

KULDEEP S. MEEL

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RESEARCH INTERESTS

The goal of my research is to advance artificial intelligence techniques, which utilize ubiquity of data, to enable computing to deal with increasingly uncertain real-world environments.

- Constrained Sampling and Counting, Artificial Intelligence, Machine Learning, Formal Methods, Probabilistic reasoning and inference, Decision Making Under Uncertainty, Resilience of Critical Infrastructure Networks

EMPLOYMENT

National University of Singapore <i>Assistant Professor in the Computer Science Department</i>	(Jan'18 –)
Rice University <i>Graduate Research Assistant</i>	(Jan'13 – May'17)
IBM Research, T J Watson Research Center <i>Summer Intern (Mentors: Dr. Dmitry Malioutov and Dr. Vijay Saraswat)</i>	(May'16- July'16)
Microsoft Research, Bangalore, India <i>Summer Intern (Mentors: Dr. Aditya Nori and Dr. Sriram Rajamani)</i>	(May'15- Aug'15)
Pocket Gems Inc., San Francisco, USA <i>Mobile Developer & Eng Lead - India hiring team</i>	(May'11- Jan'12)
Areograph Ltd., Dunedin, New Zealand <i>Software Engineer Intern (Mentor: Dr. Phil McLeod)</i>	(May'10- July'10)

EDUCATION

Rice University PhD in Computer Science <u>Thesis</u> : Constrained Counting and Sampling: Bridging the Gap Between Theory and Practice <u>Thesis Committee</u> : Supratik Chakraborty, Leonardo Dueñas-Osorio, Swarat Chaudhuri, Sanjit A. Seshia, and Moshe Y. Vardi	May 2014 - May 2017
Rice University M.S. in Computer Science <u>Thesis</u> : “Sampling Techniques for Boolean Satisfiability” <u>Thesis Committee</u> : Supratik Chakraborty, Swarat Chaudhuri, Luay Nakhleh, and Moshe Y. Vardi	Jan 2013 - Apr 2014
Indian Institute of Technology, Bombay Bachelor of Technology (with Honors) in Computer Science & Engineering GPA: 9.02 (on the scale of 10)	Aug 2008 - May 2012

AWARDS AND HONORS

- IBM PhD Fellowship (2016-17)
- Lodieska Stockbridge Vaughn Fellowship (2016-17), awarded to upto five students university wide whose record at Rice shows evidence of outstanding achievement and promise.
- 2014 Outstanding Master Thesis Award from the Vienna Center for Logic and Algorithms
- Best Student Paper Award, 21st International Conference on Principles and Practice of Constraint Programming (CP-2015)
- Andrew Ladd Fellowship (2013-14) for excellence in computer science at Rice University
- Invited to 12 member AAAI 2015 Futures Focus Group tasked with creation of vision for AAAI
- Selected to participate in 3rd Heidelberg Laureate forum (2015)

TUTORIALS

- Discrete Sampling and Integration for the AI Practitioner (Feb 2017)
Co-presented with Supratik Chakraborty and Moshe Y. Vardi
AAAI Conference on Artificial Intelligence (AAAI 2017)

- Discrete Sampling and Integration in High Dimensional Spaces
Co-presented with Supratik Chakraborty and Moshe Y. Vardi
Conference on Uncertainty in Artificial Intelligence (UAI 2016)

(June 2016)

PUBLICATIONS

Except for [6], [7], [13] and [17], the names of authors are sorted alphabetically by last name.

Papers At Highly Selective Journals And Conferences (Refereed And Archived)

1. **The Hard Problems Are Almost Everywhere For Random CNF-XOR Formulas**
Jeffrey Dudek, Kuldeep S. Meel, and Moshe Y. Vardi
In Proc. of International Joint Conference on Artificial Intelligence (IJCAI), 2017
2. **Counting-based Reliability Estimation for Power-Transmission Grids**
Leonardo Duenas-Osorio, Kuldeep S. Meel, Roger Paredes, and Moshe Y. Vardi
In Proc. of AAAI Conference on Artificial Intelligence (AAAI) 2017
3. **Algorithmic Improvements in Approximate Counting for Probabilistic Inference: From Linear to Logarithmic SAT Calls**
Supratik Chakraborty, Kuldeep S. Meel, and Moshe Y. Vardi
In Proc. of International Joint Conference on Artificial Intelligence (IJCAI) 2016
4. **Combining the k-CNF and XOR Phase-Transitions**
Jeffrey Dudek, Kuldeep S. Meel, and Moshe Y. Vardi
In Proc. of International Joint Conference on Artificial Intelligence (IJCAI) 2016
5. **On computing Minimal Independent Support and its Applications to Sampling and Counting**
Alexander Ivrii, Sharad Malik, Kuldeep S. Meel and Moshe Y. Vardi
Constraints 21(1), 2016
6. **Design and Verification of Distributed Phasers**
Karthik Murthy, Sri Raj Paul, Kuldeep S. Meel, Tiago Cogumbreiro, and John Mellor-Crummey
In Proc. of International European Conference on Parallel and Distributed Computing (Euro-Par) 2016
7. **Automatic Data Layout Generation and Kernel Mapping for CPU+GPU Architectures**
Deepak Majeti, Kuldeep S. Meel, Raj Barik, and Vivek Sarkar
In Proc. of International Conference on Compiler Construction (CC) 2016.
8. **Approximate Probabilistic Inference via Word-Level Counting**
Supratik Chakraborty, Kuldeep S. Meel, Rakesh Mistry and Moshe Y. Vardi
In Proc. of AAAI Conf. on Artificial Intelligence (AAAI) 2016
9. **On computing Minimal Independent Support and its applications to sampling and counting**
Best Student Paper Award
Alexander Ivrii, Sharad Malik, Kuldeep S. Meel and Moshe Y. Vardi
In Proc of International Conference on Principles and Practice of Constraint Programming (CP) 2015
10. **From Weighted to Unweighted Model Counting**
Supratik Chakraborty, Dror Fried, Kuldeep S. Meel, and Moshe Y. Vardi
In Proc. of International Joint Conference on Artificial Intelligence (IJCAI) 2015, pages 304-319
11. **On Parallel Scalable Uniform SAT Witness Generation**
Supratik Chakraborty, Daniel J. Fremont, Kuldeep S. Meel, Sanjit A. Seshia, and Moshe Y. Vardi
In Proc. of International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2015
12. **Distribution-Aware Sampling and Weighted Model Counting for SAT**
Supratik Chakraborty, Daniel J. Fremont, Kuldeep S. Meel, Sanjit A. Seshia, and Moshe Y. Vardi
In Proc. of AAAI Conf. on Artificial Intelligence (AAAI) 2014, pages 1722-1730
13. **ADHA: Automatic Datalayout Framework for Heterogenous Architectures**
Deepak Majeti, Kuldeep S. Meel, Raj Barik, and Vivek Sarkar
In Proc. of International Conf. on Parallel Architectures and Compiler Technologies (PACT) 2014, pages 479-480
14. **Balancing Scalability and Uniformity in SAT Witness Generator**
Supratik Chakraborty, Kuldeep S. Meel, and Moshe Y. Vardi
In Proc. of Design Automation Conference (DAC) 2014, pages 60:1-60:6

15. **A Scalable Approximate Model Counter**
Supratik Chakraborty, Kuldeep S. Meel, and Moshe Y. Vardi
In Proc. of International Conf. on Principles and Practice of Constraint Programming (CP), 2013, pages 200-216
16. **A Scalable and Nearly Uniform Generator of SAT-Witnesses**
Supratik Chakraborty, Kuldeep S. Meel, and Moshe Y. Vardi
In Proc. of International Conf. on Computer-Aided Verification (CAV) 2013, pages 608-623

Workshop Publications(Refereed and Archived)

17. **Constrained Sampling and Counting: Universal Hashing Meets SAT Solving**
Kuldeep S. Meel, Moshe Vardi, Supratik Chakraborty, Daniel J. Fremont, Sanjit A. Seshia, Dror Fried, Alexander Ivrii and Sharad Malik
In Proc. of AAAI-16 Workshop on Beyond NP (BNP) 2016

INVITED TALKS

- [1] Constrained Sampling and Counting: Bridging the gap between Theory and Practice
 1. *Iowa State University* **April 13, 2017**
 2. *Rutgers University* **April 6, 2017**
 3. *New York University* **April 4, 2017**
 4. *University of Utah* **March 31, 2017**
 5. *Virginia Tech* **March 27, 2017**
 6. *Purdue* **March 22, 2017**
 7. *Arizona State University* **March 15, 2017**
 8. *IST Austria* **March 9, 2017**
 9. *MPI-SWS, Germany* **March 6, 2017**
 10. *University of Waterloo* **March 2, 2017**
 11. *National University of Singapore* **Feb 22, 2017**
 12. *Institute of Theoretical Computer Science, Shanghai* **Feb 20, 2017**
 13. *IIT Delhi* **January 18, 2017**
 14. *IIT Kanpur* **January 16, 2017**
 15. *IIT Bombay* **January 12, 2017**
 16. *Tata Institute of Fundamental Research* **January 11, 2017**
 17. *Chennai Mathematical Institute* **January 6, 2017**
 18. *IIT Madras* **January 4, 2017**
 19. *The First Indian SAT+SMT School* **December 2016**
- [2] Constrained Sampling and Counting: From Theory to Practice and Back *Tata Research Development and Design Centre* **December 2016**
- [3] Improving Approximate Counting for Probabilistic Inference: From Linear to Logarithmic SAT Solver Calls *Fields Institute, Workshop on Theoretical Foundations of SAT Solving* **August 2016**
- [4] Constrained Sampling and Counting: When Practice Drives Theory *Chennai Mathematical Institute* **January 2016**
- [5] Scalable Techniques for Constrained Sampling and Counting. *IBM Research, Haifa* **December 2015**
- [6] Designing Scalable Techniques for Dynamic Verification and Probabilistic Inference. *IBM Research, India* **August 2015**
- [7] SAT Sampling and Counting: From Theory to Practice. *Vienna Center of Logic and Algorithms Outstanding Masters' Thesis Award Ceremony*, **May 2015**.
- [8] Sampling techniques for constraint satisfaction and beyond. *Microsoft Research India, Bangalore*, **August 2014**.
- [9] Sampling techniques for constraint satisfaction and beyond. *Mentor Graphics Inc.,* **May 2014**.

SEMINAR TALKS

- [10] Word-Level Hashing Approach to Approximate Probabilistic Inference *University of California, Berkeley* **Feb 2016**
- [11] Constrained Sampling and Counting: When Practice Drives Theory *Theory Seminar, Hebrew University of Jerusalem* **December 2015**
- [12] Sampling from combinatorial spaces: Achieving the fine balancing act between independence and scalability. *IIT Bombay*, **May 2015**
- [13] Approximating probabilistic inference without losing guarantees: Combining hashing with feasibility. *IIT Bombay*, **August 2014**
- [14] Sampling techniques for constraint satisfaction and beyond. *Princeton University*, **June 2014**
- [15] Sampling techniques for constraint satisfaction and beyond. *University of California, Berkeley*, **June 2014**
- [16] Distribution-aware sampling for SAT and beyond. *IIT Bombay*, **January 2014**
- [17] Distribution-aware sampling for SAT and beyond. *Synopsys Inc.*, **Dec 2013**
- [18] *Conference Presentations:* CAV 2013, CP 2013, DAC 2014, AAAI 2014, TACAS 2015, IJCAI 2015, CP 2015, AAAI 2016, AAAI 2017

RESEARCH VISITS

- Microsoft Research Jan 2016
- Institute for Advanced Studies, Hebrew University of Jerusalem Oct - Dec, 2015
- Synopsys Inc Dec 2013

SERVICE

- Program Committee: The Thirty-First AAAI Conference on Artificial Intelligence (AAAI) 2017, International Conference on Principles and Practice of Constraint Programming (CP) 2017, CAV-16 Artifact Evaluation
- Reviewer: Communications of ACM (CACM), NSF, ACM Transactions on Programming Languages and Systems (TOPLAS), International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2017, International Conference on Theory and Applications of Satisfiability Testing (SAT) 2016, International Conference on Computer-Aided Verification (CAV) 2015, Foundations of Software Science and Computation Structures (FoSSaCS) 2015, Design Automation Conference 2014
- Judge: Rice Undergraduate Research Symposium (RURS) (2013, 2014), Science & Engineering Fair of Houston (2013, 2016)
- Co-founded Rice Computer Science Graduate Association (CSGSA) in 2013
- Overall Coordinator: Rice Computer Science Graduate Association (CSGSA) (2014-15)