VCG mechanism-inspired transfers for decentralized collision-free execution (accepted to **IEEE CDC 2026**)
- Developing hierarchical world-model reinforcement learning for quadruped robot soccer, including low-level skill training, high-level Dreamer control, and iterative self-play
- Studying a **risk-sensitive extension** of the same soccer framework using CVaR-constrained R2-Dreamer, with tail-risk diagnostics, and sim-to-real evaluation on the Unitree Go2

Guidance, Navigation, and Control Scientist, Indian Space Research Organisation (ISRO)

U R Rao Satellite Centre (URSC)

Bangalore, India

Aug. 2019 – July 2024

- Designed and implemented safety-critical guidance, navigation, attitude, and orbit control system (AOCS) algorithms for 10+ spacecraft missions, including **Chandrayaan-3**, **Gaganyaan** (Indian Human space program), **LUPEX**, and **NISAR** (NASA-ISRO collaboration)
- Developed real-time flight algorithms under strict latency and computational constraints, including lunar-landing feasibility/retargeting, thrust estimation, and telemetry-driven analysis
- Served as AOCS Project Manager for remote sensing satellite **TRISHNA** (India–France collaboration) and **INS-2B** nanosatellite, coordinating end-to-end control-system development and verification

SELECTED RESEARCH PROJECTS

World-Model Reinforcement Learning for Quadruped Robot Soccer

Summer 2026 – Present

- Developed a **hierarchical quadruped soccer architecture in Isaac Sim**, with a high-level R2-Dreamer controller commanding a separately trained, domain-randomized dribbling locomotion policy held fixed during high-level training
- Trained the high-level policy through **iterative self-play**, using each trained ego-policy checkpoint as the opponent for the next iteration to create progressively stronger competition
- Extended R2-Dreamer with a **CVaR-based lower-tail objective** designed to reduce poor closed-loop outcomes such as falls, collisions, timeouts, and unsuccessful play
- Built a **multi-seed evaluation framework** measuring mean return, goal rate, lower-tail performance, falls, and timeouts; ongoing studies examine imagined-versus-real tail-risk fidelity and failure-aware world-model training

Adaptive Safety Shielding for Goal-Directed Navigation under Exogenous Disturbance

Spring 2026

- Combined a nominal **PPO** navigation policy with an offline bank of **Hamilton–Jacobi reachability backward reachable-tube (BRT) safety certificates** and online disturbance-bound estimation
- Designed adaptive certificate selection and hierarchical fallback; under shifted obstacles and time-varying disturbances, improved performance from **58% success / 42% collision** for vanilla PPO to **100% success / 0% collision**

- Developed a VLM-gated policy-switching framework that replaces human trajectory-preference queries with automated visual-language-model supervision
- Integrated RRT* planning with imitation and TD learning, achieving **86% success with zero crashes over 50 evaluation episodes** in MetaDrive urban-driving scenarios

Predicting Keystrokes from Electromyography Signals

Winter 2026

- Built PyTorch LSTM and Transformer models with CTC loss for EMG-to-keystroke decoding; reduced test character error rate from **23.21% to 12.06%** and performed ablations on data scale, sensor density, augmentation, and sampling frequency

Chandrayaan-3 Moon Landing Mission

Sept. 2019 – Aug. 2023

- Developed **real-time retargeting**, *first-ever machine-learning-enabled planetary landing algorithm* for autonomous landing feasibility detection and online landing-site recomputation
- Designed an **engine thrust estimation algorithm** using Recursive Least Squares from accelerometer data
- Analyzed **propellant slosh-control interaction** via 6-DOF simulation and Monte Carlo studies, contributing to the successful landing

SELECTED PUBLICATIONS

- **Debajyoti Chakrabarti**, Anushri Dixit. “*Paying for Space: Incentive-Aware Motion Planning for Multi-Agent Collision Avoidance.*” **IEEE Conference on Decision and Control (CDC)**, 2026 [Accepted]
- Suraj Kumar*, **Debajyoti Chakrabarti***, Aditya Rallapalli, Bharat K. G V P. “*Real-Time Retargeting Based Robust Polynomial Guidance for Chandrayaan-3 Lunar Landing Mission.*” **Journal of Guidance, Control, and Dynamics**, 2026
- Suraj Kumar*, **Debajyoti Chakrabarti***, Aditya Rallapalli. “*Real-Time Retargeting Using Controllability Boundary for Chandrayaan-3 Lunar Landing.*” **American Control Conference (ACC)**, 2026
- Suraj Kumar, Aditya Rallapalli, **Debajyoti Chakrabarti**, Rijesh M P, Bharat K. G V P. “*Powered Descent Trajectory Design and Guidance Algorithms for Chandrayaan-3 Lunar Landing Mission.*” **AIAA Scitech 2026 Forum**, 2026
- **Debajyoti Chakrabarti**, Suraj Kumar, Aditya Rallapalli, MP Rijesh, Bharat K. G V P. “*Convex Decision Boundary Design for Guidance Feasibility Check During Powered Descent Phase of Chandrayaan-3 Lander.*” **IFAC-PapersOnLine**, 2024
- Aditya Rallapalli, **Debajyoti Chakrabarti**, Nivriti Priyadarshini, MP Rijesh, Bharat K. G V P. “*Stability Analysis Using Describing Function for Non-Linear Attitude Control Loop with Slosh Dynamics of Chandrayaan-3 Landing Mission.*” **IEEE Indian Control Conference**, 2024
- **Debajyoti Chakrabarti**, N. Selvaganesan. “*PD and PD^β Based Sliding Mode Control Algorithms with Modified Reaching Law for Satellite Attitude Maneuver.*” **Advances in Space Research**, 2020

SERVICE & TEACHING

- **Peer Reviewer:** Robotics: Science and Systems (RSS); IEEE Conference on Decision and Control (CDC); Conference on Robot Learning (CoRL)
- **Teaching Assistant:** UCLA – Mathematics of Engineering (MAE-82), Fall 2025, Fall 2026; IIST – Spacecraft Dynamics Modelling and Control, Fall 2018

SELECTED HONORS

- **Departmental Fellowship**, UCLA Mechanical & Aerospace Engineering, 2024 – Present
- Certificate of Merit from the Chief Minister of West Bengal for the outstanding contribution to India’s Chandrayaan-3 lunar south-pole landing, 2023
- Rated **Outstanding Scientist** in annual performance appraisal for all five consecutive years of service at ISRO
- Top-5 finalist among 120 IIST students for the NASA JPL summer internship sponsored by IIST/ISRO, 2018

TECHNICAL SKILLS**Programming:** Python, C++, C, MATLAB**Machine Learning / Robotics:** PyTorch, reinforcement learning, model-based RL, world models, imitation learning, sim-to-real robotics**Planning / Control:** trajectory optimization, MPC, optimal control, Hamilton–Jacobi reachability, multi-agent motion planning**Tools:** CasADi, Simulink, Git, Linux, STK, L^AT_EX