Kartik Nagpal

kartiknagpal@berkeley.edu | Website | Google Scholar | LinkedIn

Education

University of California, Berkeley [Jan'24 - Present]
MS/Ph.D. in Mechanical Engineering | NSF Fellowship Awardee
Advisor: Prof. Negar Mehr
GPA: 4.0/4.0

University of Illinois Urbana-Champaign (UIUC) [Aug'22 - Dec'23]
Ph.D. in Aerospace Engineering | Stillwell Fellowship Awardee
Advisor: Prof. Negar Mehr

University of Texas at Austin [Aug'18 - May'22]
B.S. in Computational Engineering

Research Interests

Robotics, Multi-Agent Reinforcement Learning, Safe Reinforcement Learning, Safety-Critical Systems, High-Interaction Environments, Human-Robot Interaction

Publications

Journal Papers

[1] Y. Yu, **K. Nagpal**, S. Mceowen, B. Açıkmeşe, U. Topcu., 2023. Real-Time Quadrotor Trajectory Optimization with Time-Triggered Corridor Constraints. *Journal of Guidance, Control, and Dynamics*, 46(6), pp. 1197-1205.

Peer-Reviewed Conference Papers

[2] **K. Nagpal**, D. Dong, N. Mehr, "Leveraging Large Language Models for Effective and Explainable Multi-Agent Credit Assignment". *24th International Conference on Autonomous Agents and Multiagent Systems*, 2025 (accepted pre-print).

[3] JB. Bouvier, **K. Nagpal**, N. Mehr, "Learning to Provably Satisfy High Relative Degree Constraints for Black-Box Systems". *63rd IEEE Conference on Decision and Control*, 2024.

[4] JB. Bouvier, **K. Nagpal**, N. Mehr. POLICEd RL: Learning Closed-Loop Robot Control Policies with Provable Satisfaction of Hard Constraints. *Robotics: Science and Systems (RSS)*, 2024.

[5] **K. Nagpal**, N. Mehr. Optimal Robotic Assembly Sequence Planning: A Sequential Decision-Making Approach. *International Conference on Intelligent Robots and Systems (IROS)*, 2024.

Conference Papers

[6] M. Esteva, W. Xu, N. Simone, **K. Nagpal**, A. Gupta, M. Jah., 2023. "Synchronic Curation for Assessing Reuse and Integration Fitness of Multiple Data Collections". *International Journal of Digital Curation*, 17(1), pp.11-11.

[7] N. Simone, **K. Nagpal**, A. Gupta, M. Esteva, W. Xu, M. Jah., 2021. "Transparency and Accountability in Space Domain Awareness: Demonstrating ASTRIAGraph's Capabilities with the United Nations Registry Data".

Achievements and Awards

- Honored with **National Science Foundation's Graduate Research Fellowship Program** ['24]
- Awarded the **Stillwell Fellowship** for excellent undergraduate research and potential ['22]
- Bestowed with the **40 Acres Scholarship** for exceptional merit and likelihood to succeed ['18]
- Received the **Best Presentation Award** at RSS 2024 Towards Safe Autonomy Workshop ['24]
- Winner of HackTX 2021 from among **1000**+ teams, as well as winning Chase and PIMCO challenges ['19]
- Winner of First Annual TAMU Datathon with novel ensemble ML method for unbalanced datasets ['19]
- Winner of Google Tech Challenge in Austin, TX branch ['19]

Talks

- University of California, Berkeley - BAIR Workshop - Diffusion Opponent Modeling [May '24]
- NASA Goddard Space Flight Center - AI Showcase - ORASP Paper [July '24]
- Robotics: Science and Systems (RSS) - POLICEd RL [July '24]
- RSS Towards Safe Autonomy: Emerging Requirements, Definitions, and Methods - POLICEd RL [July '24]
- RSS Safety and Normative Behaviors in Human-Robot Interaction - POLICEd RL [July '24]
- RSS Frontiers of Optimization for Robotics - POLICEd RL [July '24]
- International Conference on Intelligent Robots and Systems (IROS) - ORASP Paper [Oct '24]

Work Experience

Graduate Student Researcher | University of California, Berkeley [Jan'24-Present]

- Proposed novel **LLM-based credit assignment technique** which learns multi-agent policies which far outperform state-of-the-art methods across common benchmarks (Accepted Pre-print)
- Co-developed a safe-RL methodology with **provable satisfaction of hard constraints**
- Requisitioned, built, and setup a collection of robotic manipulator arms using APIs and ROS2
- Mentored undergraduate students in developing a **custom quadcopter** and software tools

Graduate Research Intern | NASA Goddard Space Flight Center [May'24-Aug'24]

- Reviewed literature on NASA's Conjunction Assessment and Risk Analysis framework and other recent works
- Designed a novel system which utilizes a **transformer with custom attention head** and a **model-based Deep Neural Network** to perform spacecraft perturbation estimation based on space weather data
- Trained an **opponent-modeling based policy** for planning against adversarial spacecraft in simulation
- Invited to talk at the NASA AI showcase to discuss these results and past ISAM work

Research Collaborator | NASA Jet Propulsion Laboratory [Aug'22-Dec'23]

- Developed a novel **optimal assembly sequencing planner** based on a sequential decision making framework to **enable real-time re-planning** for In-space Servicing, Assembly, and Manufacturing (ISAM) missions
- Proposed offset-based space-maneuver schedule for minimizing collision and conflict scenarios during missions
- Collaborated with Dr. Woollands' SASSI Lab to design minimum fuel trajectories for multi-agent payload trajectories while satisfying non-convex constraints

Research Engineer | Draper Laboratories [May'22-Aug'22]

- Joined and assisted a team working on the DARPA Competency-Aware Machine Learning (CAML) project
- Extended single agent controller to **swarm control** while **satisfying constraints** in PyTorch
- Formally verified **model-based learning** methods to avoid black-box limitations

Research Engineer | Air Force Research Laboratories [Jun'22-Aug'22]

- Devised an algorithm in MATLAB-Simulink for learning an **on-the-fly controller from limited data**
- Simulated the dynamics of an F-16 for testing an adaptive autonomous Ground Collision Avoidance System

Undergraduate Researcher | UT Austin with Dr. Ufuk Topcu [Aug'21-Aug'22]

- Developed specialized **non-convex** optimization problem solver in C++ for **real-time control of UAV**
- Formulated mathematical models and optimization problems in MATLAB CVX to establish ground truth
- Designed scripts to auto-generate high-fidelity simulations for **autonomous driving** algorithms

Software Skills

Programming	C/C++, Python, Julia, MATLAB, Simulink, Java, FORTRAN
Libraries	PyTorch, Pandas, NumPy, SciPy, JAX, TensorFlow, Keras, JuMP, CVX, YalMIP
Technical Tools	CUDA, Bash, Git, Docker, Kubernetes, ROS, Gazebo, Autodesk Inventor, SolidWorks, LabVIEW, ANSYS, QT Learning

Key Courses

Learning	Machine Learning, Markov Decision Processes & Reinforcement Learning, Stochastic Systems, Applied Regression & Time Series
Control & Dynamics	Modeling and Control of Multi-Agent Systems, Experiential Advanced Control Design II, Dynamics and Control of Autonomous Flight, Feedback Control Systems
Applied Mathematics	Optimal Control Systems, Probability and Random Processes, Convex Optimization, Differential Equations and Applied Linear Algebra, Real Analysis

Leadership and Service

- **Teaching:** Graduate Student Instructor, ME 292B: Modeling and Control of Multi-Agent Systems [Fall'24]
- **Reviewer:**

Robotics: Science and Systems (RSS)	2024
International Conference on Robotics and Automation (ICRA)	2024, 2025
International Conference on Intelligent Robots and Systems (IROS)	2024
Conference on Decision and Control (CDC)	2024
International Symposium on Robotics Research (ISRR)	2024

- **Recent Volunteering:** Bay Area Robotics Symposium (Volunteer, ['24]), Texas Rocket Engineering Laboratory (Alumni Mentoring, ['21-Present], TAMUHack (Coding Mentor, ['20])
- **Student Mentoring:** Stephanie Dutra (Undergrad, [Aug'22-Jan'23]), Yiheng Ji (Undergrad, [Jan'24-May'24]), Erik Emilio Dahlhaus Broude (Undergrad, [Jan'24-Present]), Benni Isler (Undergrad, [Aug'24-Present])
- **Affiliations:** US Citizen, Co-founder of EconBusters.org, IEEE Member, IEEE RAS Member, SIAM Member
- **Other Languages:** Hindi (Proficient), Punjabi (Proficient), Latin (Competent)