Viraj Parimi

Cambridge, MA
Ph.D. Candidate MIT EECS • CSAIL (MERS)

Learning-Guided Planning   Multi-Agent Planning   Safety   Long-Horizon Control

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⌂ GitHub | ▶ YouTube

Research Focus: Advancing safe, scalable autonomy for multi-robot systems by integrating decomposition and conflict/precedence reasoning with learning-guided planning (diffusion, VLMs, RL) to enable reliable, data-efficient closed-loop control.

🎓 Education

Massachusetts Institute of Technology (MIT)	Cambridge, MA
Ph.D., Electrical Engineering and Computer Science	2021–2027
Minor in Management	
Carnegie Mellon University (CMU)	Pittsburgh, PA
M.S., Robotics	GPA: 4.08/4.00	2021
IIIT-Delhi	Delhi, India
B.Tech, Computer Science and Engineering (Honors)	GPA: 8.96/10	2019

💼 Experience

MIT CSAIL – Model-Based Embedded and Robotics Systems (MERS)   Cambridge, MA
Research Assistant   2021–Present
Advisor: Prof. Brian C. Williams   (Featured in MIT CSAIL CAP spotlight)

- Designed multi-agent planners that decompose large coordination problems into tractable subproblems and re-compose them via conflict/precedence reasoning and hierarchical task structure, enabling scalable execution across multiple robots.
- Developed risk-aware planning methods with dynamic risk budgeting and iterative reallocation to maintain global safety guarantees under uncertainty for multi-robot navigation.
- Learning structured latent spaces encoding safety, cooperation, and temporal consistency, enabling interpolation-based reasoning and long-horizon decision-making.

Motional   Boston, MA
Autonomy Intern   Summer 2023

- Prototyped a lateral-contingency MPC controller and demonstrated improved closed-loop stability under injected faults and unexpected driving scenarios.

Carnegie Mellon University – Robotics Institute   Pittsburgh, PA
Research Assistant   2019–2021
Advisor: Prof. Stephen F. Smith, Intelligent Coordination and Logistics Lab

- Built a robust multi-agent planning framework combining timeline-based planning with hierarchical task planning; deployed on a mission-operations testbed simulating deep-space habitats.

Carnegie Mellon University – Robotics Institute Summer Scholars (RISS)   Pittsburgh, PA
Research Scholar   Summer 2018
Advisor: Prof. Stephen F. Smith

- Developed a computationally scalable Bayesian sequential learning framework for time-series forecasting, achieving up to $10{,}000\times$ faster inference than baseline approaches.

IIIT-Delhi Department of CSE   Delhi, India
Undergraduate Research Assistant   2017–2019
Advisors: Prof. T. Chakraborty (LCS2 Lab), Prof. P. Kumaraguru (Precog Lab)

- Analyzed robustness of community structure in complex networks by modeling how perturbing high-influence nodes/edges degrades community stability.

📄 Publications

Journal Publications

[J.1] I. Isukapati, C. Igoe, E. Bronstein, **Viraj Parimi**, S. F. Smith, "Hierarchical Bayesian Framework for Bus Dwell Time Prediction", *IEEE Transactions on Intelligent Transportation Systems (T-ITS), 2020*

Conference Publications

[C.1] **Viraj Parimi**, B. C. Williams, "Diffusion-Guided Multi-Arm Motion Planning", *Conference on Robot Learning (CoRL), 2025*

- Also presented in RSS MRS 2025 – Poster

[C.2] M. Feng*, **Viraj Parimi***, B. C. Williams, "Safe Multi-Agent Navigation guided by Goal-Conditioned Safe Reinforcement Learning", *IEEE International Conference on Robotics and Automation (ICRA), 2025*

- Also presented in NeurIPS IMOL 2024 and CoRL LEAP 2024 – Posters

[C.3] J. Olkin*, **Viraj Parimi***, B. C. Williams, "Multi-Agent Vulcan: An Information-Driven Multi-Agent Path Finding Approach", *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2024* (Oral Pitch)

Workshops, Symposia & Colloquia

[W.1] **Viraj Parimi**, B. C. Williams, "Risk-Bounded Multi-Agent Visual Navigation via Dynamic Budget Allocation."

- *ICAPS 2025 Workshop on Bridging the Gap Between AI Planning and Reinforcement Learning (PRL)* – Talk & Poster
- *CoRL 2025 Safe and Robust Robot Learning for Operation in the Real World (SAFE-ROL)* – Poster

[W.2] **Viraj Parimi**, A. Gomez, H. Chen, A. Hoffman, B. C. Williams, "Diffusion-Guided Multi-Arm Decentralized Motion Planning", *Northeast Robotics Colloquium (NERC), 2024* – Poster

[W.3] **Viraj Parimi**, S. Hong, B. C. Williams, "Task-driven Risk-bounded Hierarchical Reinforcement Learning Based on Iterative Refinement", *AAAI Spring Symposium Series (AAAI-SS), 2024* – Talk

[W.4] A. Misra, **Viraj Parimi**, M. Agarwal, Z. B. Rubinstein, S. F. Smith, "Towards efficient and scalable planning: Learning search heuristics for multi-agent planning frameworks", *CoRL 2023 Workshop on Learning Effective Abstractions for Planning (LEAP)* – Poster

[W.5] **Viraj Parimi**, Z. B. Rubinstein, S. F. Smith, "T-HTN: Timeline-Based HTN Planning for Multiple Robots", *ICAPS 2022 Workshop on Hierarchical Planning (HPlan)* – Poster

Book Chapters

[B.1] **Viraj Parimi**, A. Pal, S. Ruj, P. Kumaraguru, T. Chakraborty, "On the Vulnerability of Community Structure in Complex Networks", *Principles of Social Networking: The New Horizon and Emerging Challenges, Springer Singapore, 2021*

Miscellaneous

[M.1] **Viraj Parimi**, I. Isukapati, S. F. Smith, "A Computationally Scalable Bayesian Sequential Learning Framework for Time-Series Forecasting", *arXiv, 2021*

[M.2] A. Lakshman, **Viraj Parimi**, S. F. Smith, I. Isukapati, "Evaluating Accuracy of DSRC GPS for Pedestrian Localization in Urban Environments", *RISS Working Papers Journal, 2018*

* denotes equal contribution.

⧗ Research in Progress

Any-STAP3L   2025–Present
Status: Ongoing
Anytime simultaneous task assignment & path planning with precedence constraints using large-neighborhood
search.

Contrastive Representations for Risk-Aware Planning   2025–Present
Status: Ongoing
Learn risk-aware contrastive representations and plan via interpolation/search in latent space to speed up
long-horizon navigation/manipulation.

Conflict-Directed RAO*   2025–Present
Status: Ongoing
Combine conflict-directed refinement with risk-aware AO* for discrete-continuous tasks under chance constraints,
enabling budgeted risk allocation and concise explanations.

RB-MAPF-RT: Real-Time Risk-Bounded Multi-Robot Navigation   2025–Present
Status: Ongoing
Anytime replanning and dynamic risk reallocation for multi-robot navigation.

Iterative Skill Refinement optimizing Risk-Reward Tradeoff   2025–Present
Status: Ongoing
Hierarchical skills with iterative refinement and dynamic risk budgeting; extension of the AAAI-SS24 study.

Collaborative VLM-Guided Planning   2025–Present
Status: Ongoing
Use VLM scene/goal semantics to shape costs and constraints for MAPF, resolve ambiguous goals with intent
recognition.

⧉ Teaching & Mentoring

Teaching

MIT Principles of Autonomy and Decision Making (Graduate Teaching Fellow)   Fall 2022
Responsibilities: general infrastructure; recitations; assignments; project design; grading.
IIIT-Delhi Advanced Programming (Head Teaching Assistant)   Fall 2017
Responsibilities: general infrastructure; assignment design; project advising; grading.

Research Mentorship

- **Yusuf Syed** (Imperial College Undergrad → MIT MEng)   2025
- **Shreya Chaudhary** (MIT Undergrad → MIT MEng)   2025
- **Hanna Chen** (MIT Undergrad)   Fall and Summer 2025
- **Haohua Howard Chen** (Imperial College Undergrad)   Summer 2024
- **Lucian Covarrubias** (MIT Undergrad)   Spring 2022

☞ Academic Service

Journal Reviewing

- IEEE Transactions on Aerospace and Electronic Systems (TAES)   2025
- Artificial Intelligence Journal (AIJ)   2022–2025

Conference Reviewing

- AAAI Conference on Artificial Intelligence   2026
- Conference on Robot Learning (CoRL)   2025
- International Conference on Automated Planning and Scheduling (ICAPS)   2025
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)   2024–2025

Workshop Reviewing

- Workshop on Generalization in Planning (GenPlan) at AAAI — 2025
- Workshop on Resource-Rational Robot Learning at CoRL — 2025
- Workshop on Learning Effective Abstractions for Planning (LEAP) at CoRL — 2024

🏆 Awards and Honors

Qualcomm Fellowship India — Finalist	2022
Robotics Institute Summer Scholar	2018
FICCI Scholarship	2018
Secured 99.7^{th} percentile among 1.5 million students in JEE Mains Examination	2015

〈/〉 Software and Data

Diffusion-Guided Multi-Arm Planner (Apache-2.0) – GitHub

Safe Multi-Agent Navigation (Apache-2.0) – GitLab

Multi-Agent Vulcan (MIT License) – GitLab

Timeline-Based HTN Planner – Github