

Swarat Chaudhuri

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Curriculum vitae (last updated in May 2022)

Research interests

My research background is in the areas of Programming Languages (PL) and Formal Methods (FM), and much of my recent work lies in the intersection of these areas and machine learning (ML). On the one hand, I bring together statistical learning and symbolic methods to develop new lines of attack on established program analysis and synthesis problems. On the other hand, I bring a PL/FM perspective to classical ML problems, using a mix of high-level programming abstractions, automated formal reasoning, and statistical methods to build learning-enabled systems that are reliable, transparent, and sample-efficient by construction.

Education

2001-2007 **Doctor of Philosophy**, *University of Pennsylvania*.

Dissertation *Logics and Algorithms for Software Model Checking* (Advisor: Professor Rajeev Alur)

1997-2001 **Bachelor of Technology**, *Indian Institute of Technology, Kharagpur, India*.

Employment

Jan. 2020 onwards **Associate Professor with Tenure**, *University of Texas at Austin*.

July 2015-Dec. 2019 **Associate Professor with Tenure**, *Rice University*.

June-Dec. 2017 **Visiting Professor**, *ETH Zürich*.

July 2011-June 2015 **Assistant Professor**, *Rice University*.

January 2008-May 2011 **Assistant Professor**, *Pennsylvania State University*.

Fall 2007 **Postdoctoral scientist**, *NEC Laboratories America*.

Summers of 2002, 2005, 2006 **Summer intern**, respectively at *Lucent Bell Laboratories*, *Grammatech Corporation*, and *IBM T.J. Watson Research Center*.

Awards

2022 **Meta Research Award**, on “*Verified Learning of Neurosymbolic Programs*”.

2022 **Distinguished Paper Award**, *POPL 2022*, for the paper “*Bottom-Up Synthesis of Recursive Functional Programs using Angelic Execution*”.

2019 **Distinguished Paper Award**, *PLDI 2019*, for the paper “*Optimization and Abstraction: A Synergistic Approach for Analyzing Neural Network Robustness*”.

2015 **Google Research Award**, on “*Statistical Program Synthesis for Productive API Usage*”.

- 2011 **Distinguished Paper Award**, ESEC/FSE 2011, for the paper “Proving programs robust” (the paper was also selected as a CACM research highlight).
- 2010 **National Science Foundation CAREER Award**, For “Robustness Analysis of Uncertain Programs: Algorithms, Theory, and Tools”.
- 2007 **John Reynolds Doctoral Dissertation Award**, Presented annually by ACM SIGPLAN to the author of the outstanding doctoral dissertation in the area of Programming Languages.
- 2007 **Morris and Dorothy Rubinoff Award**, Presented by the University of Pennsylvania to a dissertation that has resulted in or could lead to innovative applications of computer technology.

Publications

[In the author listings, names of students, visiting students, postdoctoral researchers, and research scientists whom I mentored and funded appear in bold type. All published papers are available at <http://www.cs.utexas.edu/~swarat/pubs>. Citation information is available on my Google Scholar page: <https://scholar.google.com/citations?user=9j6RBYQAAAAJ>.]

- [ICLR22] **Chenxi Yang** and Swarat Chaudhuri. Safe Neurosymbolic Learning with Differentiable Symbolic Execution. *International Conference on Learning Representations (ICLR)*, 2022.
- [POPL22] **Anders Miltner**, Adrian Trejo Nuñez, **Ana Brendel**, Swarat Chaudhuri, and Isil Dillig. Bottom-Up Synthesis of Recursive Functional Programs using Angelic Execution. *Principles of Programming Languages (POPL)*, 2022. **(Distinguished Paper)**
- [WACV22] Arkabandhu Chowdhury, **Dipak Chaudhari**, Swarat Chaudhuri, and Chris Jermaine. Meta-Meta Classification for One-Shot Learning. *Workshop on Applications of Computer Vision (WACV)*, 2022.
- [FnT21] Swarat Chaudhuri, Kevin Ellis, Oleksandr Polozov, Rishabh Singh, Armando Solar-Lezama, and Yisong Yue. Neurosymbolic Programming. *Foundations and Trends in Programming Languages (FnT)*, 2021.
- [NeurIPS21] Rohan Mukherjee, **Yeming Wen**, **Dipak Chaudhari**, Thomas W. Reps, Swarat Chaudhuri, and Chris Jermaine. Neural Program Generation Modulo Static Analysis. *Neural Information Processing Systems (NeurIPS)*, 2021. **(Spotlight Paper)**
- [ICCV21] Arkabandhu Chowdhury, Mingchao Jiang, Swarat Chaudhuri, and Chris Jermaine. Few-shot Image Classification: Just Use a Library of Pre-trained Feature Extractors and a Simple Classifier. *International Conference on Computer Vision (ICCV)*, 2021.
- [EMNLP21] Kaj Bostrom, Xinyu Zhao, Swarat Chaudhuri, and Greg Durrett. Flexible Generation of Natural Language Deductions. *Empirical Methods in Natural Language Processing (EMNLP)*, 2021.
- [TASE21] **Yue Wang**, **Abdullah Al Redwan Newaz**, Juan David Hernández, Swarat Chaudhuri, and Lydia E. Kavragi. Online Partial Conditional Plan Synthesis for POMDPs With Safe-Reachability Objectives: Methods and Experiments. *IEEE Transactions on Automation Science and Engineering*, 2021.
- [IROS21-a] Shlok Sobti, Rahul Shome, Swarat Chaudhuri, and Lydia E. Kavragi. A Sampling-based Motion Planning Framework for Complex Motor Actions. *International Conference on Intelligent Robots and Systems (IROS)*, 2021.
- [IROS21-b] Jiayi Wei, Tongrui Li, Swarat Chaudhuri, Isil Dillig, and Joydeep Biswas. OneVision: Centralized to Distributed Controller Synthesis with Delay Compensation. *International Conference on Intelligent Robots and Systems (IROS)*, 2021.

- [NeurIPS20] **Ameesh Shah***, Eric Zhan*, Jennifer J. Sun, **Abhinav Verma**, Yisong Yue, and Swarat Chaudhuri. Learning Differentiable Programs with Admissible Neural Heuristics. *Neural Information Processing Systems (NeurIPS)*, 2020.
- [NeurIPS20] **Greg Anderson**, **Abhinav Verma**, Isil Dillig, and Swarat Chaudhuri. Neurosymbolic Reinforcement Learning with Formally Verified Exploration. *Neural Information Processing Systems (NeurIPS)*, 2020.
- [VLDB20] Rohan Mukherjee, Chris Jermaine, and Swarat Chaudhuri. Searching a Database of Source Codes Using Contextualized Code Search. *Very Large Databases (VLDB)*, 2020.
- [NeurIPS19] **Abhinav Verma***, Hoang M. Le*, Yisong Yue, and Swarat Chaudhuri. Imitation-Projected Policy Gradient for Programmatic Reinforcement Learning. *Neural Information Processing Systems (NeurIPS)*, 2019.
- [ICML19] Richard Cheng, **Abhinav Verma**, Gabor Orosz, Swarat Chaudhuri, Yisong Yue, and Joel Burdick. Control Regularization for Reduced Variance Reinforcement Learning. *International Conference on Machine Learning (ICML)*, 2019.
- [PLDI19] Greg Anderson, Shankara Pailoor, Isil Dillig, and Swarat Chaudhuri. Optimization and Abstraction: A Synergistic Approach for Analyzing Neural Network Robustness. *Symposium on Programming Language Design and Implementation (PLDI)*, 2019. (**Distinguished Paper**)
- [RAL19] **Yue Wang**, Swarat Chaudhuri, and Lydia Kavraki. Point-Based Policy Synthesis for POMDPs with Boolean and Quantitative Objectives. *IEEE Robotics and Automation Letters (RAL)*, 2019.
- [ICLR19] **Josh Michalenko**, **Abhinav Verma**, **Ameesh Shah**, Richard G. Baraniuk, Swarat Chaudhuri, Ankit B. Patel. Representing Formal Languages: A Comparison between Finite Automata and Recurrent Neural Networks. *International Conference on Learning Representations (ICLR)*, 2019.
- [NeurIPS18] Lazar Valkov, **Dipak Chaudhari**, Akash Srivastava, Charles A. Sutton, and Swarat Chaudhuri. Synthesis of Differentiable Functional Programs for Lifelong Learning. *Neural Information Processing Systems (NeurIPS)*, 2018.
- [WAFR18] **Yue Wang**, Swarat Chaudhuri, and Lydia Kavraki. Online Partial Conditional Plan Synthesis for POMDPs with Safe-Reachability Objectives. *Workshop on Algorithmic Foundations of Robotics (WAFR)*, 2018.
- [ICML18] **Abhinav Verma**, **Vijayaraghavan Murali**, Rishabh Singh, Pushmeet Kohli, and Swarat Chaudhuri. Programmatically Interpretable Reinforcement Learning. *International Conference on Machine Learning (ICML)*, 2018. (**Long Talk**)
- [CAV18] Suguman Bansal, Swarat Chaudhuri, and Moshe Y. Vardi. Automata vs. Linear-Programming Discounted-Sum Inclusion. *International Conference on Computer-Aided Verification (CAV)*, 2018.
- [IJRR18] **Neil Dantam**, Swarat Chaudhuri, and Lydia Kavraki. An Incremental Constraint-Based Framework for Task and Motion Planning. *International Journal of Robotics Research*, 2018.
- [RAM18] **Neil Dantam**, Swarat Chaudhuri, and Lydia Kavraki. The Task Motion Kit. *IEEE Robotics & Automation Magazine*, 2018.

- [AAMAS18] **Yue Wang**, Swarat Chaudhuri, and Lydia Kavraki. Bounded Policy Synthesis for POMDPs with Safe-Reachability Objectives. *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, 2018.
- [ICLR18] **Vijayaraghavan Murali**, Letao Qi, Swarat Chaudhuri, and Chris Jermaine. Neural Sketch Learning for Conditional Program Generation. *International Conference for Learning Representations*, 2018. **(Oral Presentation)**
- [S&P18] Timon Gehr, Matthew Mirman, Dana Drachler Cohen, Petar Tsankov, Swarat Chaudhuri, and Martin Vechev. AI²: Safety and Robustness Certification of Neural Networks with Abstract Interpretation. *IEEE Symposium on Security and Privacy (S&P)*, 2018.
- [ICSE18] **Yanxin Lu**, Swarat Chaudhuri, David G. Melski, and Chris Jermaine. Program Splicing. *International Conference on Software Engineering (ICSE)*, 2018.
- [FOSSACS18] Suguman Bansal, Swarat Chaudhuri, and Moshe Y. Vardi. Comparator Automata in Quantitative Verification. *International Conference on Foundations of Software Science and Computation Structures (FoSSaCS)*, 2018.
- [FSE17] **Vijayaraghavan Murali**, Swarat Chaudhuri, and Chris Jermaine. Bayesian Specification Learning for Finding API Usage Errors. *European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE)*, 2017.
- [PLDI17] Yu Feng, Ruben Martins, Jacob Van Geffen, Isil Dillig, and Swarat Chaudhuri. Component-Based Synthesis of Table Consolidation and Transformation Tasks from Examples. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2017.
- [RSS16] **Neil T. Dantam**, Zachary Kingston, Swarat Chaudhuri, and Lydia E. Kavraki. Incremental Task and Motion Planning: A Constraint-Based Approach. *Robotics: Science and Systems (RSS)*, 2016.
- [ICAPS16] **Yue Wang, Neil T. Dantam**, Swarat Chaudhuri, and Lydia E. Kavraki. Task and Motion Policy Synthesis as Liveness Games. *International Conference on Automated Planning and Scheduling (ICAPS)*, 2016.
- [PLDI16] Navid Yaghmazadeh, Christian Klinger, Isil Dillig, and Swarat Chaudhuri. Synthesizing transformations on hierarchically structured data. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2016.
- [VMCAI16] Kengo Kido, Swarat Chaudhuri and Ichiro Hasuo. Abstract interpretation with infinitesimals — towards scalability in nonstandard static analysis. *International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*, 2016.
- [VSTTE15] Tewodros A. Beyene, Swarat Chaudhuri, Corneliu Popeea, and Andrey Rybalchenko. Recursive Games for Compositional Program Synthesis. *Verified Software: Theories, Tools, and Experiments (VSTTE)*, 2015.
- [CDC15] Zhenqi Huang, Yu Wang, Sayan Mitra, Geir Dullerud and Swarat Chaudhuri. Controller synthesis with inductive proofs for piecewise linear systems: an SMT-based algorithm. *54th IEEE Conference on Decision and Control (CDC)*, 2015.
- [WWW15] **Yanxin Lu**, Joe Warren, Christopher Jermaine, Swarat Chaudhuri, and Scott Rixner. Grading the Graders: Motivating Peer Graders in a MOOC. *24th International World Wide Web Conference (WWW)*, 2015.
- [PLDI15] **John Feser**, Swarat Chaudhuri, and Isil Dillig. Synthesizing data structure transformations from input-output examples. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2015.

- [ICDM14] Anna Drummond, **Yanxin Lu**, Swarat Chaudhuri, Chris Jermaine, Scott Rixner, and Joe Warren. Learning to grade student programs in a massive open online course. *IEEE International Conference on Data Mining (ICDM)*, 2014.
- [CAV14] Thomas Dillig, Isil Dillig, and Swarat Chaudhuri. Optimal guard synthesis for memory safety. *International Conference on Computer-Aided Verification (CAV)*, 2014.
- [PLDI14] Rishi Surendran, Raghavan Raman, Swarat Chaudhuri, John Mellor-Crummey, and Vivek Sarkar. Test Driven Repair of Data Races in Structured Parallel Programs. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2014.
- [ICRA14] **Srinivas Nedunuri, Sailesh Prabhu**, Mark Moll, Swarat Chaudhuri, and Lydia Kavraki. SMT-Based Synthesis of Integrated Task and Motion Plans for Mobile Manipulation. *IEEE International Conference on Robotics and Automation (ICRA)*, 2014.
- [POPL14] Swarat Chaudhuri, **Martin Clochard**, and Armando Solar-Lezama. Bridging Boolean and quantitative synthesis using smoothed proof search. In *41st ACM Symposium on Principles of Programming Languages (POPL)*, 2014.
- [POPL14] Tewodros Beyene, Swarat Chaudhuri, Corneliu Popeea, and Andrey Rybalchenko. A constraint-based approach to solving games on infinite graphs. In *41st ACM Symposium on Principles of Programming Languages (POPL)*, 2014.
- [POPL14] Swarat Chaudhuri, Azadeh Farzan, and Zachary Kincaid. Consistency analysis of decision-making programs. In *41st ACM Symposium on Principles of Programming Languages (POPL)*, 2014.
- [ACSAC13] Sirinda Palahan, Domagoj Babic, Swarat Chaudhuri, and Daniel Kifer. Extraction of statistically significant malware behaviors. *Annual Computer Security Applications Conference (ACSAC)*, 2013.
- [OOPSLA13] Jisheng Zhao, **Roberto Lubliner**, Zoran Budimlic, Swarat Chaudhuri, and Vivek Sarkar. Isolation for nested task-parallelism. *International Conference on Object Oriented Programming, Systems, Languages and Applications (OOPSLA)*, 2013.
- [ATVA13] Roopsha Samanta, Jyotirmoy Deshmukh, and Swarat Chaudhuri. Robustness analysis of string transducers. In *Automated Technology for Verification and Analysis (ATVA)*, 2013.
- [LICS13] Swarat Chaudhuri, Sriram Sankaranarayanan and Moshe Vardi. Regular real analysis. *ACM/IEEE Symposium on Logic in Computer Science (LICS)*, 2013.
- [VMCAI13] Roopsha Samanta, Jyotirmoy Deshmukh, and Swarat Chaudhuri. Robustness analysis of networked systems. In *International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*, 2013.
- [CACM12] Swarat Chaudhuri, Sumit Gulwani, and **Roberto Lubliner**. Continuity and robustness of programs. *Research highlights, Communication of the ACM (CACM)*, August 2012.
- [CAV12] Swarat Chaudhuri and Armando Solar-Lezama. Euler: A System for numerical optimization of programs. In *International Conference on Computer-Aided Verification (CAV)*, 2012.
- [TOPLAS11] Rajeev Alur, Swarat Chaudhuri, and P. Madhusudan. Software model-checking with languages of nested trees. *ACM Transactions on Programming Languages and Systems (TOPLAS)*, Volume 33 Issue 5, November 2011.

- [FSE11] Swarat Chaudhuri, Sumit Gulwani, **Roberto Lubliner**, and **Sara Navidpour**. Proving programs robust. *Joint European Software Engineering Conference and ACM Symposium on the Foundations of Software Engineering (ESEC/FSE)*, 2011. (**Distinguished Paper; Invited as a CACM Research Highlight**)
- [OOPSLA11] **Roberto Lubliner**, Jisheng Zhao, Zoran Budimlic, Swarat Chaudhuri, and Vivek Sarkar. Delegated isolation. *International Conference on Object Oriented Programming, Systems, Languages and Applications (OOPSLA)*, 2011.
- [USENIX-SEC11] William Enck, Damien Ocateau, Swarat Chaudhuri, and Patrick McDaniel. A path to Android application security. *The 20th USENIX Security Symposium*, 2011.
- [CAV11] Swarat Chaudhuri and Armando Solar-Lezama. Smoothing a program soundly and robustly. In *International Conference on Computer-Aided Verification (CAV)*, 2011.
- [PLDI11] Saurabh Srivastava, Sumit Gulwani, Swarat Chaudhuri, and Jeff Foster. Path-based inductive synthesis for program inversion. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2011.
- [CAV10] Pavol Černý, Arjun Radhakrishna, Damien Zufferey, Swarat Chaudhuri, and Rajeev Alur. Model checking of linearizability of concurrent list implementations. In *International Conference on Computer-Aided Verification (CAV)*, 2010.
- [PLDI10] Swarat Chaudhuri and Armando Solar-Lezama. Smooth interpretation. In *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2010.
- [POPL10] Swarat Chaudhuri, Sumit Gulwani, and **Roberto Lubliner**. Continuity analysis of programs. In *37th ACM Symposium on Principles of Programming Languages (POPL)*, 2010.
- [VMCAI10] Rajeev Alur and Swarat Chaudhuri. Temporal reasoning for procedural programs. In *International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*, 2010.
- [OOPSLA09] **Roberto Lubliner**, Swarat Chaudhuri, and Pavol Černý. Parallel programming with object assemblies. In *International Conference on Object Oriented Programming, Systems, Languages and Applications (OOPSLA)*, 2009.
- [FSE09] Chao Wang, Swarat Chaudhuri, Aarti Gupta, and Yang Yu. Symbolic Pruning of Concurrent Program Executions. In *7th Joint European Software Engineering Conference and ACM Symposium on the Foundations of Software Engineering (ESEC/FSE)*, 2009.
- [ISSTA08] Sriram Sankaranarayanan, Swarat Chaudhuri, Franjo Ivancic, and Aarti Gupta. Dynamically inferring data preconditions over predicates by tree learning. In *International Symposium on Software Testing and Analysis (ISSTA)*, 2008.
- [POPL08] Swarat Chaudhuri. Subcubic algorithms for recursive state machines. In *35th ACM Symposium on Principles of Programming Languages (POPL)*, 2008.
- [SPIN07] Swarat Chaudhuri and Rajeev Alur. Instrumenting C programs with nested word monitors. In *14th International Symposium on Model Checking Software*, 2007.
- [TACAS07] Rajeev Alur, Pavol Černý, and Swarat Chaudhuri. Model checking on trees with path equivalences. In *13th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2007.
- [FSTTCS06] Rajeev Alur and Swarat Chaudhuri. Branching pushdown tree automata. In *26th Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, 2006.

- [CAV06] Rajeev Alur, Swarat Chaudhuri, and P. Madhusudan. Languages of nested trees. In *18th International Conference on Computer-Aided Verification (CAV)*, 2006.
- [POPL06] Rajeev Alur, Swarat Chaudhuri, and P. Madhusudan. A fixpoint calculus for local and global program flows. In *33rd Annual ACM Symposium on Principles of Programming Languages (POPL)*, 2006.
- [TACAS05] Rajeev Alur, Swarat Chaudhuri, Kousha Etessami, and P. Madhusudan. On-the-fly reachability and cycle detection for recursive state machines. In *11th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2005.
- [CONCUR03] Rajeev Alur, Swarat Chaudhuri, Kousha Etessami, Sudipto Guha, and Mihalis Yannakakis. Compression of partially ordered strings. In *14th International Conference on Concurrency Theory (CONCUR)*, 2003.

Tutorials

- Summer 2022 Swarat Chaudhuri and Yisong Yue. Neurosymbolic Program Synthesis. Tutorial at *Summer School on Neurosymbolic Programming*, 2022.
- Spring 2018 Swarat Chaudhuri, Chris Jermaine, and Vijayaraghavan Murali. Bayou: Deep Learning over “Big Code” for Program Analysis and Synthesis. Tutorial at *Symposium on Programming Language Design and Implementation (PLDI)*, 2018.

Teaching

- Spring 2020, Spring 2021, Spring 2022 *Program Synthesis*. Introductory graduate course on program synthesis and learning at UT Austin. Diversity course for the CS department’s PhD program.
- Fall 2021 *Safe and Ethical AI*. Undergraduate elective on safe and trustworthy machine learning at UT Austin.
- Fall 2020 *Logic in Computer Science and Artificial Intelligence*. Undergraduate elective on logic in computer science at UT Austin.
- Spring 2014, Fall 2014, Fall 2015, Fall 2016, Fall 2018, Fall 2019 *COMP 382: Reasoning about Algorithms*. Required undergraduate course on theoretical computer science at Rice University.
- Spring 2018 *COMP 503: Reasoning about Software*. Introductory graduate course on formal methods at Rice University.
- Fall 2012, Fall 2013, Spring 2015 *COMP 507: Computer-Aided Program Design*. Introductory graduate course on program verification and synthesis at Rice University.
- Spring 2012, Spring 2013 *COMP 482: Design and Analysis of Algorithms*. Senior undergraduate course on algorithms at Rice University.
- Spring 2013 *COMP 607: Automata, Logic, and Infinite Games*. Graduate seminar at Rice University.
- Spring 2012 *COMP 607: Program Synthesis*. Graduate seminar at Rice University.
- Fall 2011 *COMP 411: Principles of Programming Languages*. Senior undergraduate and entry-level graduate course on programming languages at Rice University.
- Spring 2011 *CSE 598: Exploiting Concurrency Efficiently and Correctly*. Graduate-level course on concurrent and parallel programming at Pennsylvania State University.
- Fall 2010, Fall 2009, Fall 2008 *CMPSC 461: Programming Language Concepts*. Senior undergraduate and entry-level graduate course on programming languages at Pennsylvania State University.
- Fall 2010 *CSE 597-C: Program Analysis Seminar*. Graduate-level seminar on program analysis and synthesis at Pennsylvania State University.

- Spring 2010 *CSE 520: The Science of Computer Programming.* Graduate-level course on program verification and abstract interpretation at Pennsylvania State University.
- Spring 2009 *CSE 598: Program Analysis.* Advanced graduate-level course on program analysis and abstract interpretation at Pennsylvania State University.
- Spring 2008 *CSE 598: Computer-Aided Verification.* Advanced graduate-level course on model checking at Pennsylvania State University.

Research group

- Ph.D. students
- Samuel Anklesaria. Fall 2021 onwards.
Research topic: Bayesian program synthesis.
- Atharva Sehgal. Fall 2021 onwards.
Research topic: Rule learning from perceptual inputs.
- Meghana Sistla. Fall 2021 onwards.
Research topic: CFLOBDDs: a new class of succinct decision diagrams.
- Chenxi Yang. Spring 2020 onwards.
Research topic: Formally verified machine learning.
- Greg Anderson. Spring 2020 onwards, co-advised with Isil Dillig.
Research topic: Formally verified reinforcement learning.
- Joshua Hoffman. Summer 2020 onwards, co-advised with Joydeep Biswas.
Research topic: Lifelong reinforcement learning through neurosymbolic methods.
- Yeming Wen. Spring 2021 onwards.
Research topic: Neurosymbolic language models for code.
- Postdoctoral Researchers
- Anders Miltner. Summer 2020 onwards, co-advised with Isil Dillig.
Research topic: Inductive program synthesis.
- Masters Students
- Christopher Hahn. Summer 2022 onwards.
Research topic: Reinforcement learning for program synthesis.
- Graduated Ph.D. students
- Abhinav Verma. Ph.D. student at Rice (2016-2020), Ph.D. student at UT Austin (Fall 2020-Summer 2021).
Thesis: Programmatic reinforcement learning.
First employment: Hartz Family Career Development Assistant Professor, Penn State University, starting Fall 2022.
- Yue Wang. Ph.D. student at Rice (2013-2018). First employment at Facebook.
Thesis: Bounded Policy Synthesis for POMDPs with Safe-Reachability Objectives.
- Yanxin Lu. Ph.D. student at Rice (2012-2018). First employment at Facebook.
Thesis: Corpus-Driven Systems for Program Synthesis and Refactoring.
- Roberto Lublinerman. Ph.D. student at Penn State (2008-2012). First employment at Google.
Thesis: *Concurrent Assemblies: An execution model for irregular parallelism.*
- Former postdoctoral Researchers
- Calvin Smith. Summer 2020-Spring 2022.
Research topic: Learning logic programs from data.

Dipak Chaudhari. Summer 2017-Spring 2022.
Research topic: Neural program synthesis; calculational program synthesis.

Vijayaraghavan Murali. Spring 2015-Summer 2018; currently a researcher at Facebook.
Research topic: Neural program analysis and synthesis.

Edwin Westbrook. Summer 2011-Summer 2013; currently a researcher at Galois.
Research topic: Language-based approximate computation.

Srinivas Nedunuri. Summer 2012-Fall 2014; now a researcher at Sandia National Laboratories.
Research topic: Synthesis of policies and programs for robots.

Neil Dantam. Spring 2015-Summer 2017; now an Assistant Professor at Colorado School of Mines.
Research topic: Integrated task and motion planning for robots.

Hassan Eldib. Summer 2015-Spring 2017; now an Assistant Professor at Arab Academy for Science and Technology, Cairo.
Research topic: Data-driven program synthesis.

Graduated Masters students Ameer Shah. Undergraduate researcher at Rice from Fall 2017-Summer 2019; Masters student from Summer 2019-Summer 2020; now a Ph.D. student at UC Berkeley.
Topic of master's thesis: Learning differentiable programs with admissible neural heuristics.

John Feser. Undergraduate researcher at Rice from Fall 2013-Spring 2015; Masters student from Summer 2015-Summer 2016; now a Ph.D. student at MIT.
Topic of master's thesis: Inductive Program Synthesis from Input-Output Examples.

Afsaneh Rahbar. MS student at Rice; finished MS in Fall 2017.
Topic of master's thesis: Data-driven program verification

Suguman Bansal. MS student at Rice; finished MS in Summer 2016.
Topic of master's thesis: Algorithmic analysis of regular repeated games.

Sailesh Prabhu. MS student at Rice. Graduated Summer 2014.
Topic of master's thesis: Automatic synthesis of robot motion plans.

Ye Fang. Fall 2012-Fall 2014.
Topic of master's thesis: Computer-aided mechanism design

Sara Navidpour. ME (Masters without thesis) student at Penn State; graduated Fall 2011.

Former Undergraduate Researchers Ana Brendel. UT Austin, Fall 2020-Summer 2022.
Research topic: Program synthesis using angelic execution.

Jack Roper. UT Austin, Fall 2021-Summer 2022.
Research topic: Data generation and augmentation for neural program synthesis.

Jacqueline Li. Rice University, Fall 2018-Summer 2019.
Research topic: Learning-based program synthesis.

Grace Tan. Rice University, Fall 2018-Summer 2019.
Research topic: Learning-based program synthesis.

Kyran Adams. Rice University, Fall 2018-Summer 2019.
Research topic: Programmatically interpretable machine learning.

Visiting Ph.D. students Kengo Kido. Student at University of Tokyo; visited Rice during May-June 2014.
Research topic: Abstract interpretation using infinitesimals.

Martin Clochard. Masters student at ENS Paris; visited Rice during March–August 2012.
Research topic: Program synthesis using smoothed search.

External funding

- PI *SHF: Medium: Semantics-Aware Neural Models for Program Synthesis.* NSF Medium award with Chris Jermaine (Rice) and Tom Reps (Wisconsin). My amount: \$400,000. Award period 2022-2025.
- Gift Meta Faculty Award. Total amount \$55,000. 2022.
- co-PI *Reinforcement Learning Modulo Formal Verification : A Synergistic Approach to High-Assurance Autonomous Agents.* ONR Science of Artificial Intelligence award with Rajeev Alur (Penn), Ufuk Topcu (UT Austin), and Michael Littman (Brown). My amount: \$300,000. Award period 2020-2024.
- PI *NSCORE: Neuro-Symbolic Co-Designer Using Oracle- Guided Synthesis and Reinforcement Learning.* DARPA Symbiotic Design award. SRI is the lead institution. My amount: \$600,000. Award period: 2020-2024.
- PI *Modularity, Constraints and Multimodality in Learning for Complex, Long-Horizon, Sequential Decision Making.* DoD (Army) award with Ufuk Topcu and Scott Niekum. My amount: \$250,000. Award period: 2020-2023.
- PI *Understanding the World with Code.* NSF Expeditions award with Armando Solar-Lezama, Michael Carbin, Martin Rinard, Regina Barzilay, Philip Sharp, and Tommi Jaakkola from MIT, Yisong Yue (Caltech), Isil Dillig (UT Austin), Chris Jermaine (Rice), Osbert Bastani (UPenn), and Noah Goodman (Stanford). My amount: \$616,610. Award period 2020-2025.
- PI *Bridging Automated Formal Reasoning and Continuous Optimization for Provable Safe Deep Learning.* Collaborative NSF Medium grant with Isil Dillig. My amount: \$500,000. Award period 2019-2023.
- PI *Formal Analysis and Synthesis of Multiagent Systems with Incentives.* Collaborative NSF Medium grant with Moshe Vardi and Rajeev Alur. My amount: \$300,000. Award period 2017-2022.
- co-PI *Artemis for Automated Software Generation.* DARPA Intent-Defined Adaptive Software (IDAS) award with Grammatech, Inc., Isil Dillig (UT Austin) and Armando Solar-Lezama (MIT). Award period: 2020-2021.
- PI *Leveraging Symbolic Representations for Safe and Assured Learning.* DARPA Assured Autonomy award. My amount: \$450,000. Award period: 2019-2021.
- PI *Automating Robot Programming Through Constraint Solving and Motion Planning.* Collaborative NSF Medium grant with Lydia Kavraki. Total amount \$1,000,000. Award period 2015-2019.
- Gift Google Faculty Award. Total amount \$50,000. 2015.
- co-PI *Pliny: An End-to-End System for Big Code Analytics.* Award from the DARPA MUSE program. With Vivek Sarkar, Christopher Jermaine, Moshe Vardi, and Keith Cooper (Rice); Isil Dillig and Thomas Dillig (UT Austin); Thomas Reps and Ben Liblit (Wisconsin); and GammaTech, Inc. The award spans three technical areas; I am the lead of Technical Area 4, which focuses on program verification, repair, and synthesis. Total amount \$11 million (approximately). 2014-2018.

- co-PI *Science of Security for Systems*. NSA grant with Sayan Mitra and Geir Dullerud (UIUC). Total amount \$806,502. 2014-2017.
- PI *Computer-Aided Grading, Feedback, and Assignment Creation in Massive Online Programming Courses*. Small NSF grant with Scott Rixner and Joe Warren. Total amount \$300,000. Award period 2013-2015.
- PI *Marrying Program Analysis and Numerical Search*. Collaborative NSF Medium grant with Armando Solar-Lezama and Illya Hicks. Total amount \$1,200,000. Award period 2012-2016.
- PI *Chorus: Dynamic Isolation for Shared-Memory parallelism*. Collaborative NSF Medium grant with Vivek Sarkar. Total amount \$1,200,000. Award period 2010-2014.
- Gift \$10,000 gift from Microsoft Research. 2011.
- PI *CAREER: Robustness Analysis for Uncertain Programs: Theory, Algorithms, and Tools*. NSF CAREER award. Total amount \$426,457. Award period 2010-2015.

Departmental Service at UT Austin

- Ph.D. admissions committee Co-chair, 2021-22; chair, 2020-21; member, 2019-20
- Faculty advisor Graduate Application Assistance Program (GAAP), 2020-21
- Ph.D. committee Kostas Ferles (Advisor: Isil Dillig); Yuqian Jiang (Advisor: Peter Stone)
- RPE committee Jifan Chen (Advisor: Greg Durrett); Ishan Durugkar (Advisor: Peter Stone); Dhananjay Raju (Advisor: Ufuk Topcu); William Kretschmer (Advisor: Scott Aaronson); Jordan Schneider (Advisor: Scott Niekum); Kaj Bostrom (Advisor: Greg Durrett); Joshua Deng (Advisor: Dana Moshkovitz)

External Service

- Program Chair Conference on Computer-Aided Verification (CAV), 2016.
Workshop on Numerical Software Verification (NSV), 2012.
Workshop on Programming Language Technology for Massive Open Online Courses (PLOOC), 2014.
POPL Off the Beaten Track (OBT), 2015.
- General Chair Symposium on Machine Programming (MAPS), 2022.
- Area Chair International Conference for Learning Representations (ICLR), 2021, 2022.
Neural Information Processing Systems (NeurIPS), 2020, 2021, 2022.
International Conference on Machine Learning (ICML), 2021, 2022.
Conference on Computer-Aided Verification (CAV), 2019.
- Program Committee ACM Symposium on Programming Language Design and Implementation (PLDI), 2013, 2017, and 2021
ACM Symposium on Principles of Programming Languages (POPL), 2012, 2015, and 2019.

- Conference on Computer-Aided Verification (CAV), 2012, 2015, 2016, 2017, 2018, 2019, 2020, 2022.
- Symposium on Logic in Computer Science (LICS), 2022.
- ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2014.
- AAAI Conference on Artificial Intelligence (AAAI), 2020 and 2021.
- Conference on Uncertainty in Artificial Intelligence (UAI), 2019 and 2020.
- Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI), 2011 and 2021.
- Foundations of Software Science and Computation Structures (FoSSaCS), 2013.
- Workshop on Numerical Software Verification (NSV), 2011.
- Symposium on Automated Technology for Verification and Analysis (ATVA), 2011.
- Symposium on Games, Automata, Logics and Formal Verification (GandALF), 2011.
- ACM Conference on Languages, Compilers, and Tools for Embedded Systems (LCTES), 2009.
- 15th Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), 2009.
- External review committee and External Program Committee
- ACM Symposium on Programming Language Design and Implementation (PLDI), in 2012, 2014, 2015, 2016, 2019.
- ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), in 2011 and 2013.
- ACM Symposium on Principles of Programming Languages (POPL), 2013.
- Publicity Chair
- ACM Symposium on Principles of Programming Languages (POPL), 2010–12.
- Co-organizer
- Workshop on Exploiting Concurrency Efficiently and Correctly (EC²), 2010 and 2011.
- Referee
- Many venues, including Neural Information Processing Systems (NeurIPS), International Conference on Machine Learning (ICML), International Conference on Learning Representations (ICLR), Principles of Programming Languages (POPL), Computer-Aided Verification (CAV), Programming Language Design and Implementation (PLDI), Principles of Parallel Programming (PPoPP), Logic in Computer Science (LICS), Tools and Algorithms for the Construction and Analysis of Systems (TACAS), Concurrency Theory (CONCUR), Static Analysis Symposium (SAS), Computer Science Logic (CSL), Journal of Logic and Algebraic Programming, Symposium on Discrete Algorithms (SODA), Architectural Support for Programming Languages and Operating Systems (ASPLOS), Foundations of Software Technology and Theoretical Computer Science (FSTTCS), ACM Transactions on Programming Languages and Systems (TOPLAS).

Invited talks

- Summer and Fall 2022 *Neurosymbolic Programming*. Invited seminar talk at Google Research India and USC.
- Summer and Fall 2020 *Neurosymbolic Programming*. Invited seminar talk at University of Wisconsin and Rice University.
- Summer 2019 *Machine Learning as Program Synthesis*. Keynote speech at the International Conference on Computer-Aided Verification (CAV), 2019.

- Fall 2018 and Spring 2019 *Program Synthesis for Reliable and Interpretable Artificial Intelligence*. Given at Georgia Tech, UT Austin, University of Michigan, EPFL, and UCLA.
- Spring 2018 *Program Synthesis at the Edge of Artificial Intelligence*. Given at Microsoft Research, Google Brain, UC San Diego, and Caltech.
- Fall 2017 *Learning to Synthesize Programs*. Given at CU Boulder.
- Fall 2017 *Program Synthesis: An Old New Problem*. Given at EPFL.
- Spring 2017 *Learning to Write Code, Automatically*. Given at Northeastern University, University of Pennsylvania, Princeton University, University of Maryland, Google NYC, Amazon NYC, and Brown University.
- November 2016 *Guiding Formal Methods with Discovered Knowledge*. Keynote talk at Haifa Verification Conference, Haifa, Israel.
- Spring 2014 *Adventures in Automated Programming*. Given at Carnegie Mellon University, University of Illinois, and University of Pennsylvania.
- Summer 2013 *Bridging the Discrete and the Continuous in Reasoning about Programs*. Given at Microsoft Research, Cambridge and Institute for Science and Technology, Austria.
- Summer 2012 *Computer-Aided Numerical Programming*. Given at Ken Kennedy Institute for Information Technology (at Rice University) and Pennsylvania State University.
- Fall 2011 *Composing Composure: Reasoning about Robustness of Programs*. Given at University of Pennsylvania, Princeton University.
- Spring 2011 *When Programs Make No Jumps: Marrying the Discrete and the Continuous in Program Analysis*. Given at Rice University, Northeastern University, University of California at Irvine.
- Spring 2010, Summer 2010 *Cauchy: Towards an Analytical Calculus of Computation*. Given at New York University, Cornell University, University of Toronto, and Microsoft Research.
- Fall 2009, Summer 2009 *Parallel Programming with Object Assemblies*. Given at MIT and Microsoft Research.
- Fall 2008, Spring 2009 *Programming with Sociable Resources*. Given at NEC Laboratories, University of Pennsylvania, and Rice University.
- Spring 2007 *Context-sensitive software model checking*. Given at Pennsylvania State University, University of Texas at Austin, Carnegie Mellon University, NEC Laboratories America, and IBM T. J. Watson Research Center.

Professional memberships

Member of the Association for Computing Machinery (ACM) and the Special Interest Group on Programming Languages (ACM SIGPLAN).

Personal

- Date of birth March 27, 1979.
- Citizenship Citizen of the United States.