

KULDEEP S. MEEL

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ACADEMIC APPOINTMENT

National University of Singapore
Sung Kah Kay Assistant Professor (July 2018 – Present)
Affiliate, Institute of Data Science (Sep 2018–Present)
Assistant Professor (Dec 2017 – Present)
Computer Science Department, School of Computing

Indian Institute of Technology, Bombay
Visiting Assistant Professor (Dec 2018 – Present)

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

- Sung Kah Kay Assistant Professorship
- Ralph Budd for research in Engineering for the best doctoral thesis in the School of Engineering at Rice University, 2018
Nominated for 2017 ACM Doctoral Dissertation Award
- ACP Doctoral Dissertation Award, Honorable Mention, 2018
- Outstanding Master Thesis Award from the Vienna Center for Logic and Algorithms, 2014
- IBM PhD Fellowship (2016-17)
- Lodieska Stockbridge Vaughn Fellowship (2016-17)
- Best Student Paper Award, 21st International Conference on Principles and Practice of Constraint Programming (CP-2015)
- Andrew Ladd Fellowship for excellence in computer science at Rice University (2013-14)
- 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)

PUBLICATIONS

Except for [30], [29], [28], [25], [24], [23], [13], [12], [6], [2], and [1]. the names of authors are sorted alphabetically by last name.

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

30. **WAPS: Weighted and Projected Sampling**
Rahul Gupta, Shubham Sharma, Subhajit Roy and Kuldeep S. Meel
To Appear in Proc. of International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2019
29. **Bosphorus: Bridging ANF and CNF Solvers**
Davin Choo, Mate Soos, Kian Ming A. Chai, and Kuldeep S. Meel
To Appear in Proc. of Design, Automation and Test in Europe (DATE) 2019
28. **BIRD: Engineering an Efficient CNF-XOR SAT Solver and its Applications to Approximate Counting**
Mate Soos and Kuldeep S. Meel
To Appear In Proc. of AAAI Conference on Artificial Intelligence (AAAI) 2019
27. **On Testing of Uniform Samplers**
Sourav Chakraborty and Kuldeep S. Meel
To Appear In Proc. of AAAI Conference on Artificial Intelligence (AAAI) 2019
26. **On the hardness of Probabilistic Inference Relaxations**
Supratik Chakraborty, Kuldeep S. Meel, and Moshe Y. Vardi
To Appear in Proc. of AAAI Conference on Artificial Intelligence (AAAI) 2019
25. **IMLI: An Incremental Framework for MaxSAT-Based Learning of Interpretable Classification Rules**
Bishwamittra Ghosh and Kuldeep S. Meel
Proceedings of AAAI/ACM Conference on AI, Ethics, and Society(AIES), 2019
24. **A Weighted Model Counting Approach for Critical Infrastructure Reliability**
Roger Paredes, Leonardo Duenas-Osorio, Kuldeep S. Meel, and Moshe Y. Vardi
To Appear in Proc. of 13th International Conference on Applications of Statistics and Probability in Civil Engineering, (ICASP13), 2019
23. **Knowledge Compilation meets Uniform Sampling**
Shubham Sharma, Rahul Gupta, Subhajit Roy and Kuldeep S. Meel
In Proc. of International Conference on Logic for Programming, Artificial Intelligence and Reasoning (LPAR), 2018
22. **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.
21. **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.
20. **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
19. **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
18. **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
17. **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

16. **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
15. **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
14. **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
13. **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
12. **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.
11. **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
10. **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
9. **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
8. **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
7. **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
6. **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
5. **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
4. **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
3. **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)

2. **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

Preprints

1. **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.

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)

RESEARCH GRANTS

1. **Scaling Discrete Integration via SAT and CSP**, PI, *SGD 498,696* (share: 50%), AI Singapore, 10/18-9/21
2. **Scalable Techniques for Hashing-based Constrained Counting**, PI, *SGD 250,000*, ODPRT, 02/18-01/21

ADVISING EXPERIENCE

PhD Students

1. **Bishwamittra Ghosh** (Jan 2018 –)
2. **Yash Pote** (Jan 2019 –)
3. **Priyanka Golia** (IIT Kanpur, co-advised with Subhajit Roy) (Jul 2018–)

Masters Students

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

Research Assistant

7. **Mohimenu Kabir** (Sep 2018 –)
8. **Himanshu Arora** (Feb 2019 –)

Undergraduate Researchers

9. **Do Andre Khoi Nguyen** (May 2018 –)
10. **Yang Suwei** (Aug 2018 –)

Alumni

11. **Alexis de Colnet** (Completed Masters thesis) (Jan 2018 – Dec 2018)
12. **Dr. Mate Soos** (postdoc until June 2018, now Senior Privacy Engineer at Zalando SE)
13. **Bhavishya Desai** (undergraduate intern from May 2018 – July 2018, now student at IIT Kanpur)

TEACHING (AT NATIONAL UNIVERSITY OF SINGAPORE)

1. CS 4244: Knowledge Representation and Reasoning (Spring 2019)
2. CS 6283: Logic in AI (Fall 2018)
Sample (anonymous) student feedback:

[Student#1] The teaching style is like a fresh of breath air and it forces you to question the material. It was one of those classes where I'd get excited to attend and participate in the class. I had fun in this class!

[Student#2] Despite the high standard set in his lecture, assignment and quiz, I always find him approachable and encouraging. He is one the most trusted and inspiring teachers I have met.

3. 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.

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

Towards Verifying AI Systems

1. *Rice University* **Feb 2019**
2. *Indian Institute of Technology, Bombay* **Jan 2019**

CrystalBall: Gazing in the Black Box of SAT Solving

3. *The Third Indian SAT+SMT School, IIIT Hyderabad* **Dec 2018**
4. *Indian Institute of Technology, Delhi* **Sep 2018**
5. *Theory and Practice of Satisfiability Solving at Casa Matematica Oaxaca* **Aug 2018**

Beyond NP Revolution

6. *Complexity, Algorithms, Automata and Logic Meet (CAALM), Chennai* **Jan 2019**
7. *IIT Hyderabad* **Dec 2018**
8. *Singapore University of Technology and Design* **October 2018**
9. *DSO National Laboratories, Singapore* **July 2018**
10. *Leiden University, Netherlands* **July 2018**
11. *INRIA Rennes, France* **June 2018**
12. *And The Formal Methods Strike Back Lightning Talk, AI Singapore Workshop* **May 2018**
13. *The Second Coming of Logic in AI, First International Research Workshop in Computer Science and Information Systems 2018, Yogyakarta, Indonesia* **March 2018**
14. *On Demystifying CNF-XOR Formulas Indian Institute of Technology, Delhi* **September 2017**

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

15. *Indian Institute of Science, Bangalore* **December 5, 2017**
16. *Iowa State University* **April 13, 2017**
17. *Rutgers University* **April 6, 2017**
18. *New York University* **April 4, 2017**
19. *University of Utah* **March 31, 2017**
20. *Virginia Tech* **March 27, 2017**
21. *Purdue* **March 22, 2017**
22. *Arizona State University* **March 15, 2017**
23. *IST Austria* **March 9, 2017**

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

RESEARCH VISITS

- INRIA Rennes June 2018
- Microsoft Research Jan 2016
- Institute for Advanced Studies, Hebrew University of Jerusalem Oct - Dec, 2015
- Synopsys Inc Dec 2013

SERVICE

- Program Committee
 1. IJCAI 2019
 2. AAAI 2019
 3. SAT 2019
 4. AIES 2019
 5. CoDS COMAD 2019
 6. IJCAI 2018 (Awarded Distinguished PC Member)
 7. AAAI 2018
 8. CP 2018
 9. FAW 2018
 10. CP 2017
 11. CAV-16 Artifact Evaluation
 12. Member, AAAI 2015 Futures Focus Group tasked with creation of vision for AAAI
- Organizer
 1. Workshop on Probabilistic Reasoning and Formal Methods at FSTTCS 2017. Co-organized with S. Akshay (IIT Bombay)
- Reviewer (Conferences): HPCA 2018, IJCAR 2018, NFM 2018, SAT 2017, TACAS 2017, SAT 2016, CAV 2015, FoSSaCS 2015, DAC 2014
- Reviewer (Journals): Artificial Intelligence (2018), 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)
- Thesis Examiner at NUS
 - Guillaume Henri J. Freisz (MComp, Nov 2018)
- External Examiner
 - Mahshid Mohammadalitajrishi 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

- Invited participant at prestigious workshops
 - Bringing CP, SAT and SMT together: Next Challenges in Constraint Solving, Dagstuhl (declined due to travel conflict)
 - The Third Indian SAT+SMT School, IIT Hyderabad 2018
 - Theory and Practice of Satisfiability Solving at Casa Matematica Oaxaca 2018
 - The Second Indian SAT+SMT School, Mysore Park Workshop 2017

- Theoretical Foundations of SAT Solving, Fields Institute, 2016
- The First Indian SAT+SMT School, TIFR 2016
- 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)