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Rishabh Singh

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, Saarbrucken, Germnay.
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 1^{st} (68) in the Department of Computer Science (*Institute Silver Medal*) and 2^{nd} (750) in the Institute (*Bigyan Sinha Memorial Award*)

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

honors: Ranked 1^{st} 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**. 45^{th} SIGPLAN Symposium on Principles of Programming Languages, 2018

POPL 2018 Xinyu Wang, Isil Dillig, and Rishabh Singh. **Program Synthesis using Abstraction Refinement**. 45^{th} 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**. 31^{st} Annual Conference on Neural Information Processing Systems, 2017

SNAPL 2017 Rishabh Singh and Pushmeet Kohli.**Artificial Programming**. 2^{nd} 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**. 5^{th} 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**. 34^{th} International Conference on Machine Learning, 2017

ASE 2017 Patrice Godefroid, Hila Peleg, and Rishabh Singh.**Learn&Fuzz: Machine Learning for Input Fuzzings**. 32^{nd} 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**. 32^{nd} 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**. 42^{nd} International Conference on Very Large Databases, 2016

OOPSLA2016 Xinyu Wang, Sumit Gulwani, and Rishabh Singh. **FIDEX: Filtering Spreadsheet Data using Examples**. 31^{st} International Conference on Object-Oriented Programming, Systems, Languages & Applications, 2016

CAV 2016 Loris D'Antoni, Roopsha Samanta, and Rishabh Singh. **Qlose: Program Repair with Quantiative Objectives**. 28^{th} 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**. 34^{th} International Conference on Human Factors in Computing Systems, 2016

POPL 2016 Rishabh Singh, Sumit Gulwani, Armando Solar-Lezama. **Transforming Spreadsheet Data Types using Examples**. 43^{rd} SIGPLAN Symposium on Principles of Programming Languages, 2016

CAV 2015 Rishabh Singh and Sumit Gulwani. **Predicting a Correct Program in Programming by Example**. 27^{th} 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**. 28^{th} 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**. 15^{th} 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**. 13^{th} 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**. 34^{th} 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**. 24^{th} International Conference on Computer Aided Verification, Berkeley, CA, 2012

CAV 2012 Rishabh Singh, Armando Solar-Lezama. **SPT: Storyboard Programming Tool**. 24^{th} International Conference on Computer Aided Verification, Berkeley, CA, 2012 (Tool Paper)

VLDB 2012 Rishabh Singh, Sumit Gulwani. **Learning Semantic String Transformations from Examples**. 38^{th} International Conference on Very Large Databases, Istanbul, Turkey, 2012

FSE 2011 Rishabh Singh, Armando Solar-Lezama. **Synthesizing data-structure manipulations using Storyboards**. 8^{th} 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**. 22^{nd} 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**. 31^{st} International Conference on Software Engineering, Vancouver, Canada, 2009

SPIN 2009 Andrey Rybalchenko, Rishabh Singh. **Subsumer-first: Steering Symbolic Reachability Analysis**. 16^{th} 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 2^{nd} position in the Institute, IIT Kharagpur, 2008

Prime Minister's guest at Republic Day Parade, Rajpath New Delhi, 2005 for securing 1^{st} 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 Drachsler-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 Spotlight	The Auto Grader. 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 India ...The most notable feature in Excel...

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/