Apurva Badithela

ab5832@princeton.edu
abadithela.github.io

Research focus: Reliable and scalable evaluation for robotics leveraging tools from applied statistics, machine learning, formal methods, optimization and control theory, with applications in robot manipulation, navigation, and self-driving.

Current Position

July 2024– Presidential Postdoctoral Research Fellow — Princeton University
Host: Anirudha Majumdar

Education

2018–2024 PH.D. in Control and Dynamical Systems — California Institute of Technology
Thesis: Test and Evaluation of Autonomous Systems: Reactive Test Synthesis and Task-Relevant Evaluation of Perception [PDF]
Advisor: Richard M. Murray
Committee: Aaron D. Ames, Joel W. Burdick, Tichakorn Wongpiromsarn, Mani Chandy.

2014–2018 B.S. in Aerospace Engineering and Mechanics — University of Minnesota, Twin-Cities
Summa cum laude
Thesis: Exploiting Structure in Semidefinite Programming Problems with Applications to Robust Control
Advisor: Peter J. Seiler

Publications[1]

[15] Reliable and Scalable Robot Policy Evaluation with Imperfect Simulators [PDF][PROJECT PAGE]
Apurva Badithela, David Snyder*, Lihan Zha*, Joseph Mikhail, Matthew O'Kelly†, Anushri Dixit†, Anirudha Majumdar
Best Paper Award at *Workshop on Eval&Deploy: Evaluation and Deployment Across the Robot Learning Lifecycle, Conference on Robot Learning (CoRL 2025)*
Oral Paper at *SAFE-ROL: 2nd Workshop on Safe and Robust Robot Learning for Operation in the Real World, Conference on Robot Learning (CoRL 2025)*
Under Review.

[14] Guiding Data Collection via Factored Scaling Curves [PDF] [PROJECT PAGE]
Lihan Zha, **Apurva Badithela**, Michael Zhang, Justin Lidard, Jeremy Bao, Emily Zhou, David Snyder, Allen Z. Ren, Dhruv Shah, Anirudha Majumdar

[1] * denotes equal contribution, † denotes equal advising.

Under Review.

[13] Is Your Imitation Learning Policy Better than Mine? Policy Comparison with Near-Optimal Stopping **[PDF] [PROJECT PAGE]**
David Snyder, Asher J. Hancock, **Apurva Badithela**, Emma Dixon, Patrick Miller, Rares Andrei Ambrus, Anirudha Majumdar, Masha Itkina, and Haruki Nishimura
Robotics: Science and Systems (RSS) 2025.

[12] Flow-Based Synthesis of Reactive Tests for Discrete Decision-Making Systems with Temporal Logic Specifications **[PDF][TOOL]**
Josefine B. Graebener*, **Apurva S. Badithela***, Denizalp Goktas, Wyatt Ubellacker, Eric V. Mazumdar, Aaron D. Ames, and Richard M. Murray.
IEEE Open Journal of Control Systems (OJ-CSYS). To Appear.

[11] Task-Relevant Evaluation Metrics of Object Detection for Quantitative System-Level Analysis of Safety-Critical Autonomous Systems **[PDF] [CODE]**
Apurva Badithela, Ranai Srivastav, Tichakorn Wongpiromsarn, and Richard M. Murray.
ACM Transactions on Cyber-Physical Systems (T-CPS): Special Issue on Embodied AI in Cyber-Physical Systems: Algorithms, Computing Systems, Applications, and Trustworthiness. To Appear.

[10] Pacti: Scaling Assume-Guarantee Reasoning for System Analysis and Design **[PDF][TOOL]**
Inigo Incer, **Apurva Badithela**, Josefine Graebener, Piergiuseppe Mallozzi, Ayush Pandey, Sheng-Jung Yu, Albert Beneveniste, Benoit Caillud, Richard M. Murray, Alberto Sangiovanni-Vincentelli, and Sanjit Seshia.
ACM Transactions on Cyber-Physical Systems (T-CPS), 2025, pp 1-35.

[9] Evaluation Metrics of Object Detection for Quantitative System-Level Analysis of Safety-Critical Autonomous Systems **[PDF]**
Apurva Badithela, Tichakorn Wongpiromsarn, and Richard M. Murray.
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023.
CPS-IoT Week Workshop on Perception for Safety-Critical Cyber-Physical Systems, 2023.

[8] Reasoning over Test Specifications using Assume-Guarantee Contracts **[PDF]**
Apurva Badithela*, Josefine Graebener*, Inigo Incer*, and Richard M. Murray.
Proceedings of the 15^{th} NASA Formal Methods (NFM), 2023, pp 278-294.

[7] Synthesizing Reactive Test Environments for Autonomous Systems: Testing Reach-Avoid Specifications with Multi-Commodity Flows **[PDF]**
Apurva Badithela*, Josefine Graebener*, Wyatt Ubellacker, Eric V. Mazumdar, Aaron D. Ames, and Richard M. Murray.
IEEE International Conference on Robotics and Automation (ICRA), 2023.
Workshop on Envisioning an Infrastructure for Multi-Robot and Collaborative Autonomy Testing and Evaluation, Robotics: Science and Systems (RSS), 2022.

[6] Towards Better Test Coverage: Merging Unit Tests for Autonomous Systems. [PDF]
Josefine Graebener*, **Apurva Badithela***, and Richard M. Murray.
Proceedings of the 14^{th} *NASA Formal Methods (NFM), 2022, pp 133-155.*

[5] Leveraging Classification Metrics for Quantitative System-level Analysis of Temporal Logic Specifications. [PDF]
Apurva Badithela, Tichakorn Wongpiromsarn, and Richard M. Murray.
60^{th} *IEEE Conference on Decision and Control (CDC), 2021.*

[4] Lipschitz continuity of signal temporal logic robustness measures: Synthesizing control barrier functions from one expert demonstration [PDF]
Prithvi Akella*, **Apurva Badithela***, Richard M. Murray, Aaron D. Ames.
arXiv 2023.

[3] Synthesis of static test environments for observing sequence-like behaviors in autonomous systems [PDF]
Apurva Badithela and Richard M. Murray
arXiv 2021.

[2] Analysis of the Heavy-ball Algorithm using Integral Quadratic Constraints. [PDF]
Apurva Badithela and Peter Seiler.
2019 American Control Conference (ACC).

[1] Dynamic Modeling of a Sensible Thermal Energy Storage Tank with an Immersed Coil Heat Exchanger under Three Operation Modes. [PDF]
Austin Nash, **Apurva Badithela**, and Neera Jain.
Journal of Applied Energy, 2017.

Honors and Awards

2024– Presidential Postdoctoral Research Fellowship
Highest university-wide postdoctoral fellowship award
Princeton University

2025 Best Paper Award
EvalDeploy@CoRL2025: Evaluation and Deployment Across the Robot Learning Lifecycle
Workshop Award, Conference on Robot Learning (CoRL) 2025

2022 CMS and IST Gradient for Change
Department award for contributions toward Caltech graduate experience
California Institute of Technology

2022 CMS TA Fellow.
EAS division award to support CMS department TAs in promoting inclusive learning.

California Institute of Technology

2022 RSS Inclusion Fellow
Conference Award
Robotics: Science and Systems

2018 AIAA Guidance, Navigation and Control Undergraduate Conference Experience Award.
American Institute of Aeronautics and Astronautics.

2016-2018 Robert and John McCollum Scholarship.
Department Award
University of Minnesota

2014-2018 Gold Global Excellence Scholarship.
University-wide Award
University of Minnesota

Employment

2021 Autonomy Research Intern in Behavior Planning and Prediction — Motional
Host: Eric Wolff
Mentor: Tung Phan-Minh
Project: Counterexample Guided Repair of an Inverse Reinforcement Learning Planner

2017 ICES Moncrief Summer Research Fellow — University of Texas, Austin
Host: Ufuk Topcu
Mentor: Ivan Papusha
Project: Sparse Matrix Methods for Fast Real-time Model Predictive Control

2016 Summer Undergraduate Research Fellowship — Purdue University, West-Lafayette
Host: Neera Jain
Mentor: Austin L. Nash
Project: Dynamic Modeling and Validation of micro-CHP systems

Invited Talks

Oct 2025 Robotics Science Seminar, Amazon Robotics.
Oct 2025 Princeton Robot Planning and Learning (PRPL) Lab, Princeton University.
Oct 2025 Ames-Burdick Group Meeting Talk, California Institute of Technology (Caltech).
Oct 2025 Dixit Lab, University of California, Los Angeles (UCLA).
Oct 2025 Learning and Interactive Robot Autonomy Lab, University of Southern California (USC).
Oct 2025 Reading Group Seminar, Waymo.
Dec 2023 Toyota Motor North America R&D. Toyota Research Institute, North America (TRINA).
Nov 2023 Autonomous Systems Lab (ASL) Group Meeting Talk. Stanford University.

Nov 2023	ECE Department Seminar. University of Michigan, Ann Arbor.
Nov 2023	Intelligent Robot Motion Lab (IRoM) Group Meeting Talk. Princeton University.
Oct 2023	Group Meeting Talk. University of Michigan, Ann Arbor.
Dec 2022	National Institute of Informatics, Tokyo.
Oct 2022	40^{th} Southern California Controls Workshop.
Oct 2022	AFOSR US-Japan Seminar on Autonomy, AI, Robotics, and Informatics, Tokyo.
Mar 2022	VeHiCAL Group Meeting Talk. University of California, Berkeley.
Dec 2020	VeHiCAL Group Meeting Talk. University of California, Berkeley.

Mentoring

Summer 2025	Joseph Mikhail *Undergraduate Researcher, UT Austin* *Project:* Reliable and Scalable Robot Policy Evaluation
Summer 2023	Kimia Hassibi *(SURF)*, Jacob Alderete *(Undergraduate Researcher)* *Project:* Difficult test generation and Duckietown hardware
Fall 2021 – present	Ranai Srivastav *Undergraduate Researcher (Iowa State)* *Project:* Object Detection in Duckietown and Experiments for Validating Object Detection Algorithms
Summer 2022	Andy Dimnaku *(SURF Fellow)* *Project:* Optimization of Autonomous Vehicles Testing through Symmetry Mapping
Summer 2022	Edward Zhang, Frida Moreno, Gerard Decker *(FSRI Fellows)* *Project:* Setting up Duckietown as a Hardware Platform for Testing Autonomous Vehicles
Summer 2020	Berlin Del Aguila *(WAVE Fellow)* *Project:* Synthesis of Static Test Environments for Automated Valet Parking

Teaching

2022–23	CMS TA Fellow
Spring 2022	Teaching Assitant. Optimal Control (CDS 112 / Ae 103a). Caltech
Fall 2020	Teaching Assistant. Linear Systems Theory (CDS 131). Caltech
Fall 2019	Course Ombudsperson. Distributed Computing (CS 142). Caltech

Service

2025–26	Princeton Robotics Seminar Committee Member.
2022–24	CMS H.B. Keller Colloquium Committee Member.
2020–21	Helped organize two workshops on Building Effective Research Collaborations for graduate students.

2021–22 Computing and Mathematical Sciences (CMS) Diversity, Equity and Inclusion (DEI) Steering Committee.

Review Activities

2025 ICRA, RA-L, IASEAI
2025 ACM-IEEE International Conference on Cyber-Physical Systems (Poster and Demo Track)
2025 Robotics: Science and Systems (RSS)
2024 Nonlinear Analysis: Hybrid Systems (NAHS)
2023 IEEE Transactions on Intelligent Transportation Systems (T-IST)
2022–25 IEEE International Conference on Robotics and Automation (ICRA)
2023–24 IEEE/RSJ Robotics and Automation Letters (RAL)
2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
2022 Transactions on Automatic Control (TAC)
2021 60^{th} IEEE Conference on Decision and Control (CDC)

References

Professor Anirudha Majumdar
Associate Professor
Mechanical and Aerospace Engineering
Princeton University
Princeton, New Jersey 08544

Professor Richard M. Murray
Thomas E. and Doris Everhart Chair
Control & Dynamical Systems, Bioengineering
California Institute of Technology
Pasadena, California 91125

Professor Aaron D. Ames
Bren Professor
Mechanical and Civil Engineering, Control & Dynamical Systems
California Institute of Technology
Pasadena, California 91125

Professor Joel W. Burdick
Richard L. and Dorothy M. Hayman Chair
Mechanical Engineering, Bioengineering
California Institute of Technology
Pasadena, California 91125

Dr. Matthew O'Kelly
Research Scientist
Waymo
San Francisco, California