ABHINAV VERMA

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RESEARCH INTERESTS

My research lies at the intersection of machine learning and formal methods. I am especially concerned with building trustworthy intelligent systems, using learning models that are provably safe, human interpretable, reliable, and robust to domain shifts.

ACADEMIC EMPLOYMENT

The Pennsylvania State University *July 2022 - onward*
Hartz Family Career Development Assistant Professor *University Park, PA*
Department of Computer Science and Engineering

Institute of Science and Technology Austria *August 2021 - July 2022*
Postdoc ∘ Henzinger Group

EDUCATION

University of Texas at Austin *August 2021*
Ph.D. student ∘ Computer Science *Austin, TX*
Advisor: Prof. Swarat Chaudhuri
Thesis: Programmatic Reinforcement Learning

Indian Institute of Science *July 2011*
M.S. ∘ Mathematics *Bangalore, India*
Thesis: Irreducible Representations of the
Symmetric Group and the General Linear Group

University of Delhi - Hindu College *June 2008*
B.A. Honors ∘ Mathematics *New Delhi, India*

PUBLICATIONS

Google Scholar Profile: https://scholar.google.com/citations?user=jM1HeCIAAAAJ

Peer-Reviewed

1. Programmatically Interpretable Reinforcement Learning
   Abhinav Verma, Vijayaraghavan Murali, Rishabh Singh, Pushmeet Kohli, Swarat Chaudhuri
   35th International Conference on Machine Learning (**ICML**) 2018.
   Acceptance Rate: 29.1%
   Accepted as a Long Talk: Top 9% of submitted papers.
2. Representing Formal Languages: A Comparison of Finite Automata and Recurrent Neural Networks
   Joshua J. Michalenko, Ameesh Shah, Abhinav Verma, Swarat Chaudhuri, Ankit B. Patel
   7th International Conference on Learning Representations (**ICLR**) 2019.
   Acceptance Rate: 31.4%

3. Control Regularization for Reduced Variance Reinforcement Learning
   Richard Cheng, Abhinav Verma, Gábor Orosz, Swarat Chaudhuri, Yisong Yue, Joel W. Burdick
   36th International Conference on Machine Learning (**ICML**) 2019.
   Acceptance Rate: 22.6%
4. Imitation-Projected Programmatic Reinforcement Learning
   Abhinav Verma, Hoang M. Le, Yisong Yue, Swarat Chaudhuri
   33rd Conference on Neural Information Processing Systems (**NeurIPS**) 2019.
   Acceptance Rate: 21.6%
5. Learning Differentiable Programs with Admissible Neural Heuristics
   Ameesh Shah, Eric Zhan, Jennifer J Sun, Abhinav Verma, Yisong Yue, Swarat Chaudhuri
   34th Conference on Neural Information Processing Systems (**NeurIPS**) 2020.
   Acceptance Rate: 20.1%
6. Neurosymbolic Reinforcement Learning with Formally Verified Exploration
   Greg Anderson, Abhinav Verma, Isil Dillig, Swarat Chaudhuri
   34th Conference on Neural Information Processing Systems (**NeurIPS**) 2020.
   Acceptance Rate: 20.1%

Technical Report

- Verifiable and Interpretable Reinforcement Learning through Program Synthesis
  Abhinav Verma
  Doctoral Consortium at The 33rd AAAI Conference on Artificial Intelligence (**AAAI**) 2019.

AWARDS & HONORS

- Österreichische Forschungsförderungsgesellschaft (FFG) Career Grant 2021.
- Deutscher Akademischer Austauschdienst (DAAD) Postdoc-NeT-AI Fellowship 2021.
- J.P. Morgan AI Research PhD Fellowship 2020.
- Bronze Medal, ACM Student Research Competition at Conference on Programming Language Design and Implementation (PLDI) 2018.
- Bronze Medal, ACM Student Research Competition at The 45th ACM SIGPLAN Symposium on Principles of Programming Languages (POPL) 2018.
- Council of Scientific & Industrial Research, India 2011.

MENTORING

Six students co-advised, three from underrepresented groups, two associated publications.

Current

- **Masters**, Surya S Dwivedi, University of Texas at Austin.
  Project: Reinforcement learning for F1Tenth cars.
- **Undergraduate**, Myra Cheng, Caltech.
  Project: Machine learning for behavioral neuroscience.
- **Undergraduate**, Joshua Deng, University of Texas at Austin.
  Project: Learning programmatic models of RNA splicing.

Graduated

- **Masters**, Ameesh Shah, Rice University.
  Project: Learning differentiable programs with admissible neural heuristics.
  Currently: Graduate Student at UC Berkeley.
- **Undergraduate**, Jacqui Lee, Rice University.
  Project: Adaptive therapies for Sepsis via reinforcement learning.
  Currently: Graduate Student at MIT.
- **Intern**, Nirha Patel, University of California, San Diego.
  Project: Evolutionary algorithms for reinforcement learning.
  Currently: Developer at Yahoo.

TEACHING EXPERIENCE

Rice University *January 2017 - December 2019*
Teaching Assistant

- COMP 539: Software Engineering Methodology.
  Project based graduate course on software engineering.
- COMP 503: Reasoning About Software.
  Graduate course on formal methods and automated reasoning.
- COMP 310: Advanced Object-Oriented Programming and Design.
  Senior undergraduate course on OOP.

Wolfram Research *January 2015 - August 2016*
Certified Instructor

- Conducted online corporate training for Mathematica users.
- Helped develop and improve courses based on newly introduced functionality.

University of Oregon *September 2012 - June 2014*
Standalone Instructor
Approximately forty students in each class.

- Math 105: University Mathematics.
  Introduction to logic, combinatorics, and probability.
  Core requirement for BS degree.
- Math 111: College Algebra.
  Foundational course in algebra, functions, and mathematical modeling.
  Calculus preparation course, prerequisite for higher-level math courses.
- Math 112: Elementary Functions.
  Focus on mathematical induction and trigonometric functions.
  Precalculus designed for math, biology, physiology, and CS majors.

Teaching Assistant

- Math 243: Introduction to Probability and Statistics.
  Undergraduate course on statistical reasoning.

Dr. B. R. Ambedkar University *January 2012 - April 2012*
Teaching Assistant

- M01: Introduction to Mathematical Thinking.
  First course on abstract mathematics.

INDUSTRIAL EXPERIENCE

SRI International *June 2019 - August 2019*
Research Intern, Mentor: Susmit Jha *Menlo Park, CA*

- Researched interpretable reinforcement learning via program synthesis.
- Integrated vision models with programmatic reinforcement learning.

Microsoft Research *June 2017 - September 2017*
Research Intern, Mentor: Christoph M. Wintersteiger *Cambridge, UK*

- Researched methods to use deep neural networks for quantifier instantiation in Z3.
- Intern in the Programming Principles and Tools group.

Wolfram Research *August 2014 - August 2016*
Technology Engineer *Champaign, IL*

- Researched integrating automated theorem proving into the Wolfram Language.
- Helped identify and implement new functionality based on cutting edge research.

SERVICE

Referee

- The 10th International Conference on Learning Representations (ICLR) 2022.
- The 38th International Conference on Machine Learning (ICML) 2021.
- Machine Learning (Springer Journal).
- The 34th Conference on Neural Information Processing Systems (NeurIPS) 2020.
- The 23rd International Conference on Artificial Intelligence and Statistics (AISTATS) 2020.
- The 32nd International Conference on Computer-Aided Verification (CAV) 2020.
- The 12th NASA Formal Methods Symposium (NFM) 2020.

Committees

University of Texas, Austin

- Junior Graduate Admissions Committee: responsible for initial screening of PhD applications.

Rice University

- Graduate Student Faculty Search Committee: responsible for feedback on faculty candidates.
- School of Engineering Co-op management committee.

Indian Institute of Science

- PC Member, Conference on Algebraic and Combinatorial Representation Theory.

- Student Committee, Indian Institute of Science Centenary Conference.

Delhi University

- Member Central Council: governing body of student union with fifty thousand members.

INVITED TALKS

- Henzinger Group Seminar, Institute of Science and Technology Austria, April 2021.
- Institute for Foundations of Machine Learning Seminar, UT Austin, November 2020.
- Neurosymbolic Learning Seminar, University of Pennsylvania, October 2020.

INVITED PARTICIPATION

- The New York Academy of Sciences, 14th Annual Machine Learning Symposium 2020.
- International Conference on Neural Information Processing Systems, Virtual 2020.
- International Conference on Computer-Aided Verification (CAV), New York 2019.
- International Conference on Machine Learning, Long Beach 2019.
- International Conference on Learning Representations, New Orleans 2019.
- International Conference on Neural Information Processing Systems, Vancouver 2019.
- Doctoroal Consortium at AAAI Conference on Artificial Intelligence, Honolulu 2019.
- Deep Learning and Reinforcement Learning Summer School, University of Alberta 2019.
- Marktoberdorf Summer School on Engineering Secure and Dependable Software Systems 2018.
- International Conference on Machine Learning, Stockholm, Sweden 2018.
- Rice University Machine Learning Seminar, 2018.
- Wolfram Technology Conference, Champaign, Illinois 2014.
- Western Algebraic Geometry Symposium, University of Colorado, Boulder 2014.
- Graduate Student Topology and Geometry Conference, University of Texas, Austin 2014.
- Pacific Northwest Geometry Seminar, Stanford University 2014.
- Midwest Dynamical Systems Meeting, University of Illinois at Urbana-Champaign 2013.
- Workshop on Unitary Representations of Real Reductive Groups, University of Utah 2013.
- Graduate Student Topology and Geometry Conference, University of Notre Dame 2013.
- International Congress of Mathematicians (ICM), Hyderabad, India 2010.
- Conference on Algebraic and Combinatorial Approaches to Representation Theory, Bangalore, India 2010.
- Conference on Groups, Actions, Computations (GAC), Allahabad, India 2010.
- Conference on Analysis and its Applications, Bangalore, India 2009.