

Curriculum Vitæ

✉ ashutosh.trivedi@colorado.edu

🌐 www.ashutoshrivedi.com

🏠 plv.colorado.edu

📄 dblp.uni-trier.de/pid/06/5756

🆔 orcid.org/0000-0001-9346-0126

🏠 tinyurl.com/9WDXyy4AAAAJ



Assistant Professor

Department of Computer Science

University of Colorado Boulder

1111 Engineering Dr, 430 UCB

Boulder, CO 80309-0430 USA



(303) 735-6628



303-492-2844



A. EDUCATIONAL BACKGROUND

PhD	University of Warwick, UK , Computer Science Advisor: Prof. Marcin Jurdziński Thesis: Competitive Optimization on Timed Automata Committee: Profs. Marcin Jurdziński (chair), Ranko Lazic, and Joël Ouaknine	2009
M.Tech	Indian Institute of Technology Bombay, India , Electrical Engineering Advisor: Prof. Supratik Chakraborty Thesis: Techniques in Symbolic Model Checking	2003
B.Eng	Visvesvaraya National Institute of Technology Nagpur, India , Computer Science	2000

B. ACADEMIC APPOINTMENTS

University of Colorado Boulder (CU Boulder), USA Assistant Professor , Department of Computer Science Assistant Professor , Electrical, Computer, and Energy Engineering	August 2017–present (by courtesy)
University of Colorado Boulder (CU Boulder), USA Research Assistant Professor , Department of Computer Science	August 2016–July 2017
University of Colorado Boulder (CU Boulder), USA Research Associate , Department of Computer Science	August 2015–July 2016
Indian Institute of Technology Bombay (IITB), INDIA Assistant Professor , Department of Computer Science	December 2012–August 2015
University of Pennsylvania, USA Postdoctoral Researcher (Advisor: Rajeev Alur)	January 2011–December 2012
University of Oxford, UK Postdoctoral Researcher (Advisor: Marta Kwiatkowska)	August 2009–December 2010
University of Tübingen, Germany Research Intern (Advisor: Thomas Kropf)	May 2004–January 2005
Indian Institute of Technology Bombay (IITB), India Research Assistant (Advisor: Supratik Chakraborty)	November 2003 – May 2004
Istituto per la Ricerca Scientifica e Tecnologica (IRST), Italy Research Intern (Advisor: Alessandro Cimatti)	June 2003–October 2003

C. RESEARCH INTERESTS

Research Program. AI-assisted software solutions have made substantial inroads in critical aspects of modern existence where they routinely make safety-, socio-, and legal-critical decision with certainty and swift. Instances of such AI-assisted decisions include: self-driving cars deciding to stop, implantable pacemakers deciding to pace, or the COMPAS (Correctional Offender Management Profiling for Alternative Sanctions) software deciding if individuals are prone to reoffend. These AI-assisted software are data-driven: they adapt their behavior based experiences in the form of data: be it the expertly curated data in *supervised learning*, surprising patterns hidden in raw data in *unsupervised learning*, or the experiential data guided by expertly designed reward signals in *reinforcement learning*.

*The focus of my research is on enabling rigorous system engineering of data-driven system towards improved **safety, security, fairness and accountability**.*

While formal methods for rigorous system engineering provide principles, processes, and practices for traditional systems development, data-driven systems—due to their statistical, inductive, and adaptive nature—demand a paradigm shift. My research seeks to understand and to redefine the role of formal methods in data-driven system development. While I continue to leverage my expertise in analyzing functional requirements including safety and privacy, I am also exploring the applications of formal methods in analyzing legal and societal implications of data-driven software systems.

Keywords. This research program is supported by concentrated effort in developing *principled methodologies* and *powerful tools* along the following major thrusts.

- ▶ **Formal Methods** for Verification and Synthesis of *Safety-Critical (Cyber-Physical) Systems*
- ▶ Automata-Theoretic Foundations of Safety-Critical **Reinforcement Learning**
- ▶ Software and Cyber-Physical Systems **Security**
- ▶ Software **Fairness** and **Accountability**

D. AWARDS/HONORS

Professional/Fellowships

National Science Foundation CAREER Award	2022
Reinforcement Learning for Recursive MDPs and Beyond	
Air Force Research Laboratory VFRP Fellowship	2020-21
Asymptotically-Constrained Reinforcement Learning	
Top 25% of Program Committee Members (AAAI 2021)	2021
Sigma Xi–Full Membership	2020
Research & Innovation Seed Grant Winner	2019
Learning to Control Safety-Critical Systems	
Liverpool India Fellowship	2014
Stochastic Control of Cyber-Physical Systems	
UK EPSRC Research Studentship, University of Warwick	2005-09
Ministry of Education Postgraduate Fellowship, IIT Bombay	2001-03
Undergraduate Merit Scholarship, Visveswaraya NIT Nagpur	1997

Award Papers

Static Analysis Symposium (SAS): Radhia Cousot Best Young Researcher Paper Award	2021
To student coauthor Tianhan Lu for our paper “Selectively-Amortized Resource Bounding”	
Static Analysis Symposium (SAS): Journal Special Issue Invitation	2021
Selectively-Amortized Resource Bounding	
International Symposium on Formal Methods (FM): Journal Special Issue Invitation	2021
Model-Free Reinforcement Learning for Lexicographic Omega-Regular Objectives	
Language and Automata Theory and Applications (LATA): Journal Special Issue Invitation	2016
A Logical Characterization for Dense-Time Visibly Pushdown Automata	
Hybrid Systems Computation and Control (HSCC): Best Paper Award	2012
Optimal Scheduling for Constant-Rate Multi-Mode Systems	

E. FUNDING

I have been a PI or co-PI on sponsored research totaling in awards of approximately \$7.7M of which \$1.2M have been led by me as PI. My portion of these awards has totaled approximately \$1.5M. A summary of these figures is given below:

Total Awarded:	\$7,734,551
Awarded for CU Boulder	\$4,689,860
Awarded, my portion, approximate:	\$1,533,812
Awarded as PI for CU Boulder:	\$1,201,000

Current Funding (4)

- 1. NSF-CCF-2146563, CAREER: Reinforcement Learning for Recursive MDPs and Beyond**
 - Total amount: \$596,000
 - Period: 05/01/2022 — 04/30/2027
 - Investigators: Ashutosh Trivedi (PI)
 - Funding Agency: NSF (Computer and Information Science and Engineering: Core Programs)
- 2. EE-AIL IRT Seed Grant FY20-21, Developing AI to Support Teaching in Large Programming Classes**
 - Total amount: \$20,000
 - Period: March-June 2022
 - Investigators: Gowtham Kaki (co-PI), Fabio Somenzi (co-PI), and Ashutosh Trivedi (PI)
 - Funding Agency: Engineering Education and AI-Augmented Learning IRT, CU Boulder
- 3. NSF EPCN-2015403, Secure-by-Construction Controller Synthesis for Cyber-Physical Systems**
 - Total Amount: \$387,640
 - Period: 08/15/2020 — 07/31/2023
 - Investigators: Ashutosh Trivedi (co-PI) and Majid Zamani (PI)
 - Funding Agency: NSF (Energy, Power, Control, and Networks Program)

4. **NSF CCF-2009022, SHF: *Small: Omega-Regular Objectives for Model-Free Reinforcement Learning***

- Total amount: \$500,000
- Period: 06/15/2020 — 05/31/2023
- Investigators: Fabio Somenzi (co-PI) and Ashutosh Trivedi (PI)
- Funding Agency: NSF (Computer and Information Science and Engineering: Core Programs)

Past Funding (6)

1. **RISGP FY20, *Learning to Control Safety-Critical Systems***

- Total amount: \$50,000
- Period: 2019–2020
- Investigators: Emilinao Dallanese (co-PI), Fabio Somenzi (co-PI), and Ashutosh Trivedi (PI)
- Funding Agency: Research & Innovation Seed Grant Program, CU Boulder

2. **SPARC 2018-2019, *Developing Safe and Secure Autonomous Cyber-Physical Systems***

- Total amount: \$93K (Travel Grant)
- Period: 2019–2021
- Investigators: Jyotirmoy Deshmukh (USC, Co-PI), Indranil Saha (IIT Kanpur, PI), Pramod Subramanyan (IIT Kanpur, Co-PI), and Ashutosh Trivedi (CU Boulder, Co-PI)
- Funding Agency: Ministry of Human Resource Development, Government of India (Scheme for Promotion of Academic and Research Collaboration [SPARC])

3. **EE-AIL IRT Seed Grant FY20-21, *Human-AI Collaborative Programming : Integrating Reinforcement Learning and Formal Requirements in Programming Curriculum***

- Total amount: \$20,000
- Period: 2020–2021
- Investigators: Fabio Somenzi (co-PI), and Ashutosh Trivedi (PI)
- Funding Agency: Engineering Education and AI-Augmented Learning IRT, CU Boulder

4. **ASIRT Seed Grant, *Towards Scalable Synthesis of Large-Scale Cyber-Physical Systems***

- Total amount: \$46,800
- Period: March 2019–June 2020
- Investigators: Majid Zamani (PI), Ashutosh Trivedi (co-PI), Morteza Lahijanian (co-PI), Fabio Somenzi (co-PI), Sriram Sankaranarayanan (co-PI)
- Funding Agency: Autonomous Systems Interdisciplinary Research Theme, College of Engineering and Applied Science, CU Boulder.

5. **ASIRT Seed Grant, *Temporal-logic based Reinforcement Learning***

- Total amount: \$15,000
- Period: February 2018–December 2018
- Investigators: Ashutosh Trivedi (PI), Pavol Cerny (co-PI), and Fabio Somenzi (co-PI)
- Funding Agency: Autonomous Systems Interdisciplinary Research Theme, College of Engineering and Applied Science, CU Boulder.

6. DARPA FA8750-15-2-0096, *Auditr: Securing Space/Time Defenses in Java Bytecode*

- Total amount: \$5,797,751 with \$2,822,810, for CU Boulder,
- Period: 2015–2019 with a no-cost extension until May 2020.
- Investigators: Pavol Cerny (PI); John Black, Bor-Yuh Evan Chang, Sriram Sankaranarayanan, Ashutosh Trivedi (co-PIs); Isil Dillig (PI at the University of Texas at Austin); Marijn Heule (co-PI); Henny Sipma (PI at Kestrel Technology).
- Funding Agency: DARPA (Space/Time Analysis for Cybersecurity program)

E. ADVISING

Graduated PhD Dissertation Advisees (CU Boulder and IIT Bombay):

Saeid Tizpaz-Niari (jointly supervised with Prof. Pavol Cerny) Fall 2015 – Fall 2020

Affiliation: Electrical, Computer, and Energy Engineering. CU Boulder.

Thesis: *Differential Performance Debugging*

First Employment: Assistant Professor, University of Texas at El Paso.

Devendra Bhawe (jointly supervised with Prof. Krishna S.) Fall 2014 – Fall 2020

Affiliation: Computer Science. IIT Bombay.

Thesis: *Perfect Subclasses of Real-time Recursive Systems*

First Employment: Senior Software Engineer, Mathworks.

Current PhD Dissertation Advisees (CU Boulder)

Tianhan Lu (jointly supervised with Prof. Bor-Yuh Evan Chang) Fall 2015 – Now

Topic: Selective-Amortization for Resource Bounding

Status: *Passed Comprehensive Exam (August 2021)*

Current Employment: Research Scientist, Meta from October 2021

Taylor Dohmen August 2018 – Now

Topic: Regular Reinforcement Learning

Status: *Passed Preliminary Exam (November 2021)*

John Komp (part time —Technical Fellow at Medtronic) August 2018 – Now

Topic: Reinforcement Learning for Safety-Critical Real-Time Systems

Status: *Passed Preliminary Exam (February 2022)*

Mateo Perez (jointly supervised with Prof. Fabio Somenzi) August 2020 – Now

Topic: Omega-Regular Rewards in Reinforcement Learning

Status: *Planned Preliminary Exam (September 2022)*

Vishnu Murali (jointly supervised with Prof. Majid Zamani) August 2020 – Now

Topic: Restructural Induction for Stochastic Control Systems

Status: *Planned Preliminary Exam (September 2022)*

David Baines (Financial Planning & Analytics Manager at Verizon) Fall 2022

Interests: Reinforcement Learning for Financial Planning

Status: *Joined in Fall 2022*

Alireza Nadali Fall 2022

Interests: Transfer Learning and Control Theory

Status: *Joined in Fall 2022*

Shadi Tasdighi Kalat (jointly supervised with Prof. Sriram S.)

Fall 2022

Interests: Online Learning

Status: *Started Working in Fall 2022*

Amin Falah

Spring 2023

Interests: Reinforcement Learning for Continuous-Time MDPs

Status: *Joined in Spring 2023*

MS/BS Thesis Advisees (CU Boulder)

1. Jordan Perr-Sauer (MS) on “Verification of Neural Networks”, Summer 2022–Fall 2022, Computer Science, CU Boulder
2. Zachary Mckevitt (BS) on “Recurrent Neural Networks for Automatic Transient Execution Attack Detection”, co-advised with Tamara Lehman, Fall 2020–Spring 2022, Electrical, Computer, and Energy Engineering, CU Boulder
3. Vishnu Murali (MS, switched to PhD) on “Optimal Repair for Omega-Regular Properties”, 2019-2020, Computer Science, CU Boulder.

MS/BS Research Advisees (CU Boulder)

1. Ali Almutawa, Jr. (BS), co-advised with Fabio Somenzi, Summer 2022, Computer Science, CU Boulder
2. Adam Adl (BS), co-advised with Fabio Somenzi, Summer 2022, Computer Science, CU Boulder
3. Ian Mckibben (BS), co-advised with Fabio Somenzi, Summer 2021, Computer Science, CU Boulder
4. Emily Millican (BS), Spring 2020, Computer Science, CU Boulder. Emily is now an associate Embedded Software Engineer with Ball Aerospace.
5. John Paul Martin (MS), 2018-2020. Co-advised with Prof. Evan Chang, Computer Science, CU Boulder.
6. Juraj Culak (MS), 2017-2019, Computer Science, CU Boulder.
7. Mateo Perez (BS), co-advised with Fabio Somenzi, Summer 2018-Spring 2020, Electrical, Computer, and Energy Engineering, CU Boulder. Mateo is now a PhD student in my group.
8. Shemal Somil Lalaji (MS), Independent Study Project, Fall 2019. Shemal is now a Senior Software Engineer working at Visa.
9. Electrical, Computer, and Energy Engineering (ECEE) Capstone Team Love Bugs (Developing a Self-Driving Car): Mohammed Al Hasani, George Matthew Helmick, Rodolfo Gonzalez Hill V, Myungshin Im, Michael Shea Oliver, and Mateo Perez, co-advised with Fabio Somenzi.
10. Aniruddha Phatak (MS/PhD), co-advised with Pavol Cerny, 2019-2020, Electrical, Computer, and Energy Engineering. CU Boulder.
11. Aniket Lata (MS), co-advised with Evan Chang, Spring 2015–Spring 2016. Electrical, Computer, and Energy Engineering. CU Boulder. Aniket is now a Software Engineer at Qualcomm.
12. Ram Das Diwakaran (MS), co-advised with Sriram Sankaranarayanan, Fall 2016–Spring 2017. Computer Science, CU Boulder. Ram is a Software Development Engineer at Generac.

External Research Advisees

1. Sankalp Gambhir (BS, IIT Bombay) and Mohd. Afzal (PhD candidate, IIT Bombay), co-advised with Krishna S. on “LTL-Based Non-Markovian Inverse Reinforcement Learning” , 2021-2022.

2. Amin Falah (MS, Chennai Mathematical Institute), co-advised with Shibashis Guha on “Omega-Regular Reinforcement Learning for Continuous-Time MDPs”, 2021-2022. Amin Falah is joining CU Boulder as a PhD student in Fall 2022.
3. Vrunda Dave (PhD, IIT Bombay), advised by Prof. Krishna S. (IIT Bombay), 2015–2021. Vrunda Dave’s dissertation won honorable mention in the ACM India 2021-2022 Doctoral Dissertation Award.
4. Kalyani Dole (PhD, IIT Bombay), advised by Prof. Krishna S. (IIT Bombay), 2020–Now.
5. Lakshmi Manasa (PhD, IIT Bombay), advised by Prof. Krishna S. (IIT Bombay), 2013–2015.
6. Aviral Kumar (BS, IIT Bombay), co-advised with Prof. Krishna S. on “The Reach-Avoid Problem for Constant-Rate Multi-mode Systems”, 2016-2017. Aviral is now a PhD student at UC Berkeley.
7. M. S. Krishna Deepak (BS, IIT Bombay) on “Incentive Stackelberg Mean-Payoff Games”, 2014-2015. Krishna Deepak is now a PhD student at Cornell Tech.
8. Sagar Jha (BS, IIT Bombay) on “Bounded-rate multi-mode systems based motion planning”, 2014-2015. Sagar Jha is now a PhD student at Cornell.
9. Ankush Das (BS, IIT Bombay) on “On Pure Nash Equilibria in Stochastic Games”, 2014–2015. Ankush Das is a final year PhD student at CMU.
10. Umang Mathur (BS, IIT Bombay) on “Weak Singular Hybrid Automata”, 2014-2015. Umang Mathur completed his PhD at UIUC and he is now an assistant professor at the National University of Singapore.
11. Ramchandra Phawade (Postdoc, IIT Bombay) on “Context-Sensitive Timed Languages”, 2014-2015. Ramchandra Phawade is now an assistant professor at IIT Dharwad.
12. Shibashis Guha (PhD, IIT Delhi) on “Stochastic Timed Games”, 2013-2015. Shibashis is now reader at Tata Institute of Fundamental Research, Mumbai.

RESEARCH PRODUCTS

In many areas of Computer Science, including theoretical computer science, the first and primary publication venues are full length papers in the proceedings of selective conferences. Many conferences have extensive two-phase review processes with author responses. The two main outlets are proceedings published by ACM (Association for Computing Machinery) and the Lecture Notes in Computer Science (LNCS) series published by Springer. The DBLP service (<http://dblp.uni-trier.de/db/>) maintains an up-to-date index of Computer Science literature. In the following, the † mark indicates students or post-doctoral researchers that I formally advise, and the ‡ mark indicates other student co-authors. Also, in theoretical computer science publications, author ordering is typically by alphabetical order—most of my paper follow this norm.

F. PAPERS SUBMITTED FOR REVIEW

1. **Co-Buchi Barrier Certificates for Discrete-time Dynamical Systems** by Vishnu Murali[†], **A.Trivedi**, Majid Zamani.
2. **Formal Verification of Control Systems against Hyperproperties via Barrier Certificates** by Mahathi Anand[‡], Vishnu Murali[†], **A.Trivedi**, Majid Zamani. <https://arxiv.org/abs/2105.05493>
3. **Reinforcement Learning for Compositional Analysis of Probabilistic Systems** by Taylor Dohmen[†], **A. Trivedi**, and Alvaro Velasquez.

4. **Omega-Regular Reward Machines** by Ernst M. Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak.
5. **Assume-Guarantee Reinforcement Learning** by Milad Kazemi[‡], Mateo Perez[†], Fabio Somenzi, Sadegh Soudjani, **A. Trivedi**, and Alvaro Velasquez
6. **Discounting the Past** by Taylor Dohmen[†] and **A. Trivedi**. <https://arxiv.org/abs/2102.06985>.
7. **Compositional Reinforcement Learning for Discrete-Time Stochastic Control Systems** by Abolfazl Lavaei[‡], Mateo Perez[†], Milad Kazemi[‡], Fabio Somenzi, Sadegh Soudjani, **A. Trivedi**, and Majid Zamani.
8. **Composing Copyless Streaming String Transducers** by Rajeev Alur, Taylor Dohmen[†], and **A. Trivedi**.
9. **Omega-Regular Model-Free Reinforcement Learning for Continuous-Time MDPs** by Amin Falah[†], Shibashis Guha, and **A. Trivedi**.
10. **Recurrent Neural Networks for Automatic Transient Execution** by Zack McKeivitt[†], **A. Trivedi**, Tamara Lehman.

G. PEER-REVIEWED CONFERENCE PAPERS

1. **Information-Theoretic Testing and Debugging of Fairness** by Verya Monjezi[‡], **A. Trivedi**, Gang Tan, Saeid Tizpaz-Niari · International Conference on Software Engineering (ICSE) 2023 · (Acceptance Rate: 26%).
2. **TenForty: Debugging Tax Preparation Software via Metamorphic Relations** by Saeid Tizpaz-Niari, Morgan Wagner[‡], Shiva Darian[‡], Krystia Reed, and **A. Trivedi**. · International Conference on Software Engineering (ICSE) – Software Engineering in Society (SEIS) –2023 · (Acceptance Rate: 18% for full research papers) <https://arxiv.org/abs/2205.04998>.
3. **Mungojerrie: Reinforcement Learning of Linear-Time Objectives** by Ernst M. Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak. · TACAS 2023 · To Appear · <https://arxiv.org/abs/2106.09161>.
4. **LTL-Based Non-Markovian Inverse Reinforcement Learning** by Mohd. Afzal[‡], Sankalp Gambhir[‡], Ashutosh Gupta, Krishna S, **A. Trivedi**, and Alvaro Velasquez. · AAMAS 2023 · (To Appear)
5. **Reinforcement Learning with Depreciating Assets** by Taylor Dohmen[†] and **A. Trivedi**. · AAMAS 2023 · (To Appear)
6. **The Octatope Abstract Domain for Verification of Neural Networks** by Taylor Dohmen[†], **A. Trivedi**, Alvaro Velasquez, K Subramani, Piotr Wojciechowski and Stanley Bak. · Formal Methods 2023 · (To Appear)
7. **Correct-by-Construction Reinforcement Learning of Cardiac Pacemakers from Duration Calculus Requirements** by Kalyani Dole[‡], Ashutosh Gupta, John Komp[†], Krishna S., and **A. Trivedi**. · AAI 2023 · (To Appear)
8. **Recursive Reinforcement Learning** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS'22) · 9 pages · <https://arxiv.org/abs/2206.11430> · (Acceptance Rate: 25.6%)
9. **An Impossibility Result in Automata-Theoretic Reinforcement Learning** Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · Symposium on Automated Technology for Verification and Analysis (ATVA) 2022 · 16 pages · (Acceptance Rate: 30%)

10. **Optimal Repair For Omega-regular Properties** by Vrunda Dave[†], Shankara Narayanan Krishna, Vishnu Murali[†] and **A. Trivedi** · Symposium on Automated Technology for Verification and Analysis (ATVA) 2022 · 16 pages · (Acceptance Rate: 30%)
11. **Alternating GFM Automata** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · Symposium on Automated Technology for Verification and Analysis (ATVA) 2022 · 16 pages · (Acceptance Rate: 30%)
12. **k-Inductive Barrier Certificates for Stochastic Systems** by Mahathi Anand[‡], Vishnu Murali[†], **A. Trivedi**, Majid Zamani · Conference on Hybrid Systems :Computation and Control (HSCC) 2022 · Pages 12:1-12:11 · (Acceptance Rate: 36%)
13. **Inferring Probabilistic Reward Machines from Non-Markovian Reward Signals for Reinforcement Learning** by Taylor Dohmen[†], Noah Topper[‡], George Atia, Andre Beckus, **A. Trivedi** and Alvaro Velasquez · Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS) 2022, 32(1) · Pages 574–582 · (Acceptance Rate: 30%)
14. **Active Grammatical Inference for Non-Markovian Planning** by Noah Topper[‡], George Atia, **A. Trivedi** and Alvaro Velasquez · Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS) 2022, 32(1) · Pages 647–651 · (Acceptance Rate: 30%)
15. **Controller Synthesis for Omega-Regular and Steady-State Specifications** by Alvaro Velasquez, Ismail Alkhouri[‡], Andre Beckus, **A. Trivedi**, and George Atia · International Conference on Autonomous Agents and Multiagent Systems (AAMAS) 2022 · Pages 1310–1318 · (Acceptance Rate: 27%)
16. **Translating Omega-Regular Specifications to Average Objectives for Model-Free Reinforcement Learning** by Milad Kazemi[‡], Mateo Perez[†], Fabio Somenzi, Sadegh Soudjani, **A. Trivedi**, and Alvaro Velasquez · International Conference on Autonomous Agents and Multiagent Systems (AAMAS) 2022 · Pages 732–741 · (Acceptance Rate: 27%)
17. **Fairness-aware Configuration of Machine Learning Libraries** by Saeid Tizpaz-Niari, Ashish Kumar, Gang Tan, and **A. Trivedi**, · International Conference on Software Engineering (ICSE) 2022 · Pages 909–920 · (Acceptance rate: 28.5%)
18. **Event-Triggered and Time-Triggered Duration Calculus for Model-Free Reinforcement Learning** by Kalyani Dole[†], John Komp[†], Ashutosh Gupta, Shankara Narayanan Krishna, **A. Trivedi** · Real-Time System Symposium (RTSS) 2021 · Pages 240-252 · (Acceptance Rate: 29%)
19. **Regular Model Checking with Regular Relations** by Vrunda Dave[†], Taylor Dohmen[†], Shankara Narayanan Krishna, **A. Trivedi** · Fundamentals of Computation Theory (FCT) 2021 · Pages 190-203 · (Acceptance Rate: 31%)
20. **Model-Free Reinforcement Learning for Branching Markov Decision Processes** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · Computer Aided Verification (CAV) 2021 · Pages 651–673 · (Acceptance Rate: 27%)
21. **Model-Free Reinforcement Learning for Lexicographic Omega-Regular Objectives** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · Symposium on Formal Methods (FM) 2021 · Pages 142–159 · (Acceptance Rate: 26%)
Recipient of Journal Special Issue Invitation.
22. **Selectively-Amortized Resource Bounding** by Tianhan Lu[†], Bor-Yuh Evan Chang, **A. Trivedi** · Static Analysis Symposium (SAS) 2021 · Pages 286–307 · (Acceptance rate: 55%)
Winner of the Radhia Cousot Student Best Paper Award
Recipient of Journal Special Issue Invitation

23. **Faithful and Effective Reward Schemes for Model-Free Reinforcement Learning of Omega-Regular Objectives** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · Symposium on Automated Technology for Verification and Analysis (ATVA) 2020 · 16 pages · (Acceptance Rate: 40%)
24. **Model-Free Reinforcement Learning for Stochastic Parity Games** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, and Dominik Wojtczak · 31st International Conference on Concurrency Theory (CONCUR) 2020 · Pages 21:1–21:16 · (Acceptance Rate: 40%)
25. **Weighted Transducers for Robustness Verification** by Emmanuel Filiot, Nicolas Mazzocchi[‡], Jean-François Raskin, Sriram Sankaranarayanan and **A. Trivedi** · 31st International Conference on Concurrency Theory (CONCUR) 2020 · Pages 17:1–17:21 · (Acceptance Rate: 40%)
26. **Detecting and Understanding Real-World Differential Performance Bugs in Machine Learning Libraries** by Saeid Tizpaz-Niari[†], Pavol Cerny, and **A. Trivedi** · ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA) 2020 · Pages 189–199 · (Acceptance Rate: 26.5%)
27. **Data-Driven Debugging for Functional Side Channels** by Saeid Tizpaz-Niari[†], Pavol Cerny, and **A. Trivedi** · Network and Distributed System Security Symposium (NDSS) 2020 · 17 Pages · (Acceptance Rate: 17.4%)
28. **Good-for-MDPs Automata for Probabilistic Analysis and Reinforcement Learning** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2020 · Pages 306–323 · (Acceptance Rate: 30%)
29. **Formal Controller Synthesis for Unknown Continuous-Space MDPs via Reinforcement Learning** by Abolfazl Lavaei[‡], Fabio Somenzi, Sadegh Soudjani, **A. Trivedi** and Majid Zamani · International Conference on Cyber-Physical Systems (ICCPs) 2020 · Pages 98–107 · (Acceptance Rate: 23%)
30. **Quantitative Mitigation of Timing Side Channels** by Saeid Tizpaz-Niari[†], Pavol Cerny, and **A. Trivedi** · Computer Aided Verification (CAV) 2019 · Pages 140-160 · (Acceptance Rate: 26%)
31. **Expected Reachability-Price Games** by Shibashis Guha[‡] and **A. Trivedi** · Formal Modeling and Analysis of Timed Systems (FORMATS) 2019 · Pages 282-300 · (Acceptance Rate: 35%)
32. **Efficient Detection and Quantification of Timing Leaks with Neural Networks** by Saeid Tizpaz-Niari[†], Pavol Cerny, Sriram Sankaranarayanan, and **A. Trivedi**, · Runtime Verification (RV) 2019 · Pages 329-348 · (Acceptance Rate: 65%) · **Recipient of Journal Special Issue Invitation.**
33. **Omega-Regular Objectives in Model-Free Reinforcement Learning** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2019 · Pages 395-412 · (Acceptance Rate: 31.4%)
34. **Type-directed Bounding of Collections in Reactive Programs** by Tianhan Lu[†], Pavol Cerny, Bor-Yuh Evan Chang, **A. Trivedi** · International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI) 2019 · Pages 275-296 · (Acceptance Rate: 43%)
35. **Differential Performance Debugging With Discriminant Regression Trees** by Saeid Tizpaz-Niari[†], Pavol Cerny, Bor-Yuh Evan Chang, **A. Trivedi** · AAAI Conference on Artificial Intelligence (AAAI) 2018 · Pages 2468-2475 · (Acceptance Rate: 24%)
36. **Global Almost-Sure Reachability for Stochastic Constant-Rate Multi-Mode Systems** by Fabio Somenzi, Behrouz Touri, and **A. Trivedi** · International Conference on Hybrid Systems: Computation and Control (HSCC) 2018 · Pages 11-20 · (Acceptance Rate: 43%)

37. **The Reach-Avoid Problem for Constant-Rate Multi-mode Systems** by S. Krishna, Aviral Kumar[†], Fabio Somenzi, Behrouz Touri, and **A. Trivedi** · 15th International Symposium on Automated Technology for Verification and Analysis (ATVA 2017) · Pages 463–479 · (Acceptance Rate: 37%)
38. **Analyzing neighborhoods of falsifying traces in cyber-physical systems** by Ramdas Diwakaran[†], Sriram Sankaranarayanan, and **A. Trivedi** · International Conference on Cyber-Physical Systems (IC-CPS 2017) · Pages 109-120 · (Acceptance Rate: 31%)
39. **Discriminating traces with time** by Saeid Tizpaz-Niari[†], Pavol Cerny, Bor-Yuh Evan Chang, Sriram Sankaranarayanan, and **A. Trivedi** · International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2017) · Pages 21–37 · (Acceptance Rate: 30%)

Prior to Joining CU Boulder

40. **FO-definable transformations of infinite strings** by Vrunda Dave[†], Krishna S. and **A. Trivedi** · Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2016) · Pages 12:1–12:14 · (Acceptance Rate: 39%)
41. **Mean-Payoff Games on Timed Automata** by Shibashis Guha[†], Marcin Jurdzinski, Krishna S. and **A. Trivedi** · Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2016) · Pages 44:1–44:14 · (Acceptance Rate: 39%)
42. **Stochastic Timed Games Revisited** by S. Akshay, Patricia Bouyer, Krishna S., Lakshmi Manasa[†] and **A. Trivedi** · International Symposium on Mathematical Foundations of Computer Science (MFCS 2016) · Pages 8:1–8:14 · (Acceptance Rate: 43%)
43. **Incentive Stackelberg Mean-payoff Games** by Anshul Gupta, Sven Schewe, **A. Trivedi**, Sai Krishna Deepak Maram[†] and Bharat Kumar Padarthy[†] · International conference on Software Engineering and Formal Methods (SEFM 2016) · Pages 304–320 · (Acceptance Rate: 22%)
44. **A Logical Characterization for Dense-Time Visibly Pushdown Automata** by Devendra Bhawe[†], Vrunda Dave[†], S. Krishna, Ramchandra Phawade[†] and **A. Trivedi** · International Conference on Language and Automata Theory and Applications (LATA 2016) · Pages 89-101 · (Acceptance Rate: 35%) · **Recipient of Journal Special Issue Invitation.**
45. **Revisiting Robustness in Priced Timed Games** by Shibashis Guha[†], S. Krishna, Lakshmi Manasa[†], and **A. Trivedi** · Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2015) · Pages 261–277 · (Acceptance Rate: 35%)
46. **Skolem Functions for Factored Formulas** by Ajith K. John[†], Shetal Shah, Supratik Chakraborty, **A. Trivedi**, and S. Akshay · International Conference on Formal Methods in Computer-Aided Design (FMCAD 2015) · Pages 73–80 · (Acceptance Rate: 28%)
47. **Symmetric Strategy Improvement Algorithm** by Sven Schewe, **A. Trivedi**, and Thomas Varghese[†] · 42nd International Colloquium on Automata, Languages, and Programming (ICALP 2015) · Pages 388–400 · (Acceptance Rate: 28%)
48. **Bounded-Rate Multi-Mode Systems Based Motion Planning** by Devendra Bhawe[†], Sagar Jha[†], S. Krishna, Sven Schewe, **A. Trivedi** · International conference on Hybrid systems: computation and control (HSCC'15) · Pages 41–50 · (Acceptance Rate: 39%)
49. **What's Decidable About Recursive Hybrid Automata?** by S. Krishna, Lakshmi Manasa[†], and **A. Trivedi** · International conference on Hybrid systems: computation and control (HSCC 2015) · Pages 31–40 · (Acceptance Rate: 39%)

50. **On Pure Nash Equilibria in Stochastic Games** by Ankush Das[†], S. Krishna, Lakshmi Manasa[‡], **A. Trivedi** and Dominik Wojtczak · Theory and Applications of Models of Computation (TAMC 2015) · Pages 359–371 · (Acceptance Rate: 44%)
51. **Weak Singular Hybrid Automata** by S. Krishna, Umang Mathur[†], and **A. Trivedi** · International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS 2014) · Pages 161–175 · (Acceptance Rate: 44%)
52. **First-order definable string transformations** by Emmanuel Filiot, S. Krishna, and **A. Trivedi** · Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2014) · Pages 147–159 · (Acceptance Rate: 29%)
53. **Adding Negative Prices to Priced Timed Games** by Thomas Brihaye, Gilles Geeraerts, S. Krishna, Lakshmi Manasa[‡], B. Monmege[‡], and **A. Trivedi** · International conference on concurrency theory (CONCUR 2014) · Pages 560–575 · (Acceptance Rate: 28%)
54. **From Monadic Second-Order Definable String Transformations to Transducers** by Rajeev Alur, Antoine Durand-Gasselín, and **A. Trivedi** · Symposium on Logic in Computer Science (LICS 2013) · Pages 458–467 · (Acceptance Rate: 34%)
55. **Safe Schedulability of Bounded-Rate Multi-Mode Systems** by Rajeev Alur, Vojtech Forejt, Salar Moarref[†], and **A. Trivedi** · International conference on Hybrid systems: computation and control (HSCC 2013) · Pages 243–252 · (Acceptance Rate: 34%)
56. **Playing Stochastic Games Precisely** by Taolue Chen, Vojtech Forejt, Marta Kwiatkowska, Aistis Simatis[‡], **A. Trivedi**, and Michael Ummels · International Conference on Concurrency Theory (CONCUR 2012) · Pages 348–363 · (Acceptance Rate: 36%)
57. **Regular Transformations of Infinite Strings** by Rajeev Alur, Emmanuel Filiot, and **A. Trivedi** · Logic in Computer Science (LICS 2012) · Pages 65–74 · (Acceptance Rate: 37%)
58. **Optimal Scheduling for Constant-Rate Multi-Mode Systems** by Rajeev Alur, **A. Trivedi** and Dominik Wojtczak · International Conference on Hybrid Systems: Computation and Control (HSCC 2012) · Pages 75–84 · (Acceptance Rate: 61%) · **Recipient of HSCC best paper award**
59. **Relating average and discounted costs for quantitative analysis of timed systems** by Rajeev Alur and **A. Trivedi** · International Conference on Embedded Software (EMSOFT 2011) · Pages 165–174 · (Acceptance Rate: 24%)
60. **Recursive Timed Automata** by **A. Trivedi** and Dominik Wojtczak · Automated Technology for Verification and Analysis (ATVA) 2010 · Pages 306–324 · (Acceptance Rate: 33%)
61. **Timed Branching Processes** by **A. Trivedi** and Dominik Wojtczak · International Conference on Quantitative Evaluation of Systems (QEST) 2010 · Pages 219–228 · (Acceptance Rate: 48%)
62. **Expected Reachability-Time Games** by Vojtech Forejt, Marta Kwiatkowska, Gethin Norman, and **A. Trivedi** · International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS) 2010 · Pages 122–136 · (Acceptance Rate: 45%)
63. **Concavely-Priced Probabilistic Timed Automata** by Marcin Jurdzinski, Marta Kwiatkowska, Gethin Norman, and **A. Trivedi** · International Conference on Concurrency Theory (CONCUR) 2009 · Pages 415–430 · (Acceptance Rate: 28%)
64. **Concavely-Priced Timed Automata** by Marcin Jurdzinski and **A. Trivedi** · Formal Modeling and Analysis of Timed Systems (FORMATS 2008) · Pages 48–62 · (Acceptance Rate: 45%)

65. **Average-Time Games** by Marcin Jurdzinski and **A. Trivedi** · Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2008) · Pages 340–351 · (Acceptance Rate: 29%)
66. **Reachability-Time Games on Timed Automata** by Marcin Jurdzinski and **A. Trivedi** · Colloquium on Automata, Languages and Programming (ICALP) 2007 · Pages 838–849 · (Acceptance Rate: 31%)

H. PEER-REVIEWED JOURNAL ARTICLES

1. **A Scenario Approach for Synthesizing k-Inductive Barrier Certificates** by Vishnu Murali[†], **A. Trivedi** and Majid Zamani · IEEE Control Systems Letters · Volume 6 · Pages 3247–3252 · 2022
2. **Secure-by-construction synthesis of cyber-physical systems** by Siyuan Liu[†], **A. Trivedi**, Xiang Yin, and Majid Zamani · Annual Reviews in Control · Volume 53 · Pages 30–50 · 2022
3. **Quantitative estimation of side-channel leaks with neural networks** by Saeid Tizpaz-Niari[†], Pavol Cerny, Sriram Sankaranarayanan, and **A. Trivedi** · International Journal Software Tools for Technology Transfer 23(4) · Pages 641-654 · 2021.

Prior to Joining CU Boulder

4. **Schedulability of Bounded-Rate Multi-Mode Systems** by Rajeev Alur, Vojtech Forejt, Salar Moarref[†], and **A. Trivedi** · ACM Transactions on Embedded Computing Systems · Volume 16 · No 3 · Pages 85:1-85:27 · 2017.
5. **Expected reachability-time games** by Vojtech Forejt, Marta Kwiatkowska, Gethin Norman, **A. Trivedi** · Theoretical Computer Science (TCS) · Volume 631 · Pages 139-160 · 2016.
6. **Hybrid Automata for Formal Modeling and Verification of Cyber-Physical Systems** by S. Krishna and **A. Trivedi** · Journal of the Indian Institute of Science, VOL 93:3, 2013, pages 419-440.

I. EDITING

1. **Proceedings of the The First Workshop on Verification and Validation of Cyber-Physical Systems** by Mehdi Kargahi, Ashutosh Trivedi · Workshop collocated with Integrated Formal Methods 2016, Reykjavík, Iceland, June 4-5, 2016. EPTCS 232, 2016

J. LIGHTLY REVIEWED CONFERENCE OR WORKSHOP PAPERS

1. **Safety Verification of Dynamical Systems via k-Inductive Barrier Certificates** by Mahathi Anand[†], Vishnu Murali[†], **A. Trivedi**, Majid Zamani · Conference on Decision and Control (CDC) 2021 · Pages 1314-1320 · (acceptance Rate: 63%)
2. **WiP: Automatic Transient Execution Attack Detection** by Zack McKeivitt[†], Tamara Lehman and **A. Trivedi** · Hardware and Architectural Support for Security and Privacy (HASP) 2021 · (Acceptance Rate: Unknown)
3. **Formal verification of hyperproperties for control systems** by Mahathi Anand[†], Vishnu Murali[†], Ashutosh Trivedi, Majid Zamani · Computation-Aware Algorithmic Design for Cyber-Physical Systems (CAADCPS@CPSIoTWeek) · Pages 29-30
4. **Reinforcement Learning and Formal Requirements** by Fabio Somenzi and **A. Trivedi** · International Workshop on Numerical Software Verification (NSV@CAV) 2019 · Pages 26-41
5. **Limit Reachability for Model-Free Reinforcement Learning of ω -Regular Objectives** by Ernst Moritz Hahn, Mateo Perez[†], Sven Schewe, Fabio Somenzi, **A. Trivedi**, Dominik Wojtczak · International Workshop on Symbolic-Numeric methods for Reasoning about CPS and IoT (SNR) 2019.

6. **On Timed Scope-Bounded Context-Sensitive Languages** by Devendra Bhavé[†], Shankara Narayanan Krishna, Ramchandra Phawade[‡], **Ashutosh Trivedi** · Developments in Language Theory (DLT) 2019 · Pages 168-181 · (Acceptance Rate: 66%)
7. **On Nonlinear Prices in Timed Automata** by Devendra Bhavé[†], Krishna S., and **Ashutosh Trivedi** · International workshop on Verification and Validation of Cyber-Physical Systems (VVCPS 2016) · Pages 65–78 · (Acceptance Rate: Unknown)

Prior to Joining CU Boulder

8. **A Perfect Class of Context-Sensitive Timed Languages** by Devendra Bhavé[†], Vrunda Dave[‡], S. Krishna, Ramchandra Phawade[‡] and **Ashutosh Trivedi** · Developments in Language Theory (DLT 2016) · Pages 38-50 · (Acceptance Rate: 66%).
9. **Compositional modeling and analysis of automotive feature product lines** by S. Krishna, Ganesh Khandu Narwane[‡], S. Ramesh, **A. Trivedi** · 52nd Design Automation Conference (DAC) 2015 · Pages 1–6. (Invited paper)
10. **Reachability Games on Recursive Hybrid Automata** by S. Krishna, Lakshmi Manasa[‡], and **Ashutosh Trivedi** · International Symposium on Temporal Representation and Reasoning (TIME 2015) · Pages 150–159 · (Acceptance Rate: 73%)
11. **Time-Bounded Reachability Problem for Recursive Timed Automata is Undecidable** by S. Krishna, Lakshmi Manasa[†], and **Ashutosh Trivedi** · International Conference on Language and Automata Theory and Applications (LATA 2015) · Pages 237–248 · (Acceptance Rate: 46%)
12. **Improved Undecidability Results for Reachability Games on Recursive Timed Automata** by S. Krishna, Lakshmi Manasa[‡], and **Ashutosh Trivedi** · International symposium on games, automata, logics and formal verification (GandALF 2014) · Pages 245–259 · (Acceptance Rate: Unknown.)

K. RECENT TALKS, SEMINARS, AND PRESENTATIONS

- Mar. 11, 2022 **NSF Early CAREER meeting: talk about your experience**, CU Boulder
- Dec. 14, 2021 **Reinforcement Learning and Formal Requirements**, FSTTCS 2021 Pre-Conference Workshop *iVerif: Workshop on artificial intelligence and Verification*.
- Dec. 14, 2021 **Panel Discussion on AI and Formal Verification**, FSTTCS 2021 Pre-Conference Workshop *iVerif: Workshop on artificial intelligence and Verification*.
- Oct. 27, 2021 **Pre Research Advising with Ashutosh Trivedi: Reinforcement Learning Beyond Finite MDPs** Department of Computer Science, CU Boulder.
- Oct. 18, 2021 **Convergent Reinforcement Learning Beyond Finite MDPs**, Fall 2021 Seminars, Lane Department of Computer Science and Electrical Engineering, West Virginia University.
- Aug. 20, 2021 **Human-AI Collaborative Programming and its applications to CS Education**, Engineering Education and AI-Augmented Learning Interdisciplinary Research Theme Workshop, CU Boulder.
- Aug 19, 2021 **Convergent Reinforcement Learning Beyond Finite MDPs**, AFRL/RI Information Institute.
- July. 21, 2021 **Model-free Reinforcement Learning for Branching Markov Decision Processes**, 33rd International Conference, CAV 2021, Virtual Event, July 20-23, 2021.
- July. 21, 2021 Chaired the session on **Hybrid and Cyber Physical Systems**, 33rd International Conference, CAV 2021, Virtual Event, July 20-23, 2021.

- Nov. 16, 2020 **Data-Driven Software Systems and Formal Verification**, JHU/APL and CU Boulder Formal Methods Workshop, Virtual Event.
- Sept 22, 2020 **Theoretical Foundations of Safety-Critical Reinforcement Learning**, CS Colloquium, CU Boulder.
- Sept 11, 2020 **Safe Programmatic Reinforcement Learning**, Pervasive Personalized Intelligence Center, CU Boulder.
- June 24, 2020 **Programmatic Reinforcement Learning**, DARPA Discover DSO Day.
- Oct 27, 2019 **Omega Regular Requirements in Model-Free Reinforcement Learning**, 21st International Workshop on Verification of Infinite-State System (INFINITY'19)
- Sept 19, 2019 **High Assurance Autonomy**, Autonomous Systems Interdisciplinary Research Themes (ASIRT) Workshop, CU Boulder.
- Sept 17, 2019 **Reinforcement Learning and Formal Requirements**, StatOptML seminar, CU Boulder.
- July 13, 2019 **Reinforcement Learning and Formal Requirements**, Numerical Software Verification - 12th International Workshop, NSV@CAV 2019, New York City, NY, USA
- June. 1, 2019 **Hyper-trace Debugging for software performance and security** · Workshop on Machine Learning for Software Engineering (ML4SE'19), Montreal, QC, Canada.
- Apr 15, 2019 **Limit Reachability for Model-Free Reinforcement Learning of ω -Regular Objectives**, Fifth International Workshop on Symbolic-Numeric methods for Reasoning about CPS and IoT, Montreal, Canada.
- Apr 09, 2019 **Omega-Regular Objectives in Model-Free Reinforcement Learning**, Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2019, Prague, Czech Republic.
- Sept 19, 2018 **Multi-Mode Systems: LEGO-style Development for Cyber-Physical Systems** · Center for Cyber-Physical Systems and Internet of Things, Ming Hsieh Department of Electrical and Computer Engineering, University of Southern California.
- April 11, 2018 **Global Almost-Sure Reachability in Stochastic Constant-Rate Multi-Mode Systems** · 21st ACM International Conference on Hybrid Systems: Computation and Control (HSCC 2018), Porto, Portugal.
- Nov-April, 2018 **Multi-Mode Systems: LEGO-style Development for Cyber-Physical Systems** · Job Talk.
- April 27, 2017 **Discriminating Traces with Time** · 23rd International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), Uppsala, Sweden.
- Dec. 16, 2016 Chaired the **Algorithmic Verification of Real-Time Systems (AveRTS'16)** workshop colocated with FSTTCS'16, Chennai, India.
- Dec. 15, 2016 **Mean-Payoff Games on Timed Automata** · 36th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS'16), Chennai, India.
- June 4, 2016 Chaired the **Verification and Validation of Cyber-Physical Systems** workshop colocated with Integrated Formal Methods (IFM) 2016.
- April 14, 2015 **Bounded-rate multi-mode systems based motion planning** · 18th International Conference on Hybrid Systems: Computation and Control, HSCC'15, Seattle, WA, USA.

L. TEACHING EXPERIENCE

University of Colorado Boulder:

Theory of Computation, CSCI 3434, Instructor Fall 2016

An introductory course to CS theory targetted at the UG students that introduces key results on Automata Theory (expressiveness and limitations of formal models from Finite Automata and Pushdown automata to Turing machines), Computability Theory (Decidability, Undecidability, reductions), and Complexity Theory (Intractability, Completeness, Reductions).

Design and Analysis of Algorithms, CSCI 5454, Instructor Fall 2017

A core graduate-level course introducing basic algorithms at a finer level of detail and more advanced algorithms and data structures.

Theory of Computation, CSCI 5444, Instructor Spring 2017, Fall 2018, Fall 2020, Fall 2021

Similar to CSCI 3434, but it assumes some mathematical maturity and is fast-paced. It covers foundational results on Automata Theory (expressiveness and limitations of formal models from Finite Automata and Pushdown automata to Turing machines), Computability Theory (Decidability, Undecidability, reductions), and Complexity Theory (Intractability, Completeness, Reductions). In Fall'21, I revised the course by integrating the computational learning theory into the curriculum.

Foundations of Cyber-Physical Systems, CSCI 5854, Instructor Spring 2018

A graduate-level course introducing the principles of design and verification of safety-critical cyber-physical systems. This course introduced formal modeling, specification formalisms, and verification approaches for discrete, continuous, and hybrid dynamical systems.

Data Structures, CSCI 2270, Instructor Spring 2019, Spring 2020, Spring 2021, Spring 2022

A core Undergraduate-level course that introduces students to the theoretical foundations and practical considerations in the design and implementation of basic and advanced data structures.

Automata for Verification, Synthesis, and Learning, CSCI 7000, Instructor Fall 2019

This was a new Graduate seminar course on Automata on Infinite Words (Omega Automata) and their applications in Verification, Synthesis, and Learning. While the need for Omega automata in verification and synthesis is well established, the applications to machine learning, in particular reinforcement learning, is informed by my research program at CU Boulder.

Indian Institute of Technology Bombay:

Automata Theory and Logic, CS208, Instructor Summer 2012-13, Spring 2013-14, Spring 2014-15

Similar to CSCI 3434 at CU Boulder.

Digital Logic Design (Theory+Lab), CS 226, Instructor Spring 2014-15

Core undergraduate-level course on the fundamental ideas behind the design of combinational circuits and synchronous and asynchronous sequential circuits design approaches.

Modeling and Analysis of Cyber-Physical Systems, CS 620, Instructor Autumn 2013-14

Graduate seminar introducing the principles of design and verification of safety-critical cyber-physical systems. This course introduced formal modeling, specification formalisms, and verification approaches for discrete, continuous, and hybrid dynamical systems.

M. PROFESSIONAL ACTIVITIES

Grant Review Panels

- National Science Foundations Panelist: 2018, 2019, 2020, 2021, 2022
- Project Proposal Review for the Dutch Research Council (2021)
- Project Proposal Review for the French National Research Agency (2021)
- Project Proposal for the Air Force Office of Scientific Research (2019, 2020, 2021)
- CU Boulder Research & Innovation Office Seed Grant Review: Engineering & Applied Sciences (2020)

Program Chair

- Eighth International Workshop on Symbolic-Numeric Methods for reachability Analysis (SNR'22)
- First Workshop on Verification and Validation of Cyber-Physical Systems (VVCPS'16)
- 2nd Workshop on Algorithmic Verification of Real-Time Systems (AVeRTS'17)
- 1st Workshop on Algorithmic Verification of Real-Time Systems (AVeRTS'16)

Program Committees

- 50th EATCS International Colloquium on Automata, Languages and Programming (ICALP'23)
- 42nd Conference on Foundations of Soft. Technology and Theoretical Computer Science (FSTTCS'22)
- 27th International Conference on Formal Methods for Industrial Critical Systems (FMICS'22)
- 20th International Symposium on Formal Methods and Models for System Design (MEMOCODE'22)
- 25th ACM International Conference on Hybrid Systems: Computation and Control (HSCC'22)
- 12th International Symposium on Games, Automata, Logics, and Formal Verification (GandALF'22)
- 19th International Conference on Formal Methods and Models for System Design (MEMOCODE'21)
- 32nd International Conference on Concurrency Theory (CONCUR'21)
- 24th ACM International Conference on Hybrid Systems: Computation and Control (HSCC'21)
- 12th International Conference on Cyber-Physical Systems (ICCPS'21)
- 35th AAAI Conference on Artificial Intelligence (AAAI'21) . **Top 25% PC Members**
- 33rd International Conference on Computer-Aided Verification (CAV'21)
- 32nd International Conference on Computer Aided Verification (CAV'20)
- 7th International Workshop on Strategic Reasoning (SR'19)
- 19th International Conference on Application of Concurrency to System Design (ACSD'19)
- 12th International Workshop on Numerical Software Verification (NSV'19)
- 22nd ACM International Conference on Hybrid Systems: Computation and Control (HSCC'19)
- 15th ACM SIGBED International Conference on Embedded Software (EMSOFT'19)

- 16th Asian Symposium on Programming Languages and Systems (APLAS'18)
- 6th International Workshop on Strategic Reasoning (SR'18)
- 16th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS'18)
- 21st International Conference on Hybrid Systems: Computation and Control (HSCC'18)
- 19th International Conference on Application of Concurrency to System Design (ACSD'18)
- ACM/IEEE 9th International Conference on Cyber-Physical Systems (ICCPS'18)
- 1st International Workshop on Multi-objective Reasoning in Verification and Synthesis (MORE'18)
- Workshop on Development aspects of Intelligent Adaptive Systems at ISEC (DIAS'17)
- 18th International Conference on Application of Concurrency to System Design (ACSD'17)
- 19th International Conference on Hybrid Systems: Computation and Control (HSCC'16)
- 27th International Conference on Concurrency Theory (CONCUR'16)
- 13th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS'15)
- 18th International Conference on Hybrid Systems: Computation and Control (HSCC'15)
- 34th Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS'14)
- 12th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS'14)
- 17th International Conference on Hybrid Systems: Computation and Control (HSCC'14)
- 11th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS'13)

External Reviews (Conferences)

- 39th International Conference on Machine Learning (ICML'22)
- 36th AAAI Conference on Artificial Intelligence (AAAI'22)
- 40th Conference on Foundations of Soft. Technology and Theoretical Computer Science (FSTTCS'20)
- 45th International Symposium on Mathematical Foundations of Computer Science (MFCS'20)
- 47th International Colloquium on Automata, Languages and Programming (ICALP'20)
- 22nd International Conference on Hybrid Systems: Computation and Control (HSCC'19)
- 15th International Conference on Software Engineering and Formal. Methods, (SEFM'17)
- 37th Conference on Foundations of Soft. Technology and Theoretical Computer Science (FSTTCS'17)
- 41st International Colloquium on Automata, Languages and Programming (ICALP'14)
- 29th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS'14)
- 26th International Conference on Computer Aided Verification (CAV'14)
- 11th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS'13)
- 16th Conference on Foundations of Software Science and Computation Structures (FOSSACS'13)
- 25th International Conference on Computer Aided Verification (CAV'13)

- 24th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA'13)
- 34th International Conference on Petri Nets (Petri'13)
- 18th Intl. Conf. on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'12)
- 14th Conference on Foundations of Software Science and Computation Structures (FOSSACS'11)
- 13th Conference on Foundations of Software Science and Computation Structures (FOSSACS'10)
- 24th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS'10)
- 37th International Colloquium on Automata, Languages and Programming (ICALP'10)
- 23rd Annual ACM/IEEE Symposium on Logic in Computer Science (LICS'09)
- 15th Intl. Conf. on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'09)
- 7th International Symposium on Automated Technology for Verification and Analysis (ATVA'09)
- 20th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS'06)
- 17th International Conference on Concurrency Theory (CONCUR'06)
- 3rd International Symposium on Automated Technology for Verification and Analysis (ATVA'05)
- 17th International Conference on Computer Aided Verification (CAV'05)

External Review (Journals)

- **Formal Methods.** Logical Methods in CS (1), Software Tools for Technology Transfer (2), Theoretical Computer Science (6), Formal Methods in System Design (2), Information and Computation (1), Information Processing Letters (3), International Journal of Foundations of Computer Science (1)
- **Control Theory.** The IEEE Open Journal of Control Systems (1), The IEEE Control Systems Letters (2), The IEEE Transactions on Automatic Control (2)
- **Others.** Artificial Intelligence (1), ACM Transactions on Embedded Computing Systems (1)

Conference Organizing Committee

- 14th Asian Logic Conference (ALC'15)
- 6th Indian Conference on Logic and its Applications (ICLA'15)
- 15th IEEE International Conference on Engineering of Complex Computer Systems (ICECCS'10)

Student Committees

PhD Dissertation Committee

- Hansol Yoon (PhD 2022), advised by Sriram Sankaranarayanan. Computer Science. CU Boulder.
- Vruna Dave (PhD 2021), advised by Krishna S. Computer Science. IIT Bombay.
- Chou Yi (PhD 2021), advised by Sriram Sankaranarayanan. Computer Science. CU Boulder.
- Taisa Kushner (PhD 2020), advised by Sriram Sankaranarayanan. Computer Science. CU Boulder.

PhD Proposal/PhD Comprehensive Examination Committee

- Shawn Meier (passed March 18, 2022), advised by Bor-Yuh Evan Chang. Computer Science. CU Boulder.

- Hansol Yoon (passed Nov 12, 2021), advised by Sriram Sankaranarayanan. Computer Science. CU Boulder.
- Chou Yi (passed Nov 16, 2020), advised by Sriram Sankaranarayanan. Computer Science. CU Boulder.
- Taisa Kushner (passed Nov 11, 2019), advised by Sriram Sankaranarayanan. Computer Science. CU Boulder.

PhD Preliminary Examination Committee

- Monal Narasimhamurthy (passed November 30, 2021), advised by Sriram Sankaranarayanan. Computer Science. University of Colorado Boulder.
- Kandai Watanabe (passed June 21, 2021), advised by Sriram Sankaranarayanan and Morteza Lahijanian. Aerospace Engineering. University of Colorado Boulder.
- Hansol Yoon (passed Nov. 30, 2020), advised by Sriram Sankaranarayanan. Computer Science. University of Colorado Boulder.
- Chou Yi (passed April 26, 2019), advised by Sriram Sankaranarayanan. Computer Science. University of Colorado Boulder.
- Taisa Kushner (passed April 1, 2019), advised by Sriram Sankaranarayanan. Computer Science. University of Colorado Boulder.
- Shawn Meier (passed May 08, 2018), advised by Bor-Yuh Evan Chang. Computer Science. University of Colorado Boulder.

MS/BS Thesis Committee

- Amin Falah (MS 2022), advised by Shibashis Guha. Computer Science. Chennai Mathematical Institute.
- Zack Mckevitt (BS 2022), advised by Tamara Lehman. Electrical, Computer, and Energy Engineering. University of Colorado Boulder.
- Michael Dresser (BS 2020), advised by Sriram Sankaranarayanan. Computer Science. University of Colorado Boulder.

Department Service

Department of Computer Science. University of Colorado Boulder

- Diversity, Equity, and Inclusion (DEI) committee (and Broadening Participation Plan (BPC) Subcommittee) · Role: **Member**, 2022-Now
- Department-level Search Committee for Open-Discipline Faculty Positions in Engineering and Applied Science · Role: **Member**, 2021-2022
- Department-level Search Committee for Open-Discipline Faculty Positions in Engineering and Applied Science · Role: **Member**, 2022-2023
- Computer Science Instructor Search Committee · Role: **Member**, 2020-2022
- Trustworthy-Software Search Committee · Role: **Chair**, 2019-2020
- Undergraduate Curriculum Committee: Summer 2020-Now
- Graduate Committee: Fall 2017-Spring 2019)

Department of Electrical, Computer, and Energy Engineering. University of Colorado Boulder

- Computer Engineering (ECE) Search Committee · Role: **Member**, 2018-2019

College Service

- CAREER proposal review committee (2022)
- College-level Search-Committee for Open-Discipline Faculty Positions in Engineering and Applied Science · Role: **Member**, 2022-2023.
- College-level Search-Committee for Open-Discipline Faculty Positions in Engineering and Applied Science · Role: **Member**, 2021-2022.
- Mentor for the CURC du Colorado initiative to get more women and non- binary undergraduates involved in computing research. This program is supported by Google exploreCSR program and the CU BOLD Center. (2019–2020)

University Service

- Grant Review Panelist for the Research & Innovation (RIO) Seed Grant proposals for the “Engineering & Applied Sciences” category. (Fall 2020)
- DEI advocate representing CU Boulder in the NSF-CMD-IT LEAP (diversifying future **LEAdership** in the computing **Professoriate**) initiative (cmd-it.org/program/current/leap-alliance/)

N. RESEARCH SOFTWARE (OPEN SOURCE)

- **Mungojerrie**. Mungojerrie (<https://plv.colorado.edu/mungojerrie/>) is a reinforcement learning tool primarily designed for testing reward schemes for omega-regular objectives, of which Linear Temporal Logic (LTL) is a special case. Mungojerrie contains multiple reinforcement learning algorithms and a probabilistic model checker. Mungojerrie supports models specified in PRISM and ω -automata specified in HOA.
- **Parfait-ML**. Parfait-ML (<https://github.com/Tizpaz/Parfait-ML>) is an open-source tool to detect fairness bugs in the hyperparameter space of ML libraries. Using Parfait-ML, software developers can also exploit the configuration space of ML libraries to improve fairness.
- **DPFuzz and DPDebugger**. DPFuzz (<https://github.com/Tizpaz/DPFuzz>) is an open-source tool for fuzzing and debugging differential performance bugs. DIt is build around DPDebugger (<https://github.com/cuplv/DPDEBUGGER>) that enables *Differential Performance Debugging* to explain unexpected performance differences of a program tested on different inputs.
- **Schmit**. Schmit (<https://github.com/cuplv/Schmit>) is an open-source tool that aims to mitigate side-channel vulnerabilities based on entropy measure (such as Shannon Entropy) with considering the performance overheads.

O. CITIZENSHIP STATUS

Citizenship: India

Permanant Resident of USA.