

KULDEEP S. MEEL

✉ meel@nus.comp.edu.sg, <http://www.kuldeepmeel.com>, ☎ +65-651 61422

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

ACADEMIC APPOINTMENT

National University of Singapore (Dec 2017-date)
Assistant Professor
Computer Science Department, School of Computing

EDUCATION

Rice University **May 2014 - Sep 2017**

PhD in Computer Science

Thesis: Constrained Counting and Sampling: Bridging the Gap Between Theory and Practice

Thesis Committee: Supratik Chakraborty, Leonardo Dueñas-Osorio, Swarat Chaudhuri, Sanjit A. Seshia, and Moshe Y. Vardi

Rice University **Jan 2013 - Apr 2014**

M.S. in Computer Science

Thesis: “Sampling Techniques for Boolean Satisfiability”

Thesis Committee: Supratik Chakraborty, Swarat Chaudhuri, Luay Nakhleh, and Moshe Y. Vardi

Indian Institute of Technology, Bombay **Aug 2008 - May 2012**

Bachelor of Technology (with **Honors**) in Computer Science & Engineering
GPA: 9.02 (on the scale of 10)

AWARDS AND HONORS

- Best Student Paper Award, 21st International Conference on Principles and Practice of Constraint Programming (CP-2015)
- 2014 Outstanding Master Thesis Award from the Vienna Center for Logic and Algorithms
- 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.
- Andrew Ladd Fellowship (2013-14) for excellence in computer science at Rice University
- IIT Bombay Heritage Fellowship (2008-09)
- 3rd Heidelberg Laureate forum (2015) Invitee

PREVIOUS WORK EXPERIENCE

Rice University (Jan'13 – May'17)
Graduate Research Assistant

IBM Research, T J Watson Research Center (May'16- July'16)
Summer Intern (Mentors: Dr. Dmitry Malioutov and Dr. Vijay Saraswat)

Microsoft Research, Bangalore, India (May'15- Aug'15)
Summer Intern (Mentors: Dr. Aditya Nori and Dr. Sriram Rajamani)

Pocket Gems Inc., San Francisco, USA (May'11- Jan'12)
Mobile Developer & Eng Lead - India hiring team

Areograph Ltd., Dunedin, New Zealand (May'10- July'10)
Software Engineer Intern (Mentor: Dr. Phil McLeod)

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 (June 2016)
Co-presented with Supratik Chakraborty and Moshe Y. Vardi
Conference on Uncertainty in Artificial Intelligence (UAI 2016)

PUBLICATIONS

Except for [8], [9], [15] and [19], the names of authors are sorted alphabetically by last name.

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

1. **Scalable Approximation of Quantitative Information Flow in Programs**
Fabrizio Biondi, Mike Enescu, Annelie Heuser, Axel Legay, Kuldeep S. Meel, Jean Quilbeuf
In Proc. of International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI), 2018
2. **On Hashing-Based Approaches to Approximate DNF-Counting**
Kuldeep S. Meel, Aditya A. Shrotri, and Moshe Y. Vardi
In Proc. of IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS), 2017
3. **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
4. **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
5. **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
6. **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
7. **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
8. **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
9. **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.
10. **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
11. **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
12. **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
13. **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

14. **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
15. **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
16. **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
17. **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
18. **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)

19. **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

RESEARCH GRANTS

1. **Scalable Techniques for Hashing-based Constrained Counting**, *SGD 250,000*, ODPRT, 02/18–01/21

TEACHING (AT NATIONAL UNIVERSITY OF SINGAPORE)

1. CS 4244: Knowledge-based Systems (co-teaching with Henry Chia)

STUDENTS ADVISED

Masters Students

1. **Alexis de Colnet** (Jan 2018 –)
2. **Rahul Gupta** (IIT Kanpur, co-advised with Subhajit Roy) (Jan 2018 –)
3. **Shubham Sharma** (IIT Kanpur, co-advised with Subhajit Roy) (Jan 2018 –)

Mentorship Experience

1. **Aditya Shrotri** Fall 2015-Spring 2018
 - 1 co-author publication (and 1 pending). Shrotri is currently in PhD program at Rice U.
2. **Jeffrey Dudek** Fall 2014-Spring 2017
 - 2 co-author publications. Dudek completed BS in 2015 and is currently in PhD program at Rice U.
3. **Sean Doyle** Fall 2014-Fall 2015
 - Doyle completed BS in 2015 and is currently in MS program at Rice U.

TEACHING ASSISTANT (AT RICE UNIVERSITY)

- COMP 409: Logic in Computer Science (Fall 2014, Fall 2016)
- COMP 430: Operating Systems and Concurrent Programming (Spring 2013, Spring 2014)
- COMP 482: Automata, Formal Languages and Computability (Fall 2013)

TALKS

- [1] On Demystifying CNF-XOR Formulas *Indian Institute of Technology, Delhi* **September 2017**
- Constrained Counting and Sampling: Bridging the gap between Theory and Practice
- [2] *Indian Institute of Science, Bangalore* **December 5, 2017**
- [3] *Iowa State University* **April 13, 2017**
- [4] *Rutgers University* **April 6, 2017**
- [5] *New York University* **April 4, 2017**
- [6] *University of Utah* **March 31, 2017**
- [7] *Virginia Tech* **March 27, 2017**
- [8] *Purdue* **March 22, 2017**
- [9] *Arizona State University* **March 15, 2017**
- [10] *IST Austria* **March 9, 2017**
- [11] *MPI-SWS, Germany* **March 6, 2017**
- [12] *University of Waterloo* **March 2, 2017**
- [13] *National University of Singapore* **Feb 22, 2017**
- [14] *Institute of Theoretical Computer Science, Shanghai* **Feb 20, 2017**
- [15] *IIT Delhi* **January 18, 2017**
- [16] *IIT Kanpur* **January 16, 2017**
- [17] *IIT Bombay* **January 12, 2017**
- [18] *Tata Institute of Fundamental Research* **January 11, 2017**
- [19] *Chennai Mathematical Institute* **January 6, 2017**
- [20] *IIT Madras* **January 4, 2017**
- [21] *The First Indian SAT+SMT School* **December 2016**
- [22] Constrained Sampling and Counting: From Theory to Practice and Back *Tata Research Development and Design Centre* **December 2016**
- [23] Improving Approximate Counting for Probabilistic Inference: From Linear to Logarithmic SAT Solver Calls *Fields Institute, Workshop on Theoretical Foundations of SAT Solving* **August 2016**
- [24] Constrained Sampling and Counting: When Practice Drives Theory *Chennai Mathematical Institute* **January 2016**
- [25] Scalable Techniques for Constrained Sampling and Counting. *IBM Research, Haifa* **December 2015**
- [26] Designing Scalable Techniques for Dynamic Verification and Probabilistic Inference. *IBM Research, India* **August 2015**
- [27] SAT Sampling and Counting: From Theory to Practice. *Vienna Center of Logic and Algorithms Outstanding Masters' Thesis Award Ceremony*, **May 2015**.
- [28] Sampling techniques for constraint satisfaction and beyond. *Microsoft Research India, Bangalore*, **August 2014**.
- [29] Sampling techniques for constraint satisfaction and beyond. *Mentor Graphics Inc.*, **May 2014**.
- [30] Word-Level Hashing Approach to Approximate Probabilistic Inference *University of California, Berkeley* **Feb 2016**
- [31] Constrained Sampling and Counting: When Practice Drives Theory *Theory Seminar, Hebrew University of Jerusalem* **December 2015**
- [32] Sampling from combinatorial spaces: Achieving the fine balancing act between independence and scalability. *IIT Bombay*, **May 2015**
- [33] Approximating probabilistic inference without losing guarantees: Combining hashing with feasibility. *IIT Bombay*, **August 2014**
- [34] Sampling techniques for constraint satisfaction and beyond. *Princeton University*, **June 2014**

- [35] Sampling techniques for constraint satisfaction and beyond. *University of California, Berkeley*, **June 2014**
- [36] Distribution-aware sampling for SAT and beyond. *IIT Bombay*, **January 2014**
- [37] Distribution-aware sampling for SAT and beyond. *Synopsys Inc.*, **Dec 2013**

RESEARCH VISITS

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

SERVICE

- Program Committee
 1. IJCAI 2018
 2. AAAI 2018
 3. CP 2018
 4. FAW 2018
 5. CP 2017
 6. CAV-16 Artifact Evaluation
- Organizer
 1. Workshop on Probabilistic Reasoning and Formal Methods at FSTTCS 2017. Co-organized with S. Akshay (IIT Bombay)
- Reviewer (Conferences): NFM 2018, SAT 2017, TACAS 2017, SAT 2016, CAV 2015, FoSSaCS 2015, DAC 2014
- Reviewer (Journals): CACM (2018, 2014), JAIR (2018), TOPLAS (2017), NSF (2015),
- University Service
 - Tutorial at School of Computing, Winter School 2018 (01/18)
 - Tutorial at SoC workshop in Indonesia Yogyakarta (03/18)
 - Graduate recruiting committee (2017-18)
- Part of 12 member AAAI 2015 Futures Focus Group tasked with creation of vision for AAAI
- 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)

MISC

- Travel grants
 - CP Doctoral Program (2013, 2015), SAT/SMT Summer School (2014), FLoC 2014, AAAI 2014, Dean's Travel Grant (2013, 2014, 2015, 2016, 2017), IJCAI Travel Grant (2015), NSF/ORAU HLF Grant (2015)

Invited participant at prestigious workshops

- The Second Indian SAT+SMT School, Mysore Park Workshop 2017
- Theoretical Foundations of SAT Solving, Fields Institute, 2016