

Rishabh Singh

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Research Interests

Neural program synthesis and reasoning. Developing program synthesis techniques for making programming accessible for end-users and programmers.

Employment

- 9/2016– Present **Researcher**, *Cognition Group*, Microsoft Research, Redmond, WA.
Neural architectures for program synthesis and program reasoning.
- 7/2014– 8/2016 **Researcher**, *RiSE Group*, Microsoft Research, Redmond, WA.
Program synthesis techniques for data wrangling and program repair.
- 5/2012– 8/2012 **Research Intern**, *Dr. Sumit Gulwani*, Microsoft Research, Redmond, WA.
Using machine learning to rank string transformation programs in FlashFill.
- 5/2011– 8/2011 **Research Intern**, *Dr. Sumit Gulwani*, Microsoft Research, Redmond, WA.
Learning lookup transformations using input-output examples.
- 5/2010– 8/2010 **Research Intern**, *Dr. Sumit Gulwani*, Microsoft Research, Redmond, WA.
Semantic entity manipulations using input-output examples.
- 6/2009– 8/2009 **Research Intern**, *Dr. Dimitra Giannakopoulou and Dr. Corina Păsăreanu*, NASA Ames Research Center, Mountain View, CA.
Using May and Must abstractions for learning component interfaces.
- 12/2007– 1/2008 **Intern**, *Prof. Andrey Rybalchenko*, Max Planck Institute of Software Systems, Saarbrücken, Germany.
Demand Driven Abstraction Refinement.
- 5/2007– 7/2007 **Intern**, *Prof. Thomas Henzinger and Dr. Andrey Rybalchenko*, Ecole Polytechnique Federal de Lausanne, Lausanne, Switzerland.
Lazy Abstraction Heuristics in ARMC.

Education

2008–2014 **PhD, Computer Science**, *Massachusetts Institute of Technology*, MA.

advisors: Prof. Armando Solar-Lezama and Dr. Sumit Gulwani

thesis: Accessible programming using program synthesis, Awarded *George M. Sprowls Award* for best PhD thesis in Computer Science, MIT

2008–2010 **MS, Computer Science**, *Massachusetts Institute of Technology*, MA.

advisor: Prof. Armando Solar-Lezama

gpa: 5.0/5.0

thesis: Storyboard Programming of Data Structure Manipulations, Awarded *William A. Martin Memorial Thesis Award* for outstanding master thesis

2004–2008 **BTech(H), Computer Science**, *IIT Kharagpur*, WB, India.

gpa: 9.60/10.0

honors: Ranked 1st (68) in the Department of Computer Science (*Institute Silver Medal*) and 2nd (750) in the Institute (*Bigyan Sinha Memorial Award*)

2004 **CBSE AISSCE**, *Kendriya Vidyalaya ONGC*, Dehradun, UK, India.

honors: Ranked 1st in India (97.6%), Awarded to be *Prime Minister's guest* at Republic Day Parade, New Delhi

Publications

POPL 2018 Jeevana Inala and Rishabh Singh. **WebRelate: Integrating Web Data with Spreadsheets using Examples**. 45th SIGPLAN Symposium on Principles of Programming Languages, 2018

POPL 2018 Xinyu Wang, Isil Dillig, and Rishabh Singh. **Program Synthesis using Abstraction Refinement**. 45th SIGPLAN Symposium on Principles of Programming Languages, 2018

NIPS 2017 Jacob Devlin, Rudy Bunel, Rishabh Singh, Matthew Hausknecht, and Pushmeet Kohli. **Neural Program Meta-induction**. 31st Annual Conference on Neural Information Processing Systems, 2017

SNAPL 2017 Rishabh Singh and Pushmeet Kohli. **Artificial Programming**. 2nd Summit on Advances in Programming Languages, 2017

ICLR 2017 Emilio Parisotto, Abdel-rahman Mohamed, Rishabh Singh, Lihong Li, Dengyong Zhou, and Pushmeet Kohli. **Neuro-symbolic Program Synthesis**. 5th International Conference on Learning Representations, 2017

- ICML 2017 Jacob Devlin, Jonathan Uesato, Surya Bhupatiraju, Rishabh Singh, Abdelrahman Mohamed, and Pushmeet Kohli. **RobustFill: Neural Program Learning under Noisy I/O**. 34th International Conference on Machine Learning, 2017
- ASE 2017 Patrice Godefroid, Hila Peleg, and Rishabh Singh. **Learn&Fuzz: Machine Learning for Input Fuzzings**. 32nd IEEE/ACM International Conference on Automated Software Engineering, 2017
- OOPSLA2017 Xinyu Wang, Isil Dillig, and Rishabh Singh. **Synthesis of Data Completion Scripts using Finite Tree Automata**. 32nd International Conference on Object-Oriented Programming, Systems, Languages & Applications, 2017
- FSE 2017 Loris D'Antoni, Rishabh Singh, and Michael Vaughn. **NoFAQ: Synthesizing Command Repairs from Examples**. ACM SIGSOFT Symposium on the Foundations of Software Engineering, 2017
- NOW 2017 Sumit Gulwani, Oleksandr Polozov, and Rishabh Singh. **Program Synthesis**. Foundations and Trends in Programming Languages, 2017
- VLDB 2016 Rishabh Singh. **BlinkFill: Semi-supervised Programming By Example for Syntactic String Transformations**. 42nd International Conference on Very Large Databases, 2016
- OOPSLA2016 Xinyu Wang, Sumit Gulwani, and Rishabh Singh. **FIDEX: Filtering Spreadsheet Data using Examples**. 31st International Conference on Object-Oriented Programming, Systems, Languages & Applications, 2016
- CAV 2016 Loris D'Antoni, Roopsha Samanta, and Rishabh Singh. **Qlose: Program Repair with Quantitative Objectives**. 28th International Conference on Computer Aided Verification, Berkeley, CA, 2016
- CHI 2016 Parmit K. Chilana, Rishabh Singh, and Philip J. Guo. **Understanding Conversational Programmers: A Perspective from the Software Industry**. 34th International Conference on Human Factors in Computing Systems, 2016
- POPL 2016 Rishabh Singh, Sumit Gulwani, Armando Solar-Lezama. **Transforming Spreadsheet Data Types using Examples**. 43rd SIGPLAN Symposium on Principles of Programming Languages, 2016
- CAV 2015 Rishabh Singh and Sumit Gulwani. **Predicting a Correct Program in Programming by Example**. 27th International Conference on Computer Aided Verification, Berkeley, CA, 2015
- UIST 2015 Mikael Mayer, Gustavo Soares, Maxim Grechkin, Vu Le, Mark Marron, Oleksandr Polozov, Rishabh Singh, Benjamin Zorn, and Sumit Gulwani. **User Interaction Models for Disambiguation in Programming by Example**. 28th ACM User Interface Software and Technology Symposium, 2015
- TOCHI 2015 Elena L. Glassman, Jeremy Scott, Rishabh Singh, Philip J. Guo, and Robert C. Miller. **OverCode: Visualizing Variation in Student Solutions to Programming Problems at Scale**.

- VMCAI 2014 Rohit Singh, Rishabh Singh, Zhilei Xu, Rebecca Krosnick, Armando Solar-Lezama. **Modular Synthesis of Sketches using Models**. 15th International Conference on Verification, Model Checking, and Abstract Interpretation, San Diego, CA, 2014
- FMCAD 2013 Rajeev Alur, Rastislav Bodik, Garvit Juniwal, Milo Martin, Mukund Raghothaman, Sanjit Seshia, Rishabh Singh, Armando Solar-Lezama, Emina Torlak, Abhishek Udupa. **Syntax-Guided Synthesis**. 13th International Conference on Formal Methods in Computer-Aided Design, Portland, OR, 2013 (Invited Paper)
- PLDI 2013 Rishabh Singh, Sumit Gulwani, Armando Solar-Lezama. **Automated Feedback Generation for Introductory Programming Assignments**. 34th Conference on Programming Language Design and Implementation, Seattle, WA, 2013
- CACM 2012 Sumit Gulwani, William Harris, Rishabh Singh. **Spreadsheet Data Manipulation Using Examples**. [CACM Research Highlight](#), August 2012
- CAV 2012 Rishabh Singh, Sumit Gulwani. **Synthesizing Number Transformations from Input-Output Examples**. 24th International Conference on Computer Aided Verification, Berkeley, CA, 2012
- CAV 2012 Rishabh Singh, Armando Solar-Lezama. **SPT: Storyboard Programming Tool**. 24th International Conference on Computer Aided Verification, Berkeley, CA, 2012 (Tool Paper)
- VLDB 2012 Rishabh Singh, Sumit Gulwani. **Learning Semantic String Transformations from Examples**. 38th International Conference on Very Large Databases, Istanbul, Turkey, 2012
- FSE 2011 Rishabh Singh, Armando Solar-Lezama. **Synthesizing data-structure manipulations using Storyboards**. 8th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering, Szeged, Hungary, 2011
- CAV 2010 Rishabh Singh, Dimitra Giannakopoulou, Corina Pasareanu. **Learning Component Interfaces with May and Must Abstractions**. 22nd International Conference on Computer Aided Verification, Edinburgh, Scotland, UK, 2010
- ICSE 2009 Derek Rayside, Zev Benjamin, Rishabh Singh, Joseph P. Near, Aleksandar Milicevic, Daniel Jackson. **Equality and Hashing for (almost) Free: Generating Implementations from Abstraction Functions**. 31st International Conference on Software Engineering, Vancouver, Canada, 2009
- SPIN 2009 Andrey Rybalchenko, Rishabh Singh. **Subsumer-first: Steering Symbolic Reachability Analysis**. 16th International SPIN Workshop on Model Checking of Software, Grenoble, France, 2009

In Submission

Sahil Bhatia, Pushmeet Kohli, Rishabh Singh. **Neuro-symbolic Program Corrector**. 2017

Surya Bhupatiraju, Rishabh Singh, Abdel-rahman Mohamed, Pushmeet Kohli. **Deep API Programmer: Learning to Program with APIs**. 2017

Rishabh Singh, Benjamin Livshits, and Benjamin Zorn. **Melford: Using Neural Networks to Find Spreadsheet Errors**. 2017

Alexander L. Gaunt, Marc Brockschmidt, Rishabh Singh, Nate Kushman, Pushmeet Kohli, Jonathan Taylor, Daniel Tarlow. **TerpreT: A Probabilistic Programming Language for Program Induction**. 2017

Awards

George M. Sprowls Award for outstanding PhD thesis in Computer Science, MIT, 2014

Microsoft Research PhD Fellowship, Microsoft Research, 2012-2014

CACM Research Highlight for FlashFill, CACM, 2012

William A. Martin Memorial Thesis Award for outstanding Master's thesis in Computer Science, MIT, 2010

Institute Silver Medal for best academic performance in the Department of Computer Science and Engineering, IIT Kharagpur, 2008

Bigyan Sinha Memorial Prize for securing 2nd position in the Institute, IIT Kharagpur, 2008

Prime Minister's guest at Republic Day Parade, Rajpath New Delhi, 2005 for securing 1st position in AISSCE CBSE 2004

Interns Supervised

- 2017 Matej Balog, Cambridge University
- 2017 Chenglong Wang, University of Washington
- 2017 Konstantin Bottinger, Fraunhofer Research Institute
- 2017 Robert Bowden, Harvard
- 2017 Ke Wang, UC Davis
- 2017 Saswat Anand, UCLA
- 2017 Qinheping Hu, Wisconsin
- 2016 Emilio Parisotto, CMU
- 2016 Jeevana Priya Inala, MIT
- 2016 Hila Peleg, Technion
- 2016 Ke Wang, UC Davis

- 2015 Dana Drachler-Cohen, Technion
- 2015 John Feser, Rice
- 2015 Thorsten Tarrach, IST Austria
- 2015 Xinyu Wang, UT Austin

Service

- Program Committee POPL 2017, PLDI 2017, ICML 2017, ISEC 2017
- Reviewer ICML 2017, NIPS 2017
- Co-organizer PLOOC 2015, ASSES 2015, CHESE 2016, Dagstuhl seminar on Inductive Programming 2017
- SyGuS-COMP Co-organizing the first Syntax-Guided Synthesis Competition (SyGuS-COMP 2014) at FLOC 2014 with Rajeev Alur, Dana Fisman, and Armando Solar-Lezama.
- External Reviewer EMSOFT 2009, ESOP 2010, POPL 2011, VMCAI 2011, TACAS 2011, SAS 2011, SAS 2013

Selected Press

AutoGrader

- MIT News Automatically grading programming homework.
<http://web.mit.edu/newsoffice/2013/automatically-grading-programming-homework-0603.html>
- MIT CSAIL The Auto Grader.
Spotlight <http://www.csail.mit.edu/node/1886>

FlashFill

- MIT News Excel Programming for Nonprogrammers.
<http://web.mit.edu/newsoffice/2012/excel-programming-for-nonprogrammers-0508.html>
- Microsoft Research Flash Fill gives Excel a smart change.
<http://research.microsoft.com/en-us/news/features/flashfill-020613.aspx>
- CNN Money ...Excel 2013's coolest new feature that should have been available years ago...
<http://cnnmoneytech.tumblr.com/post/27346588168/excel-2013s-coolest-new-feature-that-should-have-been?iid=EL>
- Ars Technica ...One of the shock-and-awe features of the Excel 2013 demo was the "flash fill" feature...
- ZDNet ...One of the more useful features in Flash Fill...

Times Of ...The most notable feature in Excel...
India

<http://timesofindia.indiatimes.com/tech/itslideshow/15015129.cms>

Wired ...Excel is now a lot easier for people who aren't spreadsheet pros.

<http://www.wired.com/gadgetlab/2012/07/first-look-at-microsoft-office-2013-and-office-365-going-to-the-cloud/2/>