

Roopsha Samanta

Assistant Professor
Department of Computer Science
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Research Interests

My research focuses on building reliable and efficient programs using formal methods and programming languages principles. My work spans the development of mathematical theory, algorithms and tools for program verification, analysis, repair and synthesis. The application domains that my work targets include concurrent systems software, real-time and cyber-physical systems in robotics and Internet of Things (IoT), and education technology for programming courses.

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.*
Thesis: *Block Matching Techniques used in Video Compression*
Supervisor: D. R. Pagay

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 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 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 Workshops

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

Technical Reports

ArXiv e-prints 2015 P. Černý, E. M. Clarke, T. A. Henzinger, A. Radhakrishna, L. Ryzhyk, R. Samanta and T. Tarrach. Optimizing Solution Quality in Synchronization Synthesis. ArXiv e-prints 2015, arXiv:1511.07163

Tech. Report 2010 J. V. Deshmukh, E. A. Emerson and R. Samanta. Economical Transformations for Structured Data. Department of Computer Science, The University of Texas at Austin, Technical Report TR-10-28, 2010.

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 or Preparation

- [1] 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. Invited submission to Formal Methods in System Design (FMSD).

Patents

- [1] N. Himayat, R. Samanta, and S. Talwar. Link Performance Prediction Presence of Co-channel Interference. US Patent 7,697,906. 2010.
- [2] S. Talwar, R. Samanta, and N. Himayat. MIMO Precoding in the Presence of Co-channel Interference. US Patent Application 20,070/211,813. 2006.

Tutorials

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

Conference Talks, Invited Seminars and other Presentations

Qlose: Program repair with Quantitative Objectives

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

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

- July 2015 *From Non-preemptive to Preemptive Scheduling using Synchronization Synthesis*
Computer Aided Verification (CAV), San Francisco, USA
- June 2015 *Concurrent Trace Sets for Synchronization Synthesis*
Northeastern University, Boston, USA
- June 2015 *Towards Computer-aided Concurrent Programming*
Annual Expeditions in Computer Augmented Program Engineering (ExCAPE) meeting,
Massachusetts Institute of Technology, Boston, USA
- June 2015 *Lipschitz Robustness of I/O Systems*
Max Planck Institute for Software Systems, Kaiserslautern, Germany
- May 2015 *Succinct Representation of Concurrent Trace Sets*
University of Oxford, Oxford, UK
- Feb. 2015 Vienna University of Technology, Vienna, Austria
- Jan. 2015 Principles of Programming Languages (POPL), Mumbai, India
- Dec. 2014 *Lipschitz Robustness of Finite-State Transducers*
Foundations of Software Technology and Theoretical Computer Science (FSTTCS), New Delhi, India
- Sep. 2014 *Cost-aware Program Repair*
Static Analysis Symposium (SAS)
- May 2014 *Robustness Analysis of Transducers*
Alpine Verification Meeting, Frejus, France
- Oct. 2013 *Robustness Analysis of String Transducers*
Automated Technology for Verification and Analysis (ATVA), Hanoi, Vietnam
- Jan. 2013 *Synchronization Synthesis for Shared-Memory Concurrent Programs*
Principles of Programming Languages (POPL) Student Talk, Rome, Italy
- Jan. 2013 *Robustness Analysis of Networked Systems*
Verification, Model Checking and Abstract Interpretation (VMCAI), Rome, Italy
- Jan. 2013 Institute of Science and Technology Austria
- Jan. 2013 Vienna University of Technology
- July 2012 *Towards Algorithmic Synthesis of Synchronization for Shared-Memory Concurrent Programs*
Workshop on Synthesis (SYNT), colocated with CAV, Berkeley, USA
- April 2012 *An Algorithmic Framework for Synthesis of Concurrent Programs*
Dagstuhl Seminar on Software Synthesis, Wadern, Germany
- Oct. 2011 *Automatic Generation of Local Repairs for Boolean Programs*
Automated Technology for Verification and Analysis (ATVA), Taipei, Taiwan
- Nov. 2008 *Formal Methods in Computer Aided Design (FMCAD)*
Formal Methods in Computer Aided Design (FMCAD)

Teaching

Fall 2016 CS59000-CPR: Computer-aided Program Reasoning. Purdue University

Students

2014–2016 Mentored Thorsten Tarrach, a doctoral student of Thomas A. Henzinger, on synchronization synthesis using concurrent trace sets [POPL 2015], [CAV 2015].

2015–2016 Mentored Bernhard Kragl, a doctoral student of Thomas A. Henzinger, on performance-aware software synthesis

Professional Service

Program co-chair 1st Workshop on Design and Analysis of Robust Systems (DARS) 2016.
Colocated with Cyberphysical Systems Week (CPS Week) 2016.

Publicity chair Computer-aided Verification (CAV) 2016.

Program committee Verification, Model Checking and Abstract Interpretation (VMCAI) 2016.
Workshop on Synthesis (SYNT) 2016.

Reviewer *Conferences:*

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.

Journals:

Formal Methods in System Design (FMSD),
IEEE Transactions on Communications,
IEEE Transactions on Signal Processing,
IEEE Transactions on Vehicular Technology etc.

Books:

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.

Personal Information

Citizenship India

Residency Permanent Resident of the United States