# Rahul Sharma

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## Research Interests

Program Analysis, Compilers, and Machine Learning.

## Education

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| 2010 - present | Ph.D. Candidate, Computer Science, *Stanford University*, USA<br>Advised by Prof. Alex Aiken |
| 2006 - 2010 | B.Tech. in Computer Science, *Indian Institute of Technology (IIT Delhi)*, India |

## Publications

*Conditionally Correct Superoptimization.* Rahul Sharma, Eric Schkufza, Berkeley Churchill, and Alex Aiken. Proceedings of the International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), October 2015.

*Verification of Producer-Consumer Synchronization in GPU Programs.* Rahul Sharma, Michael Bauer, and Alex Aiken. Proceedings of the Conference on Programming Language Design and Implementation (PLDI), June 2015.

*From Invariant Checking to Invariant Inference Using Randomized Search.* Rahul Sharma, and Alex Aiken. Proceedings of the International Conference on Computer Aided Verification (CAV), July 2014.

*Stochastic Optimization of Floating Point Programs with Tunable Precision.* Eric Schkufza, Rahul Sharma, and Alex Aiken. Proceedings of the Conference on Programming Language Design and Implementation (PLDI), June 2014.

*Bias-Variance Tradeoffs in Program Analysis.* Rahul Sharma, Aditya Nori and Alex Aiken. Proceedings of the Symposium on Principles of Programming Languages (POPL), January 2014.

*Data-Driven Equivalence Checking.* Rahul Sharma, Eric Schkufza, Berkeley Churchill, and Alex Aiken. Proceedings of the International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), October 2013.

*Differential Assertion Checking.* Shuvendu K. Lahiri, Kenneth L. McMillan, Rahul Sharma, and Chris Hawblitzel. In Proceedings of the Symposium on Foundations of Software Engineering (ESEC/FSE), August 2013.

*Termination Proofs from Tests.* Aditya Nori and Rahul Sharma. In Proceedings of the Symposium on Foundations of Software Engineering (ESEC/FSE), August 2013.

*Verification as Learning Geometric Concepts.* Rahul Sharma, Saurabh Gupta, Bharath Hariharan, Alex Aiken, and Aditya Nori. In Proceedings of the Static Analysis Symposium (SAS), June 2013.

*A Data Driven Approach for Algebraic Loop Invariants.* Rahul Sharma, Saurabh Gupta, Bharath Hariharan, Alex Aiken, and Aditya Nori.. In Proceedings of the European Symposium on Programming (ESOP), March 2013.

*Stochastic Superoptimization.* Eric Schkufza, Rahul Sharma, and Alex Aiken. In Proceedings of the International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), March 2013.

*Interpolants as Classifiers.* Rahul Sharma, Aditya Nori, and Alex Aiken. Proceedings of the International Conference on Computer Aided Verification (CAV), July 2012.

*Information-Flow Control for Programming on Encrypted Data.* John C. Mitchell, Rahul Sharma, Deian Stefan, and Joe Zimmerman. Proceedings of Computer Security Foundations Symposium (CSF), June 2012.

*A Domain-Specific Language for Computing on Encrypted Data.* Alex Bain, John C. Mitchell, Rahul Sharma, Deian Stefan, and Joe Zimmerman. Proceedings of Foundations of Software Technology and Theoretical Computer Science (FSTTCS), December 2011.

*Simplifying Loop Invariant Generation Using Splitter Predicates.* Rahul Sharma, Isil Dillig, Thomas Dillig, and Alex Aiken. Proceedings of the International Conference on Computer Aided Verification (CAV), July 2011.

## Talks

- *Proofs for performance* 2015
  Purdue University, West Lafayette, Indiana
  University of California at San Diego, California
  University of California at Berkeley, California
  University of California at Los Angeles, California
  Indian Institute of Technology, Kanpur, India
  Indian Institute of Technology, Delhi, India

- *Conditionally correct superoptimization* 2015
  International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), Pittsburgh, Pennsylvania

- *Verification of producer-consumer synchronization in GPU programs* 2015
  Conference on Programming Language Design and Implementation (PLDI), Portland, Oregon

- *Data-driven invariant inference* 2014
  Dagstuhl Seminar on Decision Procedures and Abstract Interpretation, Dagstuhl, Germany

- *From invariant checking to invariant inference using randomized search.* 2014
  International Conference on Computer Aided Verification (CAV), Vienna, Austria

- *Bias-variance tradeoffs in program analysis.* 2014
  Symposium on Principles of Programming Languages (POPL), San Diego, California

- *Data-driven stochastic optimization* 2013
  University of Illinois at Urbana-Champaign, Illinois
  IBM Research, Delhi, India
  Microsoft Research, Bangalore, India

- *Data-driven equivalence checking* 2013
  SoCal Programming Languages and Systems Workshop, Los Angeles, California
  International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), Indianapolis, Indiana

- *Termination proofs from tests* 2013
  Symposium on Foundations of Software Engineering (ESEC/SIGSOFT FSE), St. Petersburg, Russia

- *Differential assertion checking* 2013
  Microsoft Research, Redmond, Washington
  Symposium on Foundations of Software Engineering (ESEC/SIGSOFT FSE), St. Petersburg, Russia

- *Verification as learning geometric concepts* 2013
  University of California at Los Angeles, California
  International Static Analysis Symposium (SAS), Seattle, Washington

- *A data-driven approach for algebraic loop invariants* 2013
  European Symposium on Programming (ESOP), Rome, Italy

- *Data-driven program verification* 2012
  Microsoft Research India, Bangalore, India

- *Interpolants as Classifiers* 2012
  International Conference on Computer Aided Verification (CAV), Berkeley, California

- *Simplifying loop invariant generation using splitter predicates* 2011
  International Conference on Computer Aided Verification (CAV), Snowbird, Utah
  Microsoft Research, Redmond, Washington
  Indian Institute of Technology, Delhi, India
  Microsoft Research India, Bangalore, India

## Honors and Awards

- Recipient of the *Microsoft Fellowship* (2013-15).
- Recipient of the *Suresh Chandra Memorial Trust Award* for the best software project in Computer Science for "Relevance Heuristics for Software Model Checking".
- Twice recipient of *Dean's merit award.*
- Recipient of *Aditya Birla Scholarship* and *CBSE Merit Scholarship* during 2006-10.

- *Bronze medallist, International Chemistry Olympiad* 2006, held in Gyeongsan, South Korea.

## Research Experience

- *Research Assistant (Computer Systems Lab)* Mar 2011-present
  Advisor: Prof. Alex Aiken
  Applying machine learning to program verification and compiler optimizations.

- *Research Assistant (Stanford Security Lab)* Jan-Mar 2011
  Mentor: Prof. John Mitchell
  Designed a domain-specific language for secure cloud computing and proved correctness and confidentiality for the same.

- *Research Assistant (Computer Systems Lab)* Sep-Dec 2010
  Mentor: Prof. Alex Aiken
  Designed a semantics preserving transformation to simplify control flow structure of programs.

- *Research Intern (Max-Planck-Institut für Informatik)* May-July 2010
  Mentor: Dr. Viorica Sofronie-Stokkermans
  Designed a method for computing interpolants, possibly containing quantifiers, for extensions of a base theory with new function symbols.

## Professional Experience

- *Research Intern (Microsoft Research India)* June-Sep 2012
  Mentor: Aditya Nori
  Designed a machine learning-based algorithm for proving program termination.

- *Research Intern (Microsoft Research Redmond)* June-Aug 2011
  Mentor: Shuvendu Lahiri and Ken McMillan
  Built a tool to prove that a bug fix did not introduce any new bugs.

- *Research Intern (Microsoft Research India)* Dec 2009
  Mentor: Aditya Nori
  Collaborated with MSR India for my bachelor's thesis: "Relevance Heuristics for Software Model Checking."

- *Research Intern (Microsoft Research India)* May-July 2009
  Mentors: Aditya Nori and Sriram Rajamani
  Designed a novel specification inference algorithm, by modeling information flow paths using probabilistic constraints, and obtained specifications for device drivers by sampling.

- *Research Intern (Microsoft Research India)* Dec 2008
  Mentors: Aditya Nori and Sriram Rajamani
  Worked on reusing function summaries for an inter-procedural static analysis (YOGI).

## Teaching Experience

Teaching Assistant for CS143: Compilers
Summer Quarter 2014, Stanford University

Teaching Assistant for CS258: Introduction to Programming Language Theory
Winter Quarter 2012, Stanford University