

Roopsha Samanta

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Research Interests

My research mission is to enable programmers to write provably reliable programs. I am particularly interested in developing algorithms and tools for automated repair and synthesis in domains such as concurrent and distributed systems, personalized education, and machine learning. An overarching theme of my research approach is the use of formal methods and programming languages techniques for these goals.

Education

- 2013 **Doctor of Philosophy** *The University of Texas at Austin.*
Dissertation: *Program Reliability through Algorithmic Design and Analysis*
Advisors: E. Allen Emerson and Vijay K. Garg
- 2003 **Master of Science** *The University of Texas at Austin.*
Report: *Joint Space-time Interference Cancellation and Channel Shortening*
Advisor: Robert W. Heath, Jr.
- 2002 **Bachelor of Engineering** *University of Mumbai.*

Employment

- Aug. 2016 – current **Assistant Professor** *Department of Computer Science, Purdue University.*
- Jan. 2014 – June 2016 **Postdoctoral Researcher** *Institute of Science and Technology Austria.*
Host: Thomas A. Henzinger
- Fall 2009 **Research Intern** *Microsoft Research, Bangalore.*
- Summer 2005 **Research Intern** *Intel Labs, Santa Clara.*

Publications

Peer-reviewed Journals

- FMSD 2016* P. Černý, E. M. Clarke, T. A. Henzinger, A. Radhakrishna, L. Ryzhyk, R. Samanta and T. Tarrach. From Non-preemptive to Preemptive Scheduling using Synchronization Synthesis. *Formal Methods in System Design*, pp 1-43, 2016.
- VT 2007 R. Samanta, R. W. Heath, Jr., and B. L. Evans. Joint Interference Cancellation and Channel Shortening for Multi-User MIMO Systems. *IEEE Transactions on Vehicular Technology*, vol. 56, pp. 652-660, 2007.
- ACHA 2007 B. Mondal, R. Samanta, and R. W. Heath, Jr. On the Voronoi Tessellations of a Sphere by an Equiangular Unit Norm Frame. *Applied and Computational Harmonic Analysis*, vol. 23, pp. 254-258, 2007.

Peer-reviewed Conferences

- CAV 2016* L. D'Antoni, R. Samanta and R. Singh. Qlose: Program Repair with Quantitative Objectives. In *Computer Aided Verification (CAV)*, 2016.
- VMCAI 2016* T. A. Henzinger, J. Otop and R. Samanta. Lipschitz-Robustness of Timed I/O Systems. In *Verification, Model Checking and Abstract Interpretation (VMCAI)*, 2016.

*The authors are ordered alphabetically.

- CAV 2015* P. Černý, E. M. Clarke, T. A. Henzinger, A. Radhakrishna, L. Ryzhyk, R. Samanta and T. Tarrach. From Non-preemptive to Preemptive Scheduling using Synchronization Synthesis. In *Computer Aided Verification (CAV)*, 2015. **Runner-up in the CAV 2015 Artifact Evaluation.**
- POPL 2015* A. Gupta, T. A. Henzinger, A. Radhakrishna, T. Tarrach and R. Samanta. Succinct Representation of Concurrent Trace Sets. In *Principles of Programming Languages (POPL)*, 2015. **Approved by the POPL 2015 Artifact Evaluation Committee.**
- FSTTCS 2014* T. A. Henzinger, J. Otop and R. Samanta. Lipschitz-Robustness of Finite-State Transducers. In *Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, 2014.
- SAS 2014 R. Samanta, O. Olivo and E. A. Emerson. Cost-aware Program Repair. In *Static Analysis Symposium (SAS)*, 2014.
- ATVA 2013 R. Samanta, J. V. Deshmukh and S. Chaudhuri. Robustness Analysis of String Transducers. In *Automated Technology for Verification and Analysis (ATVA)*, 2013.
- VMCAI 2013 R. Samanta, J. V. Deshmukh and S. Chaudhuri. Robustness Analysis of Networked Systems. In *Verification, Model Checking and Abstract Interpretation (VMCAI)*, 2013.
- ATVA 2011* E. A. Emerson and R. Samanta. An Algorithmic Framework for Synthesis of Concurrent Programs. In *Automated Technology for Verification and Analysis (ATVA)*, 2011.
- FMCAD 2008 R. Samanta, J. V. Deshmukh and E. A. Emerson. Automatic Generation of Local Repairs for Boolean Programs. In *Formal Methods in Computer Aided Design (FMCAD)*, 2008.
- Asilomar 2005 R. Samanta and R. W. Heath, Jr. Codebook Adaptation for Quantized MIMO Beamforming Systems. In *IEEE Asilomar Conference on Signals, Systems, and Computers*, 2005.
- WNCMC 2005 B. Mondal, R. Samanta and R. W. Heath, Jr. Frame Theoretic Quantization of Limited Feedback MIMO Beamforming Systems. In *Wireless Networks, Communications and Mobile Computing*, 2005.
- Asilomar 2003 R. Samanta, R. W. Heath, Jr. and B. L. Evans. Joint Space-Time Interference Cancellation and Channel Shortening. In *IEEE Asilomar Conference on Signals, Systems, and Computers* (invited), 2003.

Peer-reviewed Workshops

- SYNT 2012 R. Samanta. Towards Algorithmic Synthesis of Synchronization for Shared-Memory Concurrent Programs. In *Workshop on Synthesis (SYNT)*, 2012.

Theses

- Dissertation 2013 R. Samanta. Program Reliability through Algorithmic Design and Analysis. Ph.D. Thesis, The University of Texas at Austin, 2013.
- M.S. Report 2003 R. Samanta. Joint Space-Time Interference Cancellation and Channel Shortening. Master's Report, The University of Texas at Austin, 2003.
- B.E. Thesis 2002* K. Balakrishna, P. Biswas, A. Komban and R. Samanta. Block Matching Techniques used in Video Compression. Bachelor's Thesis, University of Mumbai, 2002.

Under Submission

- [1*] Shengwei An, Sasa Misailovic, Rishabh Singh and Roopsha Samanta. Augmented Example-based Synthesis.
- [2] David Perry, Dohyeong Kim, Roopsha Samanta and Xiangyu Zhang. SemCluster: Clustering of Programming Assignments based on Quantitative Semantic Features.

Patents

- [1] N. Himayat, R. Samanta, and S. Talwar. Link Performance Prediction Presence of Co-channel Interference. US Patent 7,697,906. 2010.

Tutorials

- POPL 2015 A. Radhakrishna and R. Samanta. Trace-based Synchronization Synthesis for Concurrent Programs. In *Principles of Programming Languages (POPL)*, 2016.

Invited Talks

Discover[i]:Component-based Parameterized Reasoning for Distributed Systems

Nov. 2018 University of Washington, Washington, USA

Nov. 2018 Microsoft Research, Redmond, USA

Computer-aided Concurrent Programming

Sep. 2018 Invited talk highlighting advances in synchronization synthesis for concurrent programs over the last four decades at Papers We Love (PWL) Conference, St. Louis, USA

Trace-based Synchronization Synthesis for Concurrent Programs

Nov. 2017 University of illinois at urbana-champaign, urbana, USA

Formal Methods Research: The What, The Why and the How

June 2017 Invited talk on overview of research in formal methods for students attending the Programming Languages Mentoring Workshop (PLMW) at Programming Languages Design and Implementation (PLDI), Barcelona, Spain

Program Distances for Repair and More!

May 2017 Invited Junior Researcher Presentation at Summit oN Advances in Programming Languages (SNAPL), Asilomar, USA

Computer-aided Programming for Concurrency and Beyond

Feb. 2016 Simon Fraser University, Burnaby, Canada

Mar. 2016 Purdue University, West Lafayette, USA

Mar. 2016 Georgia Institute of Technology, Atlanta, USA

Computer-aided Concurrent Programming using Concurrent Trace Sets

Sep. 2015 Microsoft Research, Cambridge, UK

July 2015 Samsung Research America, Mountain View, USA

July 2015 University of California, Berkeley, USA

Concurrent Trace Sets for Synchronization Synthesis

June 2015 Northeastern University, Boston, USA

Lipschitz Robustness of I/O Systems

June 2015 Max Planck Institute for Software Systems, Kaiserslautern, Germany

Succinct Representation of Concurrent Trace Sets

May 2015 University of Oxford, Oxford, UK

Feb. 2015 Vienna University of Technology, Vienna, Austria

Robustness Analysis of Networked Systems

Jan. 2013 Verification, Model Checking and Abstract Interpretation (VMCAI), Rome, Italy

Jan. 2013 Institute of Science and Technology Austria

Jan. 2013 Vienna University of Technology

Conference Talks

Qlose: Program repair with Quantitative Objectives

July 2015 Computer Aided Verification (CAV), Toronto, Canada

From Non-preemptive to Preemptive Scheduling using Synchronization Synthesis

- July 2015 Computer Aided Verification (CAV), San Francisco, USA
Succinct Representation of Concurrent Trace Sets
- Jan. 2015 Principles of Programming Languages (POPL), Mumbai, India
Lipschitz Robustness of Finite-State Transducers
- Dec. 2014 Foundations of Software Technology and Theoretical Computer Science (FSTTCS), New Delhi, India
Cost-aware Program Repair
- Sep. 2014 Static Analysis Symposium (SAS)
Robustness Analysis of String Transducers
- Oct. 2013 Automated Technology for Verification and Analysis (ATVA), Hanoi, Vietnam
An Algorithmic Framework for Synthesis of Concurrent Programs
- Oct. 2011 Automated Technology for Verification and Analysis (ATVA), Taipei, Taiwan
Automatic Generation of Local Repairs for Boolean Programs
- Nov. 2008 Formal Methods in Computer Aided Design (FMCAD)

Talks at Workshops and Meetings

- Dec. 2016 Midwest Programming Languages Summit, University of Chicago, Chicago, USA
Qlose: Program repair with Quantitative Objectives
Towards Computer-aided Concurrent Programming
- June 2015 Annual Expeditions in Computer Augmented Program Engineering (ExCAPE) meeting, Massachusetts Institute of Technology, Boston, USA
Robustness Analysis of Transducers
- May 2014 Alpine Verification Meeting, Frejus, France
Synchronization Synthesis for Shared-Memory Concurrent Programs
- Jan. 2013 Principles of Programming Languages (POPL) Student Talk, Rome, Italy
Towards Algorithmic Synthesis of Synchronization for Shared-Memory Concurrent Programs
- July 2012 Workshop on Synthesis (SYNT), colocated with CAV, Berkeley, USA
- April 2012 Dagstuhl Seminar on Software Synthesis, Wadern, Germany

Teaching

- Spring 2019 CS56000: Reasoning About Programs. Purdue University
- Fall 2018 CS30700: Software Engineering I. Purdue University
- Fall 2017 CS59000-CPR: Reasoning About Programs. Purdue University
- Spring 2017 CS45600: Programming Languages. Purdue University
- Fall 2016 CS59000-CPR: Computer-aided Program Reasoning. Purdue University

PhD Students

- Fall 2018-current Christopher Wagner (CS, Purdue)
- Fall 2017-current Shengwei An (CS, Purdue)
- Fall. 2017-current Xuankang Lin. Co-supervisor: Suresh Jagannathan. (CS, Purdue)
- Spr. 2017-current Nouraldin Jaber. Co-supervisor: Milind Kulkarni (ECE, Purdue)
- Spr. 2017-current David Perry. Co-supervisor: Xiangyu Zhang (CS, Purdue)

Undergraduate Students

Supervision for the following students has been equivalent to an independent study with weekly meetings to work on a research project driven by me.

- Spr. 2018 Austin Horning (CS, Purdue)
- Fall 2017 Clayton Thomas (CS/Math, Purdue)
- Sum. 2017 Mohan Sai Teja Dantam (IIT Bombay)
- Spr. 2017 Michael Roth (CS, Purdue)

Other Graduate Student Supervision

Supervision for the following students has been equivalent to an independent study with weekly meetings to work on a research project driven by me.

- Fall 2017 Jacob Bond (Math, Purdue)
- Fall 2017 Guannan Wei (CS, Purdue)
- Spr. 2017-Sum. 2017 Habiba Farroukh (CS, Purdue)
- 2015-2016 Bernhard Kragl. Doctoal Student of Tom Henzinger (IST Austria)
- 2014-2016 Thorsten Tarrach. Doctoal Student of Tom Henzinger (IST Austria)

Professional Service

- Steering Committee Workshop on Design and Analysis of Robust Systems (DARS). 2018-current.
- Program Co-chair Programming Language Design and Implementation (PLDI)-Artifact Evaluation 2019. Workshop on Design and Analysis of Robust Systems (DARS)2017. Co-located with Computer-Aided Verification (CAV) 2017. Workshop on Design and Analysis of Robust Systems (DARS) 2016. Colocated with Cyberphysical Systems Week (CPS Week) 2016.
- Publicity chair CAV 2016.
- Program Committee Computer-Aided Verification (CAV). 2019, 2018, 2017. Programming Language Design and Implementation (PLDI) External Review Committee. 2019. Object-oriented Programming, Systems, Languages, and Applications (OOPSLA). 2018. Formal Methods in Computer Aided Design (FMCAD). 2017. Verification, Model Checking and Abstract Interpretation (VMCAI). 2017, 2016. Workshop on Synthesis (SYNT) 2018,2017,2016.
- Conference Reviewer Programming Language Design and Implementation (PLDI) 2016, Formal Modeling and Analysis of Timed Systems (FORMATS) 2015, Foundations of Software Science and Computation Structures (FOSSACS) 2013, Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2013, Automated Technology for Verification and Analysis (ATVA) 2012, 2007, International Conference On Principles Of Distributed Systems (OPODIS) 2012, Computer Aided Verification (CAV) 2009, Formal Methods for Computer Aided Design (FMCAD) 2008 etc.
- Journal Reviewer Formal Methods in System Design (FMSD), IEEE Transactions on Communciations, IEEE Transactions on Signal Processing, IEEE Transactions on Vehicular Technology etc.
- Book Reviewer Handbook of Model Checking. Editors: E. M. Clarke, Thomas A. Henzinger and Helmut Veith. Springer (*to appear*), Introduction to Lattice Theory with Computer Science Applications. Vijay K. Garg. Wiley & Sons 2015.
- Proposal Reviewer NSF Computing and Communication Foundations Panels. 2018, 2017.

Outreach

Panelist Programming Languages Mentoring Workshop (PLMW). POPL 2017, PLDI 2017.
CERIAS Symposium Panel on “Formal Methods and Secure Architecture”. 2017.

Selection Committee Student Research Competition. POPL 2018.