

RAAZ DWIVEDI



Cornell



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ACADEMIC APPOINTMENTS

Assistant Professor, Operations Research & Information Engineering (ORIE) 2024–
Field Member: Applied Math, Computer Science, ORIE, Statistics
Cornell Tech, Cornell University

Visiting Assistant Professor, ORIE, Cornell University Fall 2023

FODSI Postdoctoral Fellow, CS, Statistics, EECS 2021–2023

Harvard University & Massachusetts Institute of Technology (MIT)
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 involves a multi-disciplinary approach to data science and brings together ideas from computer science, electrical engineering, and statistics in collaboration with domain experts. I develop statistical machine learning approaches for data-driven personalized decision-making with research across *causal inference, reinforcement learning, Bayesian inference, random sampling, and high-dimensional statistics*.

SELECTED ACHIEVEMENTS & AWARDS

- Best Student Paper Award, Statistical Computing & Graphics, American Statistical Association 2022
- Best Presentation Award, Laboratory of Information & Decision Systems (LIDS) Conference, MIT 2022
- Certificate of Distinction and Excellence in Teaching (Q Award), Harvard University 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 graduating class 2014
- All India Rank 10 amongst half a million, IIT Joint Entrance Exam 2010

PRE-PRINTS

- P1. Raphael Kim, Susobhan Ghosh, Prasidh Chhabria, **Raaz Dwivedi**, Peng Liao, Kelly Zhang*, Predrag Klasnja, Susan Murphy, “Did we personalize? Assessing personalization by an online reinforcement learning algorithm using resampling”, *arxiv*. 2023
- P2. **Raaz Dwivedi**, Katherine Tian, Sabina Tomkins, Predrag Klasnja, Susan Murphy, Devavrat Shah, “Counterfactual inference in sequential experimental design”, *arxiv*. 2022
- P3. **Raaz Dwivedi**, Katherine Tian, Sabina Tomkins, Predrag Klasnja, Susan Murphy, Devavrat Shah, “Doubly robust nearest neighbors in factor models”, *preliminary version on arxiv*. 2022
- P4. Abhin Shah, **Raaz Dwivedi**, Devavrat Shah, Greg Wornell, “On counterfactual inference with unobserved confounding”, *NeurIPS workshop*. 2022

CONFERENCE
PUBLICATIONS

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

- C1. Carles Domingo-Enrich, **Raaz Dwivedi**, Lester Mackey, “Compress then test: Powerful kernel testing in near-linear time”, *Conference on Artificial Intelligence and Statistics (AISTATS)*. 2023
- C2. **Raaz Dwivedi**, Lester Mackey. “Generalized kernel thinning”, *International Conference on Learning Representations (ICLR)*. 2022
- C3. Abhishek Shetty, **Raaz Dwivedi**, Lester Mackey. “Distribution compression in near-linear time”, *International Conference on Learning Representations (ICLR)*, **Best Student Paper Award, JSM**. 2022
- C4. **Raaz Dwivedi**, Lester Mackey, “Kernel thinning”, Extended abstract in *Conference on Learning Theory (COLT)*. Full version under review in *JMLR*. 2021
- C5. **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
- C6. **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
- C7. **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
- C8. Yuansi Chen★, **Raaz Dwivedi**★, Martin J. Wainwright, Bin Yu, “Vaidya walk: A sampling algorithm based on the volumetric barrier”, *Allerton Conference*. 2017
- C9. **Raaz Dwivedi**, Vivek Borkar, “Removing sampling bias in networked stochastic approximation”, *International Conference on Signal Processing and Communications (SPCOM)*. 2014

JOURNAL
PUBLICATIONS

- J1. Nhat Ho★, Koulik Khamaru★, **Raaz Dwivedi**★, Martin J. Wainwright, Michael I. Jordan, Bin Yu, “Instability, computational efficiency, and statistical accuracy”, *accepted with minor revision at JMLR*. 2023+
- J2. **Raaz Dwivedi**★, Chandan Singh★, Bin Yu, Martin J. Wainwright, “Revisiting minimum description length complexity in overparameterized models”, *accepted with minor revision at JMLR*. 2023
- J3. Nick Altieri†, 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, Bin Yu, “Curating a COVID-19 data repository and forecasting county-level death counts in the United States”, *Harvard Data Science Review (HDSR)*. 2021
- J4. **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
- J5. **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
- J6. 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
- J7. **Raaz Dwivedi**★, Yuansi Chen★, Martin J. Wainwright, Bin Yu, “Log-concave sampling: Metropolis-Hastings algorithms are fast”, *Journal of Machine Learning Research (JMLR)*. 2019
- J8. **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
- J9. Yuansi Chen★, **Raaz Dwivedi**★, Martin J. Wainwright, Bin Yu. “Fast MCMC sampling algorithms on polytopes”, *Journal of Machine Learning Research (JMLR)*. 2018
- J10. Vivek Borkar†, **Raaz Dwivedi**, Neeraja Sahasrabudhe. “Gaussian approximations in high dimensional estimation”, *Systems & Control Letters*. 2016

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](#)).

SELECTED INVITED
TALKS

From HeartSteps to HeartBeats: Personalized Decision-making

- Large Scale Learning and Control Workshop, IIT Bombay *Dec 2023*
- AI Seminar, Cornell University *Sep 2023*
- ORIE Industry and Data Science Summit, Cornell University *Sep 2023*
- Statistics and Data Science Seminar, Cornell University *Sep 2023*
- Center for Applied Math Colloquium, Cornell University *Sep 2023*
- Gatsby Unit Seminar, University College London *Feb 2023*
- Statistics and Data Science Seminar, Yale University *Feb 2023*
- Computer Science Seminar, UIUC *Feb 2023*
- Statistics Seminar, UW Madison *Jan 2023*
- Operations, Information, and Technology Seminar, GSB, Stanford University *Jan 2023*
- Statistics and Data Science Seminar, Wharton, University of Pennsylvania *Jan 2023*
- Statistics Seminar, University of Chicago *Jan 2023*
- Statistics and Operation Research Seminar, UNC Chapel Hill *Jan 2023*
- Statistics Seminar, UCLA *Jan 2023*
- Operation Research and Industrial Engineering Seminar, Cornell University *Dec 2022*
- Operation Research and Industrial Engineering Seminar, Cornell Tech *Dec 2022*
- Statistics Seminar, Rutgers University *Nov 2022*
- ISL Colloquium, EE, Stanford University *Nov 2022*
- BLISS Seminar, EECS, UC Berkeley *Nov 2022*

Compress then test: Powerful kernel testing in near-linear time

- Joint Statistical Meeting, Toronto *Jun 2023*
- Monte Carlo Methods Conference, Paris *Jun 2023*
- Computational-Statistical Interplay in Machine Learning Workshop, MIT *May 2023*

Doubly robust nearest neighbors for counterfactual inference

- Causal Inference Workshop, ACM Sigmetrics, Orlando *Jun 2023*
- New England Statistics Symposium, Boston University *Jun 2023*
- Informs Annual Meeting, Indianapolis *Oct 2022*

Counterfactual inference in sequential experiments

- Institute of Mathematical Statistics (IMS) Annual Meeting, London *Jun 2022*
- Learning from Interventions Workshop, Simons Institute, Berkeley *Feb 2022*

Near-optimal compression in near-linear time

- SIAM Conference on Uncertainty Quantification, Atlanta *Apr 2022*
- Statistical learning Workshop, Mathematical Sciences Research Institute, Berkeley *Mar 2022*

Kernel thinning

- Data-Centric Engineering Group, Alan Turing Institute, Virtual *Sep 2021*

Revisiting minimum description length complexity in overparameterized models

- Alg. Info Theory & Machine Learning Symp., Alan Turing Institute, London *Jul 2022*
- Collaborations on the Theoretical Foundations of Deep Learning, Virtual *Nov 2021*

StaDISC: Stable discovery of interpretable subgroups via calibration

- Young Data Scientist Research Seminar, ETH Zurich, Virtual *Sep 2020*
- ASA Annual Symposium on Data Science & Statistics, Virtual *Jun 2020*

Singularity, misspecification, & the convergence rate of EM

- Math & Statistics Seminar, IIT Kanpur *Jan 2020*
- AMS Special Sections Meeting, UC Riverside *Nov 2019*

Theoretical guarantees for MCMC algorithms

- BIDS Seminar, UC Berkeley *Mar 2019*
- EE Seminar, IIT Bombay *Jan 2018*
- STCS Seminar, TIFR Bombay *Jan 2018*

Counterfactual inference in sequential experiments

- Informs APS Meeting, Nancy, France *Jun 2023*
- Statistics and data science conference (SDSCON), MIT *Apr 2022*
- Econometrics Lunch, MIT *Mar 2022*

Near-optimal compression in near-linear time

- LIDS Student Conference, MIT, **Best presentation award** *Jan 2022*

Generalized kernel thinning

- Joint Statistical Meeting (JSM), Washington DC *Aug 2022*

Kernel thinning

- Monte Carlo Methods & Applications (MCM), Virtual *Sep 2021*
- International Society for Bayesian Analysis (ISBA) World Meeting, Virtual *Aug 2021*
- The Bayesian Young Statisticians Meeting (BAYSM), Virtual *Aug 2021*
- Joint Statistical Meeting (JSM), Virtual *Aug 2021*
- Conference on Learning Theory (COLT), Virtual *Aug 2021*
- Subset Selection, International Conference on Machine Learning (ICML), Virtual *Jul 2021*

Revisiting complexity and the bias-variance tradeoff: Using minimum description length

- Theory of Overparameterized Machine Learning (TOPML) Workshop, Virtual *Apr 2021*

Converging fast and slow: Statistics vs optimization

- BAIR and BDD Retreat, Berkeley, Virtual *Aug 2020*

Log-concave sampling: Metropolis Hastings algorithms are fast

- Joint Statistical Meeting (JSM), Washington DC *Dec 2018*

Vaidya walk: A sampling algorithm based on the volumetric barrier

- Allerton Conference *Oct 2017*

CONTRIBUTED POSTER PRESENTATIONS	Compress then test: Powerful kernel testing in near-linear time	• Conference on Artificial Intelligence and Statistics (AISTATS) Conference, Spain	Apr 2023
	Doubly robust nearest neighbors for counterfactual inference	• American Causal Inference Conference (ACIC), Austin	May 2023
	On counterfactual inference with unobserved confounding	• American Causal Inference Conference (ACIC), Austin	May 2023
		• NeurIPS Causality for Real world impact workshop, New Orleans	Nov 2022
	Counterfactual inference in sequential experiments	• Cornell ORIE Young Researchers Workshop, Ithaca	Oct 2022
		• Royal Statistical Society (RSS) Conference, Aberdeen, Scotland	Sep 2022
		• Synthetic Control Methods Workshop, Data X, Princeton University	Jun 2022
		• American Causal Inference Conference (ACIC), UC Berkeley	May 2022
		• Symposium for Mathematical Sciences (SMaSH), Harvard University	May 2022
		• Statistics and data science conference (SDSCON), MIT	Apr 2022
	Near-optimal compression in near-linear time	• Royal Statistical Society (RSS) Conference, Aberdeen, Scotland	Sep 2022
	Generalized kernel thinning	• Advances in Approximate Bayesian Inference (AABI), Virtual	Feb 2022
	Revisiting minimum description length complexity in overparameterized models	• North American School of Information Theory (NASIT), Virtual	Jun 2021
	Theoretical guarantees for EM under misspecified Gaussian mixture models	• Neural Information Processing Systems (NeurIPS), Montréal, Canada	Dec 2018
TEACHING EXPERIENCE	Log-concave sampling: Metropolis Hastings algorithms are fast	• Conference on Learning Theory (COLT), Stockholm, Sweden	Jul 2018
	On power of two choices in reducing discrepancy	• SAMSI Workshop, Duke University, Raleigh	Aug 2017
	T1. Instructor: Statistical Principles (ORIE 6700), <i>Cornell University</i>		Fall 2023
	T2. Instructor: Statistical RL for real life (one week; link), <i>CDT Summer School, Missenden</i>		Jul 2023
	T3. TA: Sequential Decision Making (STAT 234), <i>Harvard University</i> . Gave four guest lectures and supervised several half-semester long research projects.		Spring 2022
	T4. TA: Modern Statistical Prediction and Machine Learning (STAT 154), <i>UC Berkeley</i> . Gave one guest lecture and helped in redesign of the class.		Spring 2019
	T5. TA: Introduction to Machine Learning (EECS 189), <i>UC Berkeley</i> . Co-head for the content developments in team of 10+ TAs, helped design discussion sections, homeworks, and exams.		Spring 2018
	T6. TA: Linear Algebra, Calculus, Differential equations (MA 105, 106, 108, 207), <i>IIT Bombay</i> . Taught teaching sections and several voluntary help sessions that were often attended by 200+ students. 2011–2014		

GUEST LECTURES	L1. Regret analysis of posterior sampling (3 lectures, STAT 234), <i>Harvard University</i>	<i>Apr 2022</i>
	L2. Offline off-policy reinforcement learning (STAT 234) <i>Harvard University</i> .	<i>Feb 2022</i>
	L3. Revisiting complexity and the bias-variance tradeoff (STAT 212) <i>UC Berkeley</i> .	<i>Apr 2021</i>
	L4. Introduction to ensemble methods in machine learning (EECS 189), <i>UC Berkeley</i> .	<i>Oct 2019</i>
	L5. Introduction to boosting methods (STAT 154), <i>UC Berkeley</i> .	<i>Apr 2019</i>
ACADEMIC SERVICES	Undergraduate Research Mentoring	
	• UC Berkeley, One student that led to a co-authored journal publication	<i>2020–2021</i>
	• Harvard, Two students with three co-authored submissions in preparation	<i>2022–</i>
	Institutional Mentoring	
	• MIT Institute for Data, Systems, & Society (IDSS) Postdoc Mentors for two <i>PhD</i> students	<i>2022–</i>
	• UC Berkeley Artificial Intelligence Research (BAIR) Buddies for two <i>incoming PhD</i> students	<i>2020–2021</i>
	• UC Berkeley BAIR Mentoring Program for five <i>undergraduates</i>	<i>2017–2021</i>
	• IIT Bombay Student Mentoring Program (ISMP) for twelve <i>incoming undergraduates</i>	<i>2013–2014</i>
	• IIT Bombay Academic Mentoring Program (DAMP) for four <i>sophomores & juniors</i>	<i>2012–2014</i>
	• IIT Bombay Intensive Mentoring Program for thirty <i>undergraduates</i>	<i>2012–2013</i>
	Committees	
	• Member, Committee on Equality and Diversity, IMS	<i>2022–</i>
	Scientific Meetings	
	• Mentor, Let-All Mentoring Session, Learning Theory Mentorship Workshop	<i>2023</i>
	• Moderator, Panel Discussion on Mentoring, New Researcher Conference Statistics, Toronto	<i>2023</i>
	• Chair, New Researchers Group Session, IMS Annual Meeting	<i>2022</i>
	• Chair, Statistical Machine Learning Session, IMS Annual Meeting	<i>2022</i>
	• Mentor, Summer Institute on Just-in-Time Adaptive Interventions via MRTs	<i>2021</i>
	Graduate Admissions	
	• EECS Graduate Admissions Committee, MIT	<i>2021</i>
	• EECS Graduate Admissions Committee, UC Berkeley	<i>2018–2020</i>
	Reviewing Activities	
	• <i>Journals</i> : AOS, JMLR, MOR, OR, Sto. Sys., IEEE-IT, JRSSB, Bernoulli, HDSR, Stats-Comp., SIAM, Jour. of Causal Inference, ISR, JCGS	
	• <i>Conferences</i> : NeurIPS (Area Chair), COLT, ICML, AISTATS, FOCS, STOC, SODA, AAAI, UAI, SIGMETRICS	
WORK EXPERIENCE	Microsoft Research , Research Intern with Lester Mackey, New England, USA	<i>2019</i>
	Mist Systems, Juniper Networks, Data Science Intern, Cupertino, USA	<i>2017</i>
	WorldQuant Research, Senior Quantitative Researcher, Mumbai, India	<i>2014–2015</i>
	Stanford University , Research Intern with Prof. Balaji Prabhakar, USA	<i>2013</i>
	Ivy Mobility, Data Science Intern, Chennai, India	<i>2012</i>