Maulik Bhatt

Email: maulikbhatt@berkeley.edu | Mobile: +1-217-377-8235 | Webpage | Google Scholar

Education

University of California, Berkeley (UCB) [Jan'24 - Present]
Ph.D. student in the Department of Mechanical Engineering
Advsior: Prof. Negar Mehr
GPA: **4.0/4.0** (Transferred from UIUC starting Spring 2024)

University of Illinois Urbana-Champaign (UIUC) [Aug'21 - Dec'23]
Ph.D. student in the Department of Aerospace Engineering
Advsior: Prof. Negar Mehr
GPA: **3.91/4.0**

Indian Institute of Technology Bombay [Jul'16 - May'21]
Interdisciplinary Dual Degree Program

- Bachelor of Technology(with Honors) in the Department of Aerospace Engineering
- Master of Technology in the Department of Systems and Control Engineering

GPA : **8.96/10**

Research Interests

I am interested in developing autonomous robots that can work alongside humans and other robots. My research focuses on enabling agents to reason about other agents in the environment and effectively coordinate their motion. To this end, I have worked on approaches grounded in diffusion models [1, 2] and game theory [3, 4, 5, 6, 7, 8], developing scalable algorithms that achieve real-time performance and robust multi-agent coordination.

Publications and Preprints

1. Dayi Dong*, **Maulik Bhatt***, Seoyeon Choi, and Negar Mehr, "MIMIC-D: Multi-modal Imitation for MultI-agent Coordination with Decentralized Diffusion Policies" submitted to ICRA 2026. (arXiv:2509.14159)
(* equal contribution)

2. **Maulik Bhatt**, Honghao Zhen, Monroe Kennedy III, and Negar Mehr, "Understanding and Imitating Human-Robot Motion with Restricted Visual Fields", accepted in **IROS**, 2025. (arXiv:2410.05547)

3. **Maulik Bhatt**, Iman Askari, Yue Yu, Ufuck Topcu, Huazhen Fang, Negar Mehr, "MultiNash-PF: A Particle Filtering Approach for Computing Multiple Local Generalized Nash Equilibria in Trajectory Games", accepted in **IROS**, 2025. (arXiv:2410.05554)

4. Chih-Yuan Chiu, Jingqi Li, **Maulik Bhatt**, and Negar Mehr. "To what extent do open-loop and feedback Nash equilibria diverge in general-sum linear quadratic dynamic games?" **IEEE Control Systems Letters**, 2024. (doi:10.1109/TRO.2025.3552325)

5. **Maulik Bhatt**, Yixuan Jia, and Negar Mehr, "Strategic Decision-Making in Multi-Agent Domains: A Weighted Potential Dynamic Game Approach", **IEEE Transactions on Robotics (T-RO)**, 2025. (doi:10.1109/LCSYS.2024.3505823)

6. **Maulik Bhatt**, Yixuan Jia, and Negar Mehr, "Efficient Constrained Multi-Agent Trajectory Optimization Using Dynamic Potential Games," 2023 IEEE/RSJ **International Conference on Intelligent Robots and Systems (IROS)**, Detroit, MI, USA, 2023, pp. 7303-7310. (doi: 10.1109/IROS55552.2023.10342328)

7. Yixuan Jia, **Maulik Bhatt**, and Negar Mehr, "RAPID: Autonomous Multi-Agent Racing using Constrained Potential Dynamic Games." In 2023, **European Control Conference(ECC)**. (doi:10.23919/ECC57647.2023.10178387)

8. Negar Mehr, Mingyu Wang, **Maulik Bhatt**, and Mac Schwager, "Maximum-entropy multi-agent dynamic games: Forward and inverse solutions", **IEEE Transactions on Robotics (T-RO)**, 2023. (doi:10.1109/TRO.2022.3232300)

9. **Maulik Bhatt**, Srikant Sukumar, Amit K Sanyal, "Rigid body geometric attitude estimator using multi-rate sensors." In 2020, **Conference on Decision and Control (CDC)**. (doi:10.1109/CDC42340.2020.9304059)

10. **Maulik Bhatt**, Srikant Sukumar, Amit K Sanyal, "Discrete-time Rigid Body Pose Estimation based on Lagrange-d'Alembert principle", **Journal of Nonlinear Science**, 2022. (doi:10.1007/s00332-022-09848-z)

11. **Maulik Bhatt**, Amit K Sanyal, Srikant Sukumar, "Asymptotically Stable Optimal Multi-rate Rigid Body Attitude Estimation based on Lagrange-d'Alembert Principle", **Journal of Geometric Mechanics**, 2022. (doi:10.3934/jgm.2023004)

12. Anant Joshi*, **Maulik Bhatt***, Arpita Sinha, "Modification of Hilbert's Space-Filling Curve to Avoid Obstacles: A Robotic Path-Planning Strategy", Sixth **Indian Control Conference (ICC)**, Hyderabad, India, 2019, pp. 338-343. (doi:10.1109/ICC47138.2019.9123166) (* equal contribution)

Work Experience

Research Scientist II Intern - Amazon Robotics | Mentors: Arnold Braker, Lionel Gueguen [Summer'25]

- Researched on diffusion-based planner and evaluated optimal design choices for the autonomous robot, Proteus
- Designed and implemented fine-tuning strategies to align the diffusion planner with human-preferred behaviors

PhD Research

Multi-Agent Imitation Learning using Diffusion Models | Advisor: N.Mehr [Aug'24-Aug'25]

- Developed a **decentralized multi-agent planning** algorithm using diffusion models that exhibits coordination in the presence of **multi-modality**
- Designed an algorithm that shows **better coordination** among agents compared to state-of-the-art baselines

Understanding and Imitating Human Motion under Partially Observability | Advisors: N. Mehr, M. Kennedy [July'23-Aug'24]

- Worked on the **estimation of observation space** of agents through trajectory data under partial observability
- Modeled agents' **policies in partially observable environments** using diffusion models

Coordination in Noncooperative Multi-agent Dynamic Games | Advisor: N. Mehr [Dec'23-Jun'24]

- Combined game-theoretic planning with implicit particle filtering to capture **multi-modal human-robot interactions** and demonstrated robust real-time performance in simulation and **real-world scenarios**
- Designed an algorithm that **reduces the computation time** of discovery of all equilibria **by 50%**.

Multi-Agent Interactive Planning using Dynamic Games | Advisor: N. Mehr [Sep'21-Jul'23]

- Designed a fast and efficient **multi-agent constrained trajectory planner** using dynamic potential games
- Developed a real-time multi-agent trajectory planner that is **20 times faster** than the state-of-the-art
- Implemented the algorithm on **hardware** to demonstrate its real-time capabilities

Multi-Agent Autonomous Racing using Dynamic Games | Advisor: N. Mehr [Jun'22-Dec'22]

- Worked on developing a fast and efficient multi-agent racing planner using dynamic games
- Formulated the problem as a dynamic potential game, which resulted in a highly competitive racing algorithm

Maximum-Entropy Multi-Agent Inverse Dynamic Games | Advisors: N. Mehr, M. Schwager [May'22-Aug'22]

- Studied the problem to learn the objectives of multiple interacting agents from trajectory demonstrations.
- Worked on comparison of inverse dynamics games with state-of-the-art inverse optimal control solvers on synthetic and highway data to figure out that considering game theoretic interactions results in better algorithm

Multi-agent Deep Reinforcement Learning for Pursuit Game | RL Course Project [Feb'23-May'23]

- Implemented Independent Q-Learning(IQL) for cooperative multi-agent RL for multi-agent pursuit games.

TranDynaMo: Dynamics Modeling using Transformers | Deep Learning Course Project [Feb'23-May'23]

- Formulated dynamics modeling as a sequence modeling problem and employed Transformers capabilities to model dynamical systems and achieved as good performance as baselines like RRNs and GRUs.

Research Internship | Polytechnique Montreal, Canada

Autonomous Landing of Drones on Moving Ground Vehicles | Advisor: D. Saussie [Summer'19]

- Implemented a **Dynamic Image-Based Visual Servo Control** technique for autonomous landing
- Designed a **hybrid controller** to correct for the singularity so that a safe landing is guaranteed

Software Skills

Programming	Python, C/C++, Julia, ROS, Simulink, MATLAB, LaTeX
Libraries	PyTorch, CUDA, TensorFlow, NumPy, SciPy, JAX, Pandas
Simulation & CAD	MuJoCo, Gazebo AutoCAD, SolidWorks
Tools	Git, Jira, Docker

Key Courses

Learning	Vision-Language-Action(VLA) Models, Machine Learning, Deep Learning, Markov Decision Processes(MDPs), Reinforcement Learning(RL)
Dynamics & Control	Stochastic Control, Analytical and Geometric Dynamics, Linear Systems Theory for PDEs, Differential Geometric Methods in Control, Multivariable Control
Applied Mathematics	Optimal Control, Probability and Random Processes, Games and Information, Optimization, Matrix Computations, Applied Linear Algebra, Tensors.

Leadership and Service

- **Teaching:**
  - EE128 - Feedback Control Systems [Jan'25-May'25]
  - E178 - Statistics and Data Science for Engineers [Jan'24-Jun'24]
- **Organizer:** Robotics Seminar@Illinois, UIUC [Aug'22-Aug'23]
- **Reviewer:**
  - Transactions on Robotics(T-RO)
  - Robotics and Automation Letters(RA-L)
  - International Conference on Robotics and Automation(ICRA)
  - International Conference on Intelligent Robots and Systems (IROS)
  - Transactions on Human-Machine Systems (THMS)
  - Automatica
  - Control Systems Letters (L-CSS)
  - Workshop on the Algorithmic Foundations of Robotics (WAFR)
  - Conference on Decision and Control (CDC)
  - Journal of Guidance, Control, and Dynamics
- **Students Advised:**
  - Ethan Dong, PhD Student, UC Berkeley [Jan'25-Present]
  - Amogh Pandey, MS Student, UIUC (currently at Numerica Corporation) [Feb'23-Oct'23]
  - Yixuan Jia, Undergraduate Student, UIUC (currently PhD at MIT) [May'22-May'23]
- **Mentor:** Institute Student Mentor and Department Academic Mentor at IIT Bombay [Jul'18-Ju'20]
- **Student Representative:** Annual General Meeting of Aeronautical Society of India [Oct'16]

Achievements and Awards

- Awarded with **Summer Research Fellowship** by the Department of Mechanical Engineering at UC Berkeley for exceptional research work in **Multi-agent Motion Planning**. ['24]
- Honoured with **Undergraduate Research Award** (awarded by IIT Bombay to select undergraduate students for exceptional effort towards research) for the work on Hilbert's Space-Filling Curve ['18]
- Amongst **2** out of 50+ students to be awarded the Institute Gymkhana Award **Technical Hostel's Commendation** for an extraordinary contribution towards technical activities ['19]
- Amongst **30 students** selected for **Panasonic Scholarship Program** from all over India's 23 IITs ['16]
- Ranked in the **top 0.7%** in **IIT JEE-Advanced** examination among 150,000 million aspirants ['16]