

# KULDEEP S. MEEL

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## ACADEMIC APPOINTMENT

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### National University of Singapore

*Sung Kah Kay Assistant Professor*

(July 2018 – Present)

*Assistant Professor*

(Dec 2017 – Present)

*Computer Science Department, School of Computing*

## EDUCATION

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### 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

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- 2018 Ralph Budd for research in Engineering for the best doctoral thesis in the School of Engineering at Rice University.  
Nominated for 2017 ACM Doctoral Dissertation Award
- 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)
- 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

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### 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)*

## PUBLICATIONS

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Except for [10], [11], [17], [21], and [22] the names of authors are sorted alphabetically by last name.

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

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1. **MLIC: A MaxSAT-Based framework for learning interpretable classification rules**  
Dmitry Malioutov and Kuldeep S. Meel  
Proceedings of International Conference on Constraint Programming (CP), 2018.
2. **Not All FPRASs are Equal: Demystifying FPRASs for DNF-Counting**  
*Invited to Constraints Journal*  
Kuldeep S. Meel, Aditya A. Shrotri, and Moshe Y. Vardi  
Proceedings of International Conference on Constraint Programming (CP), 2018.
3. **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
4. **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
5. **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
6. **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
7. **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
8. **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
9. **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
10. **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
11. **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.
12. **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
13. **On computing Minimal Independent Support and its applications to sampling and counting**  
*Best Student Paper Award and Invited to Constraints Journal*  
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
14. **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
15. **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

16. **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
17. **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
18. **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
19. **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
20. **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

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#### Workshop Publications(Refereed and Archived)

21. **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

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#### Preprints

22. **Network Reliability Estimation in Theory and Practice**  
Roger Paredes, Leonardo Duenas-Osorio, Kuldeep S. Meel, and Moshe Y. Vardi  
Submitted to Reliability Engineering and System Safety, 2018.

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#### TUTORIALS

- Scaling Discrete Integration and Sampling: Foundations and Challenges (July 2018)  
Co-presented with Supratik Chakraborty  
International Joint Conference on Artificial Intelligence (IJCAI 2018)
- 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)

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#### RESEARCH GRANTS

1. **Scalable Techniques for Hashing-based Constrained Counting**, PI, *SGD 250,000*, ODPRT, 02/18-01/21
2. **Scaling Discrete Integration via SAT and CSP**, PI, *SGD 498,696*, AI Singapore, 10/18-9/21

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#### ADVISING EXPERIENCE

##### PhD Students

1. **Bishwamittra Ghosh** (Jan 2018 –)

##### Masters Students

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

## Research Assistant

6. **Yash Pote** (July 2018 —)

## Undergraduate Researchers

7. **Do Andre Khoi Nguyen** (May 2018 –)  
8. **Yoshiaki Nishimura** (Aug 2018 –)  
9. **Yang Suwei** (Aug 2018 –)

## Alumni

10. **Dr. Mate Soos** (postdoc until June 2018, now Senior Privacy Engineer at Zalando SE)  
11. **Bhavishya Desai** (undergraduate intern from May 2018 – July 2018, now student at IIT Kanpur)

## TEACHING (AT NATIONAL UNIVERSITY OF SINGAPORE)

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1. CS 4244: Knowledge-based Systems (Spring 2018, co-taught with Dr. Henry Chia)

*Sample (anonymous) student feedback:*

[Student#1] ...I feel your teaching style brought a breath of fresh air to NUS, and is just what School of Computing needed. There is only a handful of other modules that made me feel the same way: I do not want to miss a single lecture. The interactive learning style, with everybodys eyes glued to the white board not the computer screen, is the way things should be taught.....Your way of teaching has allowed me to sit down and distill my goals in both academia and personal life, and I would like to thank you for that.

[Student#2] His genuine goal of the course is to make students learn how to learn which is one of the most valuable and difficult lesson in my opinion. He has a lot of passion for the course and student's well being. He is also very caring. One would say he has a strict motherly figure.

[Student#3] I can genuinely feel that you want us to thoroughly understand what you are teaching, which is definitely a sign of a good teacher. Really tries to challenge us to think from first principles/from scratch, which is something that we are not trained to do in the Singapore education system - I can see that it is a good skill to have, just that not everyone will agree with that or see the use in that.

[Student#4] EXTREMELY difficult project. definitely one of the hardest projects in my nus life

## TEACHING ASSISTANT (AT RICE UNIVERSITY)

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- 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

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Beyond NP Revolution

*DSO National Laboratories, Singapore July 2018*

[2] *Leiden University, Netherlands July 2018*

[3] *INRIA Rennes, France June 2018*

[4] *And The Formal Methods Strike Back Lightning Talk, AI Singapore Workshop May 2018*

[5] *The Second Coming of Logic in AI, First International Research Workshop in Computer Science and Information Systems 2018, Yogyakarta, Indonesia March 2018*

[6] *On Demystifying CNF-XOR Formulas Indian Institute of Technology, Delhi September 2017*

Constrained Counting and Sampling: Bridging the gap between Theory and Practice

[7] *Indian Institute of Science, Bangalore December 5, 2017*

[8] *Iowa State University April 13, 2017*

[9] *Rutgers University April 6, 2017*

[10] *New York University April 4, 2017*

- [11] *University of Utah* **March 31, 2017**
- [12] *Virginia Tech* **March 27, 2017**
- [13] *Purdue* **March 22, 2017**
- [14] *Arizona State University* **March 15, 2017**
- [15] *IST Austria* **March 9, 2017**
- [16] *MPI-SWS, Germany* **March 6, 2017**
- [17] *University of Waterloo* **March 2, 2017**
- [18] *National University of Singapore* **Feb 22, 2017**
- [19] *Institute of Theoretical Computer Science, Shanghai* **Feb 20, 2017**
- [20] *IIT Delhi* **January 18, 2017**
- [21] *IIT Kanpur* **January 16, 2017**
- [22] *IIT Bombay* **January 12, 2017**
- [23] *Tata Institute of Fundamental Research* **January 11, 2017**
- [24] *Chennai Mathematical Institute* **January 6, 2017**
- [25] *IIT Madras* **January 4, 2017**
- [26] *The First Indian SAT+SMT School* **December 2016**
- [27] Constrained Sampling and Counting: From Theory to Practice and Back *Tata Research Development and Design Centre* **December 2016**
- [28] Improving Approximate Counting for Probabilistic Inference: From Linear to Logarithmic SAT Solver Calls *Fields Institute, Workshop on Theoretical Foundations of SAT Solving* **August 2016**  
Constrained Sampling and Counting: When Practice Drives Theory
- [29] *Chennai Mathematical Institute* **January 2016**
- [30] *Theory Seminar, Hebrew University of Jerusalem* **December 2015**
- [31] Scalable Techniques for Constrained Sampling and Counting. *IBM Research, Haifa* **December 2015**
- [32] Designing Scalable Techniques for Dynamic Verification and Probabilistic Inference. *IBM Research, India* **August 2015**
- [33] SAT Sampling and Counting: From Theory to Practice. *Vienna Center of Logic and Algorithms Outstanding Masters' Thesis Award Ceremony*, **May 2015**.
- [34] Word-Level Hashing Approach to Approximate Probabilistic Inference *University of California, Berkeley* **Feb 2016**
- [35] Sampling from combinatorial spaces: Achieving the fine balancing act between independence and scalability. *IIT Bombay*, **May 2015**
- [36] Approximating probabilistic inference without losing guarantees: Combining hashing with feasibility. *IIT Bombay*, **August 2014**  
Sampling techniques for constraint satisfaction and beyond.
- [37] *Princeton University*, **June 2014**
- [38] *University of California, Berkeley*, **June 2014**
- [39] *Microsoft Research India, Bangalore*, **August 2014**.
- [40] *Mentor Graphics Inc.*, **May 2014**.  
Distribution-aware sampling for SAT and beyond.
- [41] *IIT Bombay*, **January 2014**
- [42] Distribution-aware sampling for SAT and beyond. *Synopsys Inc.*, **Dec 2013**

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## RESEARCH VISITS

- INRIA Rennes

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

## SERVICE

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- Program Committee
  1. AAI 2019
  2. CoDS COMAD 2019
  3. IJCAI 2018
  4. AAI 2018
  5. CP 2018
  6. FAW 2018
  7. CP 2017
  8. CAV-16 Artifact Evaluation
  9. Member, AAI 2015 Futures Focus Group tasked with creation of vision for AAI
- Organizer
  1. Workshop on Probabilistic Reasoning and Formal Methods at FSTTCS 2017. Co-organized with S. Akshay (IIT Bombay)
- Reviewer (Conferences): IJCAR 2018, NFM 2018, SAT 2017, TACAS 2017, SAT 2016, CAV 2015, FoSSaCS 2015, DAC 2014
- Reviewer (Journals): Algorithms (2018), CACM (2018, 2014), JAIR (2018), TOPLAS (2017), NSF (2015),
- Service at National University of Singapore
  - Assistant Professor Representative at School of Computing Execute committee (08/18 – present)
  - School of Computing New Building Committee (05/18 – present)
  - Program Committee, AI Singapore Workshop (05/18)
  - Tutorial at SoC workshop in Indonesia Yogyakarta (03/18)
  - Tutorial at School of Computing Winter School 2018 (01/18)
  - Graduate recruiting committee (2018–present)
  - Judge, NUS High School International Mathematics Challenge (05/2018)
- Examiner
  - Mahshid Mohammadalita Jrishi at Polytechnique Montral (May 2018)
- 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

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

Invited participant at prestigious workshops

- Theory and Practice of Satisfiability Solving at Casa Matemtica Oaxaca 2018 (Declined)
- The Second Indian SAT+SMT School, Mysore Park Workshop 2017
- Theoretical Foundations of SAT Solving, Fields Institute, 2016