Raaz Dwivedi

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Academic appointments

Postdoctoral Fellow, Computer Science & Statistics, Harvard University and Electrical Engineering (EE) & Computer Sciences (CS), Massachusetts Institute of Technology (MIT) *2021—*

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

Education

Ph. D., EECS, University of California (UC), Berkeley *2015—2021*

Advisors: *Prof. Martin Wainwright & Prof. Bin Yu*
Thesis title: *Principled statistical approaches for sampling and inference in high dimensions*

B. Tech., EE, Indian Institute of Technology (IIT), Bombay, India *2010—2014*
Minors in mathematics, Institute Rank 1

Research Interests

My research builds statistically and computationally efficient strategies for data- and computation-driven personalized decision-making. My work develops theory and methods spanning the areas of causal inference, reinforcement learning, Bayesian inference, optimization, and high-dimensional statistics.

Selected Achievements & Awards

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

Best Presentation Award, Machine Learning and Statistics Session, Laboratory of Information and Decision Systems (LIDS) Student Conference, MIT *2022*

Certificate of Distinction and Excellence in Teaching (Q Award), Harvard University *2022*

Institute of Mathematical Statistics (IMS) New Researcher Travel Award, London *2022*

Foundations of Data Science (FODSI) Postdoctoral Fellowship *2021*

Outstanding Graduate Student Instructor Award, UC Berkeley *2020*

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

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

Best Undergraduate Thesis Award, IIT Bombay *2014*

All India Rank 10 amongst half a million, IIT Joint Entrance Exam *2010*

Work Experience

Microsoft Research, Research Intern with Lester Mackey, New England, USA *2019*

Mist Systems, Juniper Networks, Data Science Intern, Cupertino, USA *2017*

WorldQuant Research, Senior Quantitative Researcher, Mumbai, India *2014—2015*

Stanford University, Research Intern with Prof. Balaji Prabhakar, USA *2013*

Ivy Mobility, Data Science Intern, Chennai, India *2012*

Pre-Prints & Working Papers

(⋆ denotes equal contribution and † denotes alphabetical ordering; title is hyperlinked to the online pdf of the paper)

P1. **Raaz Dwivedi**, Katherine Tian, Sabina Tomkins, Predrag Klasnja, Susan Murphy, Devavrat Shah, "Counterfactual inference in sequential experimental design", *arxiv, to be submitted to Annals of Statistics (AoS).* *2022*

P2. Abhin Shah, **Raaz Dwivedi**, Devavrat Shah, Greg Wornell, "On counterfactual inference with unobserved confounding", *NeurIPS workshop, full version to be submitted to AoS.* *2022*

P3. Carles Domingo-Enrich, **Raaz Dwivedi**, Lester Mackey, "Compress then test: Powerful kernel testing in near-linear time", *in conference submission.* *2022*

P4. **Raaz Dwivedi***, Kelly Zhang*, Prasidh Chhabria, Predrag Klasnja, Susan Murphy, "Assessing personalization by a reinforcement learning algorithm", *Working paper to be submitted to JRSSB.* *2022*

P5. **Raaz Dwivedi**, Katherine Tian, Sabina Tomkins, Predrag Klasnja, Susan Murphy, Devavrat Shah, "On doubly robust nearest neighbors in factor models", *Working paper.* *2022*

P6. Nhat Ho*, Koulik Khamaru*, **Raaz Dwivedi***, Martin J. Wainwright, Michael I. Jordan, Bin Yu, "Instability, computational efficiency, and statistical accuracy", *under review at JMLR.* *2021*

P7. **Raaz Dwivedi***, Chandan Singh*, Bin Yu, Martin J. Wainwright, "Revisiting minimum description length complexity in overparameterized models", *in revision at JMLR.* *2021*

Journal Publications

J1. Nick Altieri†, Rebecca L. Barter, James Duncan, **Raaz Dwivedi**, Karl Kumbier, Xiao Li, Robert Netzorg, Briton Park, Chandan Singh, Yan Shuo Tan, Tiffany Tang, Yu Wang, Chao Zhang, Bin Yu, "Curating a COVID-19 data repository and forecasting county-level death counts in the United States", *Harvard Data Science Review (HDSR).* *2021*

J2. **Raaz Dwivedi***, Yan Shuo Tan*, Briton Park, Mian Wei, Kevin Horgan, David Madigan, Bin Yu, "Stable discovery of interpretable subgroups via calibration in causal studies", *Int. Statistical Review.* *2020*

J3. **Raaz Dwivedi***, Nhat Ho*, Koulik Khamaru*, Martin J. Wainwright, Michael I. Jordan, Bin Yu, "Singularity, misspecification, and the convergence rate of EM", *Annals of Statistics (AoS).* *2020*

J4. Yuansi Chen, **Raaz Dwivedi**, Martin J. Wainwright, Bin Yu, "Fast mixing of Metropolized Hamiltonian Monte Carlo: Benefits of multi-step gradients", *Journal of Machine Learning Research (JMLR).* *2020*

J5. **Raaz Dwivedi***, Yuansi Chen*, Martin J. Wainwright, Bin Yu, "Log-concave sampling: Metropolis-Hastings algorithms are fast", *Journal of Machine Learning Research (JMLR).* *2019*

J6. **Raaz Dwivedi**†, Ohad N. Feldheim, Ori Gurel-Gurevich, Aaditya Ramdas. "The power of online thinning in reducing discrepancy", *Probability Theory and Related Fields (PTRF).* *2019*

J7. Yuansi Chen*, **Raaz Dwivedi***, Martin J. Wainwright, Bin Yu. "Fast MCMC sampling algorithms on polytopes", *Journal of Machine Learning Research (JMLR).* *2018*

J8. Vivek Borkar†, **Raaz Dwivedi**, Neeraja Sahasrabudhe. "Gaussian approximations in high dimensional estimation", *Systems & Control Letters.* *2016*

Conference Publications

C1. **Raaz Dwivedi**, Lester Mackey. "Generalized kernel thinning", *International Conference on Learning Representations (ICLR).* *2022*

C2. Abhishek Shetty, **Raaz Dwivedi**, Lester Mackey. "Distribution compression in near-linear time", *International Conference on Learning Representations (ICLR).* *2022*

C3. **Raaz Dwivedi**, Lester Mackey, "Kernel thinning", Extended abstract in *Conference on Learning Theory (COLT). Full version under review in JMLR.* *2021*

C4. **Raaz Dwivedi***, Nhat Ho*, Koulik Khamaru*, Martin J. Wainwright, Michael I. Jordan, 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***, Nhat Ho*, Koulik Khamaru*, Martin J. Wainwright, Michael I. Jordan, "Theoretical guarantees for EM under misspecified Gaussian mixture models", *Advances in Neural Information Processing Systems (NeurIPS).* *2018*

C6. **Raaz Dwivedi***, Yuansi Chen*, Martin J. Wainwright, Bin Yu, "Log-concave sampling: Metropolis-Hastings algorithms are fast", Extended abstract in *Conference on Learning Theory (COLT).* *2018*

C7. Yuansi Chen*, **Raaz Dwivedi***, Martin J. Wainwright, Bin Yu, "Vaidya walk: A sampling algorithm based on the volumetric barrier", *Allerton Conference.* *2017*

C8. **Raaz Dwivedi**, Vivek Borkar, "Removing sampling bias in networked stochastic approximation", *International Conference on Signal Processing and Communications (SPCOM).* *2014*

Softwares & Methodologies

S1. Carles Domingo-Enrich, **Raaz Dwivedi**, Lester Mackey. Python package "Compress then test" (link).

S2. Abhishek Shetty*, **Raaz Dwivedi***, Lester Mackey. Python package "Compress++" (link).

S3. **Raaz Dwivedi**, Lester Mackey. Python package "Kernel Thinning" (link).

S4. **Raaz Dwivedi***, Yan Shuo Tan*, Briton Park, Mian Wei, Kevin Horgan, David Madigan, Bin Yu. Python repository "StaDISC" (link).

S5. Yuansi Chen*, **Raaz Dwivedi***, Martin Wainwright, Bin Yu. Python package (with C++ implementation) "Vaidya and John walks" (link).

Invited Research Talks

T1. Counterfactual inference in sequential experiments using nearest neighbors. *INFORMS Annual Meeting, Indianapolis.* *Oct 2022*

T2. Revisiting minimum description length complexity in overparameterized models. *Algorithmic Information Theory & Machine Learning Symp., Alan Turing Institute, London.* *July 2022*

T3. Counterfactual inference in sequential experimental design. *Institute of Mathematical Statistics (IMS) Annual Meeting, Statistical Machine Learning Session, London.* *June 2022*

T4. Near-optimal compression in near-linear time. *Symp. on Kernel methods for numerical integration, SIAM Conference on Uncertainty Quantification, Atlanta.* *Apr 2022*

T5. Near-optimal compression in near-linear time. *Stable, Generalizable, & Transferable Statistical Learning Workshop, Mathematical Sciences Research Institute, Berkeley.* *Mar 2022*

T6. Counterfactual inference in sequential experimental design. *Learning from Interventions Workshop, Simons Institute, Berkeley.* *Feb 2022*

T7. Revisiting minimum description length complexity in overparameterized models. *Collaborations on the Theoretical Foundations of Deep Learning, Virtual.* *Nov 2021*

T8. Kernel thinning. *Data-Centric Engineering Group, Alan Turing Institute, Virtual.* *Sep 2021*

T9. StaDISC: Stable discovery of interpretable subgroups via calibration. *Young Data Scientist Research Seminar, ETH Zurich, Virtual.* *Sep 2020*

T10. Veridical data science. *ASA Annual Symposium on Data Science & Statistics, Virtual.* *Jun 2020*

T11. Statistics meets optimization: Two vignettes. *Math & Stats Seminar, IIT Kanpur.* *Jan 2020*

T12. Singularity, misspecification, & the convergence rate of EM. *AMS Meeting, UC Riverside.* *Nov 2019*

T13. Power of gradients and accept-reject step in MCMC algorithms. *BIDS, UC Berkeley.* *Mar 2019*

T14. Theoretical guarantees for MCMC algorithms, *EE Dept, IIT Bombay.* *Jan 2018*

T15. Theoretical guarantees for MCMC algorithms, *STCS Seminar, TIFR Bombay.* *Jan 2018*

Contributed & Other Research Talks

R1. Generalized kernel thinning. *Joint Statistical Meeting (JSM), Washington DC.* *Aug 2022*

R2. Counterfactual inference in sequential experimental design. *Stats & DS Conference, MIT.* *Apr 2022*

R3. Counterfactual inference in sequential experimental design. *Econometrics Lunch, MIT.* *Mar 2022*

R4. Near-optimal compression in near-linear time. *LIDS Student Conference, MIT.* *Jan 2022*

R5. Kernel thinning. *Monte Carlo Methods & Applications (MCM), Virtual.* *Sep 2021*

R6. Kernel thinning. *Int. Soc. for Bayesian Analysis (ISBA) World Meeting, Virtual.* *Aug 2021*

R7. Kernel thinning. *The Bayesian Young Statisticians Meeting (BAYSM), Virtual.* *Aug 2021*

R8. Kernel thinning. *Joint Statistical Meeting (JSM), Virtual.* *Aug 2021*

R9. Kernel thinning. *Conference on Learning Theory (COLT), Virtual.* *Aug 2021*

R10. Kernel thinning. *Subset Selection, International Conference on Machine Learning (ICML), Virtual.* *Jul 2021*

R11. Revisiting complexity and the bias-variance tradeoff: Using minimum description length. *Theory of Overparameterized Machine Learning (TOPML) Workshop, Virtual.* *Apr 2021*

R12. Converging fast and slow: Statistics vs optimization. *BAIR and BDD Retreat, Berkeley, Virtual.* *Aug 2020*

R13. Log-concave sampling: Metropolis Hastings algorithms are fast. *Jerusalem Stat. Event.* *Dec 2018*

R14. Vaidya walk: A sampling algorithm based on the volumetric barrier. *Allerton Conference.* *Oct 2017*

Contributed Poster Presentations

C1. On counterfactual inference in factor models with nearest neighbors. *Cornell ORIE Young Researchers Workshop, Ithaca.* *Oct 2022*

C2. Counterfactual inference in sequential experimental design. *Royal Statistical Society (RSS) Conference, Aberdeen, Scotland.* *Sep 2022*

C3. Near-optimal compression in near-linear time. *RSS Conference, Aberdeen, Scotland.* *Sep 2022*

C4. Counterfactual inference in sequential experimental design. *Synthetic Control Methods Workshop, Data X, Princeton University.* *Jun 2022*

C5. Counterfactual inference in sequential experimental design. *American Causal Inference Conference (ACIC), UC Berkeley.* *May 2022*

C6. Counterfactual inference in sequential experimental design. *Symposium for Mathematical Sciences (SMaSH), Harvard University.* *May 2022*

C7. Counterfactual inference in sequential experimental design. *MIT Statistics & Data Science Conference (SDSCon), MIT.* *April 2022*

C8. Generalized kernel thinning. *Advances in Approx. Bayesian Inference (AABI), Virtual.* *Feb 2022*

C9. Revisiting complexity and the bias-variance tradeoff: Using minimum description length. *North American School of Information Theory (NASIT), Virtual.* *Jun 2021*

C10. Log-concave sampling: Metropolis Hastings algorithms are fast. *Conference on Learning Theory (COLT), Stockholm, Sweden.* *Dec 2018*

C11. Theoretical guarantees for EM under misspecified Gaussian mixture models. *Neural Information Processing Systems (NeurIPS), Montreál, Canada.* *Dec 2018*

C12. The power to two choices in reducing discrepancy, *SAMSI Workshop, Duke University, Raleigh.* *Aug 2017*

Teaching Experience (TAship)

T1. Sequential Decision Making (STAT 234), *Harvard University.* *2022*

T2. Modern Statistical Prediction and Machine Learning (STAT 154), *UC Berkeley.* *2019*

T3. Introduction to Machine Learning (EECS 189), *UC Berkeley.* *2018*

T4. Linear Algebra, Calculus, Differential equations (MA 105, 106, 108, 207), *IIT Bombay.* *2011–2014*

Guest Lectures

L1. Regret analysis of posterior sampling (*3 lectures*, STAT 234), *Harvard University* *Apr 2022*

L2. Offline off-policy reinforcement learning (STAT 234) *Harvard University.* *Feb 2022*

L3. Revisiting complexity and the bias-variance tradeoff (STAT 212) *UC Berkeley.* *Apr 2021*

L4. Introduction to ensemble methods in machine learning (EECS 189), *UC Berkeley.* *Oct 2019*

L5. Introduction to boosting methods (STAT 154), *UC Berkeley.* *Apr 2019*

Academic Services

Committees

- Member, Committee on Equality and Diversity, IMS *2022—*

Scientific Meetings

- Chair, New Researchers Group Session, IMS Annual Meeting *2022*
- Chair, Statistical Machine Learning Session, IMS Annual Meeting *2022*
- Mentor, Summer Institute on Just-in-Time Adaptive Interventions via MRTs *2021*

Institutional Mentoring Activities

- MIT Institute for Data, Systems, & Society (IDSS) Postdoc Mentors for *PhDs* *2022—*
- UC Berkeley Artificial Intelligence Research (BAIR) Buddies for *incoming PhDs* *2020—2021*
- UC Berkeley BAIR Mentoring Program for *undergraduates* *2017—2021*
- IIT Bombay Student Mentoring Program (ISMP) for *incoming undergraduates* *2013—2014*
- IIT Bombay Academic Mentoring Program (DAMP) for *sophomores & juniors* *2012—2014*
- IIT Bombay Intensive Program for Entrants (IPE) for *incoming undergraduates* *2012—2013*

Graduate Admissions

- EECS Graduate Admissions Committee, MIT *2021*
- EECS Graduate Admissions Committee, UC Berkeley *2018—2020*

Reviewing Activities

- *Journals*: JMLR, IEEE-IT, JRSSB, Bernoulli, HDSR, Stats & Comp., SIAM, MOR, Jour. of Causal Inference
- *Conferences*: COLT, ICML, AISTATS, NeurIPS, FOCS, STOC, SODA, AAAI

References

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