

Apurva Badithela

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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
Host: Anirudha Majumdar

Princeton University

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

Publications¹

- [18] [Beyond Binary Success: Sample-Efficient and Statistically Rigorous Robot Policy Comparison](#)
David Snyder, **Apurva Badithela**, Nikolai Matni, Anirudha Majumdar, Masha Itkina, Haruki Nishimura, George J. Pappas
Under Review
- [17] [PlayWorld: Learning Robot World Models from Autonomous Play](#)
Tenny Yin, Zhiting Mei, Zhonghe Zheng, Miyu Yamane, David Wang, Jade Sceats, Samuel M Bateman, Lihan Zha, **Apurva Badithela**, Ola Shorinwa, Anirudha Majumdar
Under Review
- [16] [Video Models in Robotics: Applications, Challenges, Future Directions](#) [\[PDF\]](#)
Zhiting Mei*, Tenny Yin*, Ola Shorinwa*, **Apurva Badithela**, Zhonghe Zheng, Joseph Bruno, Madison Bland, Lihan Zha, Asher Hancock, Jaime Fernández Fisac, Philip Dames, Anirudha Majumdar
Under Review
- [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

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

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)*

IEEE International Conference on Robotics and Automation (ICRA), 2026

- [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
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), 2025
- [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, 2025
- [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
- [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 15th NASA Formal Methods (NFM), 2023
- [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 14th NASA Formal Methods (NFM), 2022
- [5] Leveraging Classification Metrics for Quantitative System-level Analysis of Temporal Logic Specifications. [PDF]
Apurva Badithela, Tichakorn Wongpiromsarn, and Richard M. Murray.
60th 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 Workshop Award EvalDeploy@CoRL: Evaluation and Deployment Across the Robot Learning Lifecycle	Conference on Robot Learning (CoRL)
2022	CMS and IST Gradient for Change Department award for contributions toward Caltech graduate experience	Caltech
2022	CMS TA Fellow EAS division award to support CMS department TAs in promoting inclusive learning.	Caltech
2022	Inclusion Fellow Conference Award	Robotics: Science and Systems (RSS)
2018	Guidance, Navigation and Control Undergraduate Conference Experience Award	AIAA
2016-18	Robert and John McCollum Scholarship Department Award	University of Minnesota

2014-18	Gold Global Excellence Scholarship University-wide Award	University of Minnesota
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Employment

2021	Autonomy Research Intern in Behavior Planning and Prediction <i>Host:</i> Eric Wolff <i>Mentor:</i> Tung Phan-Minh <i>Project:</i> Counterexample Guided Repair of an Inverse Reinforcement Learning Planner	Motional
2017	ICES Moncrief Summer Research Fellow <i>Host:</i> Ufuk Topcu <i>Mentor:</i> Ivan Papusha <i>Project:</i> Sparse Matrix Methods for Fast Real-time Model Predictive Control	University of Texas, Austin
2016	Summer Undergraduate Research Fellowship <i>Host:</i> Neera Jain <i>Mentor:</i> Austin L. Nash <i>Project:</i> Dynamic Modeling and Validation of micro-CHP systems	Purdue University, West-Lafayette

Invited Talks

Dec 2025	Robotics Graduate Student Organization (RGSO) Seminar	University of Delaware
Oct 2025	Robotics Science Seminar	Amazon Robotics
Oct 2025	Princeton Robot Planning and Learning (PRPL) Lab	Princeton
Oct 2025	Ames-Burdick Group Meeting	Caltech
Oct 2025	Dixit Lab Group Meeting	UCLA
Oct 2025	Learning and Interactive Robot Autonomy Lab	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
Nov 2023	ECE Department Seminar	University of Michigan, Ann Arbor
Nov 2023	Intelligent Robot Motion Lab (IRoM) Group Meeting Talk	Princeton
Oct 2023	Seiler and Ozay Group Meeting Talk	University of Michigan, Ann Arbor
Dec 2022	Hasuo Lab Group Meeting	National Institute of Informatics, Tokyo
Oct 2022	40 th Southern California Controls Workshop	Caltech
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

2025-26	Jade Sceats <i>Undergraduate Researcher</i> <i>Project:</i> Reliable Evaluation with Video Models	Princeton
2025	Joseph Mikhail <i>Undergraduate Researcher</i> <i>Project:</i> Reliable and Scalable Robot Policy Evaluation	UT Austin

2023	Kimia Hassibi (<i>SURF</i>), Jacob Alderete (<i>Undergraduate Researcher</i>) <i>Project:</i> Difficult test generation and Duckietown hardware	Caltech
2021-24	Ranai Srivastav <i>Undergraduate Researcher</i> <i>Project:</i> Object Detection in Duckietown and Experiments for Validating Object Detection Algorithms	Iowa State
2022	Andy Dimnaku (<i>SURF Fellow</i>) <i>Project:</i> Optimization of Autonomous Vehicles Testing through Symmetry Mapping	Caltech
2022	Edward Zhang, Frida Moreno, Gerard Decker (<i>FSRI Fellows</i>) <i>Project:</i> Setting up Duckietown as a Hardware Platform for Testing Autonomous Vehicles	Caltech
2020	Berlin Del Aguila (<i>WAVE Fellow</i>) <i>Project:</i> Synthesis of Static Test Environments for Automated Valet Parking	Caltech

Teaching

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

Service

2025-26	Princeton Robotics Seminar Committee Member	Princeton
2022-24	CMS H.B. Keller Colloquium Committee Member	Caltech
2020-21	Workshop on Building Effective Research Collaborations	Caltech
2021-22	Department of CMS Diversity, Equity and Inclusion (DEI) Steering Committee	Caltech

REVIEW ACTIVITIES

2026	International Association of Safe and Ethical AI (IASAI)
2025	ACM-IEEE International Conference on Cyber-Physical Systems (Poster and Demo Track)
2025-26	IEEE Transactions on Robotics (T-RO)
2025-26	Robotics: Science and Systems (RSS)
2022-26	IEEE International Conference on Robotics and Automation (ICRA)
2023-25	IEEE/RSJ Robotics and Automation Letters (RAL)
2023-25	IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
2024	Nonlinear Analysis: Hybrid Systems (NAHS)
2023	IEEE Transactions on Intelligent Transportation Systems (T-IST)
2022	Transactions on Automatic Control (TAC)
2021	60 th IEEE Conference on Decision and Control (CDC)

References

Professor Anirudha Majumdar

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