

RAAZ DWIVEDI

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ACADEMIC APPOINTMENTS

FODSI Postdoctoral Fellow

2021—

Harvard University, School of Engineering and Applied Sciences, Boston, USA
Massachusetts Institute of Technology, Department of EECS, Cambridge, USA

- Advisors: *Prof. Susan Murphy & Prof. Devavrat Shah*

EDUCATION

Ph.D., Electrical Engineering and Computer Sciences

2015—2021

University of California, Berkeley, USA

- Advisors: *Prof. Martin Wainwright & Prof. Bin Yu*
- Thesis title: *Principled statistical approaches for sampling and inference in high dimensions*
- Thesis committee members: *Prof. David Aldous & Prof. Peter Bartlett*

B. Tech., Electrical Engineering

2010—2014

Indian Institute of Technology, Bombay, India

- Advisor: *Prof. Vivek Borkar*
- Graduated with Honors in EE and Minors in Mathematics
- Secured Institute Rank 1 (amongst a thousand)

RESEARCH INTERESTS

Theoretical and applied aspects of statistical machine learning and data science with a focus on causal inference, reinforcement learning, and theory of MCMC methods

ACHIEVEMENTS & AWARDS

Best Student Paper Award, Sections on Statistical Computing and Statistical Graphics, American Statistical Association (ASA) *USA, 2022*

Outstanding Graduate Student Instructor Award, UC Berkeley *Berkeley, 2020*

Student Travel Award, NeurIPS 2018 *Canada, 2018*

Oberwolfach Leibniz Graduate Students Travel Grant *Germany, 2017*

Student Travel Award, SAMSI QMC Workshop 2017, Raleigh-Durham *USA, 2017*

Berkeley Fellowship, the most prestigious fellowship for incoming students *Berkeley, 2015*

President of India Gold Medal, IIT Bombay, for the highest GPA in the institute *India, 2014*

Institute Silver Medal, IIT Bombay, for the highest Honors GPA in the EE department *India, 2014*

Best B. Tech. Project Award, IIT Bombay *India, 2014*

All India Rank 10 (amongst half a million), IIT Joint Entrance Exam (IIT-JEE) *India, 2010*

All India Rank 46 (amongst a million), All India Engineering Entrance Exam *India, 2010*

WORK EXPERIENCE	Microsoft Research , Research Intern (with Lester Mackey), New England, USA	<i>Summer 2019</i>
	Mist Systems (Juniper Networks), Data Science Intern, Cupertino, USA	<i>Summer 2017</i>
	WorldQuant Research , Senior Quantitative Researcher, Mumbai, India	<i>2014—2015</i>
	Stanford University , Research intern (with Prof. Balaji Prabhakar), USA	<i>Summer 2013</i>
	Ivy Mobility , Data Science Intern, Chennai, India	<i>Winter 2012</i>

JOURNAL
PUBLICATIONS

(\star denotes equal contribution, and \dagger denotes alphabetical ordering)

- J1. **Raaz Dwivedi** \star , Yan Shuo Tan \star , Briton Park, Mian Wei, Kevin Horgan, David Madigan, and Bin Yu, “Stable discovery of interpretable subgroups via calibration in causal studies”, *International Statistical Review (ISR)*, 2020.
- J2. Nick Altieri \dagger , Rebecca L. Barter, James Duncan, **Raaz Dwivedi**, Karl Kumbier, Xiao Li, Robert Netzer, Briton Park, Chandan Singh, Yan Shuo Tan, Tiffany Tang, Yu Wang, Chao Zhang and Bin Yu, “Curating a COVID-19 data repository and forecasting county-level death counts in the United States”, *Harvard Data Science Review (HDSR)*, 2020.
- J3. **Raaz Dwivedi** \star , Nhat Ho \star , Koulik Khamaru \star , Martin J. Wainwright, Michael I. Jordan and Bin Yu, “Singularity, misspecification, and the convergence rate of EM”, *Annals of Statistics (AoS)*, 2020.
- J4. Yuansi Chen, **Raaz Dwivedi**, Martin J. Wainwright and Bin Yu, “Fast mixing of Metropolized Hamiltonian Monte Carlo: Benefits of multi-step gradients”, *Journal of Machine Learning Research (JMLR)*, 2020.
- J5. **Raaz Dwivedi** \star , Yuansi Chen \star , Martin J. Wainwright and Bin Yu, “Log-concave sampling: Metropolis-Hastings algorithms are fast”, *Journal of Machine Learning Research (JMLR)*, 2019.
- J6. **Raaz Dwivedi** \dagger , Ohad N. Feldheim, Ori Gurel-Gurevich and Aaditya Ramdas, “The power of online thinning in reducing discrepancy”, *Probability Theory and Related Fields (PTRF)*, 2019.
- J7. Yuansi Chen \star , **Raaz Dwivedi** \star , Martin J. Wainwright and Bin Yu, “Fast MCMC sampling algorithms on polytopes”, *Journal of Machine Learning Research (JMLR)*, 2018.
- J8. Vivek Borkar \dagger , **Raaz Dwivedi** and Neeraja Sahasrabudhe, “Gaussian approximations in high dimensional estimation”, *Systems & Control Letters*, 2016.

CONFERENCE
PUBLICATIONS

- C1. **Raaz Dwivedi** and Lester Mackey, “Generalized kernel thinning”, To appear in *International Conference on Learning Representations (ICLR)*, 2022.
- C2. Abhishek Shetty, **Raaz Dwivedi** and Lester Mackey, “Distribution compression in near-linear time”, To appear in *International Conference on Learning Representations (ICLR)*, 2022.
- C3. **Raaz Dwivedi** and Lester Mackey, “Kernel thinning”, Extended abstract in *Conference on Learning Theory (COLT)*, 2021.
- C4. **Raaz Dwivedi** \star , Nhat Ho \star , Koulik Khamaru \star , Martin J. Wainwright, Michael I. Jordan and Bin Yu, “Sharp analysis of Expectation-Maximization for weakly identifiable models”, *The 23rd International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2020.
- C5. **Raaz Dwivedi** \star , Nhat Ho \star , Koulik Khamaru \star , Martin J. Wainwright and Michael I. Jordan, “Theoretical guarantees for EM under misspecified Gaussian mixture models”, *Advances in Neural Information Processing Systems (NeurIPS)*, Montréal, 2018.
- C6. **Raaz Dwivedi** \star , Yuansi Chen \star , Martin J. Wainwright and Bin Yu, “Log-concave sampling: Metropolis-Hastings algorithms are fast”, Extended abstract in *Conference on Learning Theory (COLT)*, Stockholm, 2018.

- C7. Yuansi Chen^{*}, **Raaz Dwivedi**^{*}, Martin J. Wainwright and Bin Yu, “Vaidya walk: A sampling algorithm based on the volumetric barrier”, *Communication, Control, and Computing (Allerton)*, 55th Annual Allerton Conference, 2017.
- C8. **Raaz Dwivedi** and Vivek Borkar, “Removing sampling bias in networked stochastic approximation”, *International Conference on Signal Processing and Communications (SPCOM)*, Bangalore, 2014.

PRE-PRINTS

- P1. **Raaz Dwivedi**^{*}, Chandan Singh^{*}, Bin Yu and Martin J. Wainwright, “Revisiting complexity and the bias-variance tradeoff”, *arXiv preprint (in journal submission)*.
- P2. Nhat Ho^{*}, Koulik Khamaru^{*}, **Raaz Dwivedi**^{*}, Martin J. Wainwright, Michael I. Jordan and Bin Yu, “Instability, computational efficiency, and statistical accuracy”, *arXiv preprint (in journal submission)*.

RESEARCH TALKS

- T1. Imputation using nearest neighbors for adaptively collected data. *Foundations of Data Science Institute (FODSI)*. (Invited talk) Jan 2022
- T2. Revisiting Minimum Description Length Complexity in Overparameterized Models. *Collaborations on the Theoretical Foundations of Deep Learning*. (Invited talk) Nov 2021
- T3. Non-asymptotic Guarantees for MCMC and Kernel Thinning. *Finale Doshi-Velez Group Meeting, Harvard University*. (Invited talk) Oct 2021
- T4. Kernel Thinning. *The Data-Centric Engineering Reading Group (DCE), Alan Turing Institute*. (Invited talk) Sep 2021
- T5. Kernel Thinning. *Stat 300, Harvard University*. Sep 2021
- T6. Kernel Thinning. *Monte Carlo Methods & Applications (MCM)*. (Contributed talk) Sep 2021
- T7. Kernel Thinning. *2021 World Meeting of the International Society for Bayesian Analysis (ISBA)*. (Contributed talk) Aug 2021
- T8. Kernel Thinning. *The Bayesian Young Statisticians Meeting (BAYSM) 2021*. (Contributed talk) Aug 2021
- T9. Kernel Thinning. *Conference on Learning Theory (COLT)*. (Contributed talk) Aug 2021
- T10. Kernel Thinning. *Subset Selection in Machine Learning Workshop, International Conference on Machine Learning (Subset ML, ICML)*. (Contributed talk) July 2021
- T11. Revisiting Complexity and the Bias-Variance Tradeoff: Using Minimum Description Length. *North American School of Information Theory (NASIT)*. (Contributed poster) June 2021
- T12. Revisiting Complexity and the Bias-Variance Tradeoff: Using Minimum Description Length. *Workshop on the Theory of Overparameterized Machine Learning (TOPML)*. (Contributed talk) Apr 2021
- T13. Revisiting Complexity and the Bias-Variance Tradeoff: Using Minimum Description Length. *Stat 212, UC Berkeley*. (Guest Lecture) Apr 2021
- T14. Subgroup Discovery in Randomized Experiments & Markov Chain Monte Carlo Sampling. *Research Seminar, USC Marshall School of Business*. (Invited talk) Feb 2021
- T15. Subgroup Discovery in Randomized Experiments & Markov Chain Monte Carlo Sampling. *Statistics Seminar, University of Toronto*. (Invited talk) Feb 2021
- T16. Subgroup Discovery in Randomized Experiments & Markov Chain Monte Carlo Sampling. *MINDS Symposium on the Foundations of Data Science, John Hopkins University*. (Invited talk) Feb 2021
- T17. Subgroup Discovery in Randomized Experiments & Markov Chain Monte Carlo Sampling. *Devavrat Shah and Susan Murphy Group Meetings, MIT and Harvard University*. (Invited talk) Feb 2021

- T18. Subgroup Discovery in Randomized Experiments & Markov Chain Monte Carlo Sampling. *Research Seminar, Microsoft Research New England*. (Invited talk) Jan 2021
- T19. Non-asymptotic Guarantees for Markov Chain Monte Carlo. *Flatiron Institute Seminar*. (Invited talk) Jan 2021
- T20. Subgroup Discovery in Randomized Experiments & Markov Chain Monte Carlo Sampling. *Statistics Seminar, University of Washington*. (Invited talk) Jan 2021
- T21. Subgroup Discovery in Randomized Experiments & Markov Chain Monte Carlo Sampling. *Operations Research and Statistics Group Seminar, MIT Sloan*. (Invited talk) Jan 2021
- T22. New Perspectives on Old Problems in Causal Inference and MCMC Sampling. *Statistics Seminar, UC Irvine*. (Invited talk) Jan 2021
- T23. StaDISC: Stable discovery of interpretable subgroups via calibration. *Young Data Scientist Research Seminar, ETH Zurich*. (Invited talk) Sep 2020
- T24. Veridical Data Science and the PCS Framework. *ASA Annual Symposium on Data Science and Statistics (SDSS)*. (Invited talk) Jun 2020
- T25. Statistics Meets Optimization: Two Vignettes on The Intersection, *Department of Mathematics and Statistics, IIT Kanpur, India*. (Invited talk) Jan 2020
- T26. Singularity, misspecification and the convergence rate of Expectation-Maximization. *Fall Western Sectional Meeting of the AMS, UC Riverside*. (Invited talk) Nov 2019
- T27. Power of gradients and accept-reject step in MCMC algorithms. *BIDS Statistics and Machine Learning Forum, UC Berkeley*. (Invited Talk) Mar 2019
- T28. Log-concave sampling: Metropolis Hastings algorithms are fast. *Conference on Learning Theory (COLT) 2018, Stockholm, Sweden*. (Conference Poster) Dec 2018
- T29. Log-concave sampling: Metropolis Hastings algorithms are fast. *Jerusalem Joint Statistical Event, Israel*. (Contributed talk) Dec 2018
- T30. Theoretical guarantees for EM under misspecified Gaussian mixture models. *Neural Information Processing Systems (NeurIPS) 2018, Montréal, Canada*. (Conference Poster) Dec 2018
- T31. Theoretical Guarantees for MCMC Algorithms, *Department of Electrical Engineering, IIT Bombay, India*. (Invited talk) Jan 2018
- T32. Theoretical Guarantees for MCMC Algorithms, *School of Technology and Computer Science Seminar, TIFR Bombay, India*. (Invited talk) Jan 2018
- T33. The power to two choices in reducing discrepancy, *SAMSI QMC Opening Workshop, Raleigh-Durham, Duke University*. (Contributed Poster) Aug 2017

TEACHING
EXPERIENCE

Teaching Fellow, Harvard University 2022–

- *STAT 234, Spring 2022*: Sequential Decision Making, taught by Prof. Susan Murphy.

Graduate Student Instructor, UC Berkeley 2018–2019

- *EECS 189, Spring 2018*: Introduction to Machine Learning, taught by Prof. Anant Sahai and Prof. Jennifer Listgarten. *Co-led* the content development (homeworks, discussions and exams) in a team of 20+ TAs in a class of 350+ students.
- Spring 2019 for *STAT 154*: Modern Statistical Prediction and Machine Learning taught by Prof. Bin Yu. Helped in *redesigning* the class along with one other TA, Yuansi Chen, for a class of 140+ students.
- **Guest lectures**: (i) *STAT 154, Spring 2019*: “Boosting” (ii) *EECS 189, Fall 2019*: “An Introduction to Ensemble Methods: Bagging, Random Forest, Boosting”.

Teaching Assistant, IIT Bombay and Government of India 2011–2014

- 9-time TA for undergraduate courses on *Calculus, Linear Algebra, Differential Equations, and Electromagnetism*. Responsible for weekly discussions (40 students) besides exam grading.
- TA for an online course on *Linear Algebra* (for 400 undergraduate colleges) organized by Ministry of Human Resource Development (MHRD) of Government of India.

ACADEMIC SERVICES

Mentoring Activities

- BAIR PhD Buddy Program for *incoming graduate students*, UC Berkeley 2020—2021
- BAIR UG Mentoring Program for *undergraduates*, UC Berkeley 2017—2021
- Institute Student Mentoring Program for *incoming undergraduates*, IIT Bombay 2013—2014
- EE Academic Mentoring Program for *sophomores and juniors*, IIT Bombay 2012—2014
- Intensive Mentoring Program for selected *incoming undergraduates*, IIT Bombay 2012—2013

Reviewing Activities

- Journal of Machine Learning Research (JMLR) (4 Papers) 2020–
- IEEE Transactions on Information Theory (4 Papers) 2020–
- Bernoulli (1 Paper) 2021–
- International Conference on Machine Learning (ICML) 2019, 2020
- Neural Information Processing Systems (NeurIPS) 2019, 2020
- Conference on Learning Theory (COLT) 2019
- Foundations of Computer Science (FOCS) 2018, 2020
- Symposium on Discrete Algorithms (SODA) 2019
- AAAI Conference on Artificial Intelligence 2020

EECS Graduate Admissions Committee, UC Berkeley 2018, 2019, 2020

EECS Graduate Admissions Committee, MIT 2021