Varun Jog

CONTACT INFORMATION

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PERSONAL

Born *June 1988* in Pune, India. Indian citizen. USA permanent resident from 2018-2022.

RESEARCH INTERESTS

Information theory, machine learning, statistics

EMPLOYMENT

University of Cambridge

Assistant Professor **January 2021 - current**
Department of Pure Mathematics and Mathematical Statistics (DPMMS)

University of Wisconsin - Madison

Assistant Professor **September 2016 - December 2020**
Primary appointment in the Department of Electrical and Computer Engineering (ECE)
Affiliate appointments in the Departments of Statistics and Mathematics

University of Pennsylvania, The Warren Center for Network & Data Sciences

Postdoctoral fellow **September 2015 - August 2016**
Jointly hosted by the Department of Statistics and Computer and Information Sciences (CIS)

EDUCATION

University of California, Berkeley

Ph.D. in Electrical Engineering and Computer Sciences, August 2015
Dissertation topic: "Convex geometric tools in information theory"
Advisor: Venkat Anantharam

India Institute of Technology, Bombay

B.Tech., Electrical Engineering, August 2010
Cumulative Performance Index: 9.55/10

HONORS AND AWARDS

Invited as a core member to a semester long program at the Simons Institute at Berkeley, August-December 2024

Invited to a semester long program at the Mathematical Sciences Research Institute (MSRI) at Berkeley, January-May 2025

NSF-CAREER Award, 2020

Core member for Simons Institute Summer Program on the Theory and Practice of Deep Learning, Berkeley, May-August 2019

Peter Whittle Lecturer, University of Cambridge, Cambridge, 2019

Professor R. Narasimhan Memorial Lecturer, Tata Institute of Fundamental Research (TIFR), Mumbai, 2019

IEEE Jack Keil Wolf Best Paper Award at ISIT 2015

Eli Jury Award 2015, UC Berkeley EECS Department dissertation award for outstanding achievement in Systems, Communications, Control, or Signal Processing

Bronze medals at the International Mathematics Olympiad (IMO) 2005 and 2006 as a part of the Indian delegation

Awarded National Talent Scholarship (NTSE) and Kishore Vaigyanik Protsahan Yojana Scholarship (KVPY) in 2004 by the Government of India

Journal papers

1. Pensia, A., Asadi, A., Jog, V., Loh, P. Simple Binary Hypothesis Testing under Local Differential Privacy and Communication Constraints. *Submitted to the IEEE Transactions on Information Theory, 2023*
2. Pensia, A. Jog, V. and Loh, P. Robust regression with covariate filtering: Heavy tails and adversarial contamination. *Revision submitted to the Journal of the American Statistic Association (JASA), 2023*
3. Pensia, A., Tovar Lopez, A., Jog, V. and Loh, P. Analyzing generalization error of learning algorithms: From information theory to optimal transport. *Revision submitted to the Journal of Machine Learning Research, 2023*
4. Pensia, A., Jog, V., Loh, P. Communication-constrained hypothesis testing: Optimality, robustness, and reverse data processing inequalities. *IEEE Transactions on Information Theory, 2024 (to appear)*
5. Pydi, M., Jog, V. The Many Faces of Adversarial Risk: An Expanded Study. *IEEE Transactions on Information Theory, 2023*
6. Anantharam, V., Jog, V., Nair, C. Unifying the Brascamp-Lieb inequality and the entropy power inequality. *IEEE Transactions on Information Theory, 2022*
7. Jog, V. Reverse Euclidean and Gaussian isoperimetric inequalities for parallel sets with applications. *IEEE Transactions on Information Theory, 2021*
8. Pydi, M., Jog, V. Adversarial Risk via Optimal Transport and Optimal Couplings. *IEEE Transactions on Information Theory, 2021*
9. Jog, V. and Loh, P. Teaching and learning in uncertainty. *IEEE Transactions on Information Theory, 2021*
10. Pensia, A., Jog, V., Loh, P. Estimating location parameters in sample-heterogeneous distributions. *Information and Inference, 2021*
11. Liu, Z., Zhang, J., Jog, V., Loh,P., McMillan, A. Robustifying deep networks for medical image segmentation. *Journal of Digital Imaging, 2021*
12. Gurbani, S., Morgan, D., Jog, V., Dreyfuss, L., Shen, M., Das, A., Abel, E. J., Lubner, M. G. Evaluation of radiomics and machine learning in identification of aggressive tumor features in renal cell carcinoma (RCC). *Abdominal Radiology, 2021*
13. Pensia, A., Jog, V., Loh, P. Extracting robust and accurate features via a robust information bottleneck. *Journal on Selected Areas in Information Theory, 2020*
14. Xu, M., Jog, V. and Loh, P. Optimal rates for community estimation in the weighted stochastic block model. *Annals of Statistics, 2019*
15. Hao, J. and Jog, V. Dual Loomis-Whitney inequalities using information theory. *Special Issue on Entropy and Information Inequalities, Entropy Journal, 2019*
16. Jog, V. and Anantharam, V. Intrinsic entropies of log-concave distributions. *IEEE Transactions of Information Theory, 2018*

17. Jog. V. and Loh, P. Persistence of centrality in random growing trees. *Random Structures and Algorithms, 2017*
18. Jog, V. and Loh, P. Analysis of centrality in sublinear preferential attachment trees via the CMJ branching process. *Transactions of Network Science and Engineering, 2016*
19. Jog, V. and Anantharam, V. A geometric analysis of the AWGN channel with a (σ, ρ)-power constraint. *IEEE Transactions on Information Theory, 2016*
20. Jog, V. and Anantharam, V. The entropy power inequality and Mrs. Gerber's lemma for groups of order 2^n. *IEEE Transactions on Information Theory, 2014*
21. Geng, Y., Jog, V., Nair. C., and Wang, Z. An information inequality and evaluation of Marton's inner bound for binary input broadcast channels. *IEEE Transactions on Information Theory, 2013*

Conference and workshop papers

1. Pensia, A., Asadi, A., Jog, V., Loh, P. Simple binary hypothesis testing under local differential privacy and communication constraints. *Conference on Learning Theory (COLT), 2023*
2. Pydi, M., Jog, V. The many faces of adversarial risk. *Neural Information Processing Systems (NeuRIPS), 2021*
3. Pensia, A., Jog, V., Loh, P. Simple Binary Hypothesis Testing under Communication Constraints. *IEEE International Symposium on Information Theory (ISIT), 2021*
4. Pydi, M., Jog, V. On the optimal risk and optimal classifier in the presence of an adversary. *International Conference on Machine Learning (ICML), 2020*
5. Jog, V. Teaching and learning in uncertainty. *IEEE International Symposium on Information Theory (ISIT), June 2019*
6. Jog, V., Nair, C. and Anantharam V. Unifying the entropy power inequality and the Brascamp-Lieb inequality. *IEEE International Symposium on Information Theory (ISIT), June 2019*
7. Hao, J. and Jog, V. Dual Loomis-Whitney inequalities using information theory. *International Symposium on Information Theory (ISIT), 2019*
8. Pensia, A., Jog, V., Loh, P. Mean estimation for entangled single-sample distributions. *International Symposium on Information Theory (ISIT), June 2019*
9. Khim, J., Jog V., Loh P. Adversarial influence maximization. *International Symposium on Information Theory (ISIT), June 2019*
10. Tovar Lopez A., Jog, V. Generalization error bounds using the Wasserstein metric. *Information Theory Workshop (ITW), November 2018*
11. Wibisono, A., Jog, V. Convexity of mutual information in the Ornstein-Uhlenbeck flow. *International Symposium on Information Theory and its Applications (ISITA), 2018*
12. Sreenivas, M., Jog, V., Loh., P. Graph-Based Ascent Algorithms for Function Maximization. Muni Pydi Sreenivas, Varun Jog, and Po-Ling Loh. *Allerton Conference on Communication, Control, and Computing, October 2018*
13. Wibisono, A., Jog, V. Convexity of mutual information in the heat flow. *International Symposium on Information Theory (ISIT), June 2018*
14. Pensia, A., Jog, V., Loh., P. Generalization bounds for noisy, iterative algorithms. *International Symposium on Information Theory (ISIT), June 2018*
15. Hao, J., Jog, V. An entropy inequality for symmetric random variables. *International Symposium on Information Theory (ISIT), June 2018*
16. Jog, V. A convolution inequality for entropy over $\mathbb{Z}_2$. *International Symposium on Information Theory (ISIT), June 2017*
17. Wibisono, A., Jog, V., Loh, P. Information and estimation in Fokker-Planck channels. *International Symposium on Information Theory (ISIT), June 2017*

18. Khim, J., Jog V., Loh P. Computing and maximizing influence in linear threshold and triggering models *Neural Information Processing Systems conference (NIPS), 2016.*
19. Jog. V. and Loh, P. Information-theoretic bounds for exact recovery in weighted stochastic block models using the Rényi divergence. *Allerton Conference on Communication, Control, and Computing, October 2015*
20. Jog, V. and Anantharam, V. On the geometry of convex typical sets. *International Symposium on Information Theory (ISIT), June 2015*
(Best paper award)
21. Jog, V. and Anantharam, V. A geometric analysis of the AWGN channel with a (σ, ρ)-power constraint. *International Symposium on Information Theory (ISIT), June 2015*
22. Jog, V. and Loh, P. On model misspecification and KL separation for Gaussian graphical models. *International Symposium on Information Theory (ISIT), June 2015*
23. Jog, V. and Anantharam, V. An energy harvesting AWGN channel with a finite battery *International Symposium on Information Theory (ISIT), 2014*
24. Jog, V. and Anantharam, V. Convex relative entropy decay in Markov chains. *Conference on Information Sciences and Systems (CISS), 2014*
25. Jog, V. and Anantharam, V. The entropy power inequality and Mrs. Gerber's lemma for groups of order 2^n. *International Symposium on Information Theory (ISIT), 2013*
26. Jog, V., Pillai S., Karandikar, A. On achieving Marton's region for broadcast channel using feedback. *IEEE National Conference on Communication, 2011*
27. Jog, V. and Nair, C. An information inequality for the BSSC channel. *Information Theory and Applications (ITA) Workshop, 2010*

PH.D. STUDENTS

Ankit Pensia (Ph.D. 2023), UW–Madison

Muni Sreenivas Pydi (Ph.D. 2022), UW–Madison

Jinnian Zhang (Ph.D. 2022), UW–Madison

Adrian Tovar Lopez (Ph.D. 2021), UW–Madison

POSTDOCS

Amir Asadi (2021-2023), University of Cambridge

Andre Wibisono (2016-2018), UW–Madison

Deepanshu Vasal (2017-2018), UW–Madison

GRANTS

Isaac Newton Trust G101121, "Information inequalities for statistics and machine learning" (2021-2022, £55,000, PI: Varun Jog)

NIH 1R01LM013151-01A1 (R01), "Can machines be trusted? Robustification of deep learning for medical imaging" (2020-2024, $1,300,000. co-PIs: Alan McMillan, Varun Jog, Po-Ling Loh)

NSF-CAREER Award, "Geometry-inspired approaches to information theory and learning" (2020-2025, $487,239. PI: Varun Jog)

Machine Learning for Medical Imaging Pilot Grant award, "Application of Machine Learning to CT characterization of Renal Cell Carcinoma" (2019-2020, $50,000. co-PIs: Meghan Lubner, Varun Jog, Dane Morgan)

NSF CCF-1907786, "CIF: Small: Bridging the Inequality Gap" (2019-2021, $150,000. PI: Varun Jog)

NSF CCF-1841190, "EAGER: Developing a Theory for Function Optimization on Graphs Using Local Information" (2018-2021, $175,326. PI: Varun Jog, co-PI: Po-Ling Loh)

Machine Learning for Medical Imaging Pilot Grant award, "DeepRad: An accessible, open-source tool for deep learning in medical imaging" (2018-2019, $50,000. PI: Varun Jog, co-PI: Alan McMillan)

Wisconsin Alumni Research Foundation (WARF) Fall Research Competition, "Information theoretic analysis of random projections" (2018-2019, $42,000. PI: Varun Jog)

Nvidia GPU Grant ($1500 towards a Titan Xp GPU)

Talks

"Sample complexity of simple binary hypothesis testing." *Invited talk at the International Zurich Seminar on Information and Communication, March 2024*

Discussant on "Root and community inference on the latent growth process of a network" by Harry Crane and Min Xu. *Invited by the Royal Statistical Society, December 2023*

"Sample complexity of simple binary hypothesis testing." *Invited talk at European School of Information Theory, July 2023*

"Threshold channels and potential applications." *Invited talk at the Mini-Workshop: Mathematical Foundations of Robust and Generalizable Learning, Oberwolfach, Germany, October 2022*

"Simple Hypothesis Testing under Communication Constraints." *Information Theory Seminar, Cambridge, October 2022*

"Simple Hypothesis Testing under Communication Constraints." *CRiSM Seminar, Warwick University, March 2022*

"Communication efficient hypothesis testing." *Workshop on Mathematical Statistics and Learning, Banff, Canada, November 2021*

"Estimating location parameters in sample-heterogeneous distributions." *Invited talk the the Beyond IID Workshop, Cambridge, U.K., September 2021*

"A medley of geometry, optimal transport, and machine learning." *Invited talk at the ECE Seminar, University of Delaware, April 2021*

"Reverse Euclidean and Gaussian isoperimetric inequalities for parallel sets with applications". *Probability and Analysis Webinar (PAW), September 2020*

"A medley of geometry, optimal transport, and machine learning." *Invited plenary speaker at the Workshop on Optimal Transport, Topological Data Analysis and Applications to Shape and Machine Learning, July 2020*

"Extracting robust and accurate features via robust information bottleneck." *Invited talk at the*

Conference on Information Science and Systems (CISS), Princeton, March 2020

"Adversarial risk via optimal transport and optimal couplings." *Invited talk at the Conference on Information Science and Systems (CISS), Princeton, March 2020*

"Extracting robust and accurate features via robust information bottleneck." *Invited talk at the Bombay Information Theory Seminar (BITS), Mumbai, January 2020*

"Adversarial risk via optimal transport and optimal couplings." *Invited talk at the NeuRIPS workshop on Information theory and Machine Learning, Vancouver, December 2019*

"Bridging the inequality gap." *Workshop on "Estimation of entropies and other functionals: Statistics meets information theory", University of Cambridge, September 2019*

"Bridging the inequality gap." *Special session on Data Science, Fall Western Sectional Meeting of AMS, UC Riverside, November 2019*

"Unifying the entropy power inequality and the Brascamp-Lieb inequality." *ISIT 2019, Paris, France, June 2019*

"Dual Loomis-Whitney inequalities using information theory." *ISIT 2019, Paris, France, June 2019*

"Teaching and learning in uncertainty." *ISIT 2019, Paris, France, June 2019*

Mean estimation for entangled single-sample distributions. *ISIT 2019, Paris, France, June 2019*

Adversarial influence maximization. *ISIT 2019, Paris, France, June 2019*

"Analyzing learning algorithms: Perspectives from information theory and optimal transport" *University of Southern California ECE Seminar, April 2019*

"Bridging the inequality gap." *Princeton University EE Seminar, April 2019*

"Bridging the inequality gap." *Invited talk at the Information Theory and Applications (ITA) workshop, February 2019*

"Bridging the inequality gap." *EE Seminar, Cornell University, February 2019*

"Bridging the inequality gap." *Invited tutorial at the Tata Institute of Fundamental Research (TIFR), January 2019*

"Probability on graphs: Centrality, optimization, and social learning." *EECS Seminar, University of Michigan, December 2018*

"Probability on graphs: Centrality, optimization, and social learning." *EE Seminar, Columbia University, December 2018*

"Information-theoretic perspectives on learning algorithms." *Communications and Signal Processing Seminar, University of Maryland, November 2018.*

"Information-theoretic perspectives on learning algorithms." *ECE Colloquium talk, Rutgers University, October 2018.*

"Information-theoretic perspectives on learning algorithms." *Institute of Mathematical Statistics,*

Asia Pacific Rim meeting, Singapore, June 2018.

"Teaching and learning in uncertainty." International Chinese Statistical Association annual conference, Rutgers, New Jersey, June 2018.

"Social learning on graphs." *HAMLET Seminar, UW-Madison, March 2018*

"Entropy inequalities for directional entropies." *Conference on Information Sciences and Systems (CISS), March 2018*

"Teaching and learning in uncertainty." *Probability seminar, University of Bristol, March 2018*

"Information-theoretic perspectives on learning algorithms." *Department of Engineering, University of Cambridge, February 2018*

"Information-theoretic perspectives on learning algorithms." *Isaac Newton Institute, Cambridge, UK, February 2018*

"Teaching and learning in uncertainty." *Information Theory and Applications Workshop, February 2018*

"Teaching and learning in uncertainty." *Probability seminar, UW-Madison, October 2017*

"Teaching and learning in uncertainty." *Statistics seminar, UW-Madison, October 2017*

"Optimal rates for community estimation in the weighted stochastic block model." *INFORMS Annual Meeting, Houston, October, 2017*

"Persistence of centrality in random growing trees". *Joint Statistical Meetings, Baltimore, August 2017.*

"A convolution inequality for entropy over $\mathbb{Z}_2$". *ISIT 2017, Aachen, Germany, June 2017.*

"Intrinsic entropies of log-concave distributions". *International Chinese Statistical Association annual conference, Chicago, June 2017.*

"Discrete entropy power inequalities". *American Institute of Mathematics Workshop on Entropy Power Inequalities. San Jose, May 2017.*

"Information and estimation in Fokker-Planck systems." *Information-theoretic inequalities workshop, University of Delaware, Newark, April 2017.*

"Modeling stochastic networks: Sharp thresholds and persistent phenomena." *IIT Bombay EE Seminar, Mumbai, India, January 2017.*

"Persistence of centrality in random growing trees." *Allerton Conference, Allerton, October 2016.*

"Persistence of centrality in random growing trees." *International Indian Statistical Association (IISA) conference, Corvallis, OR, August 2016.*

"Modeling stochastic networks: Sharp thresholds and persistent phenomena." *ESE Departmental Seminar, University of Pennsylvania, April 2016*

"Persistence of centrality in random growing trees." *Conference on Information Sciences and Systems*

(CISS), Princeton, March 2016

"Modeling stochastic networks: Sharp thresholds and persistent phenomena." *ECE Departmental Seminar, University of Wisconsin, Madison, March 2016*

"Persistence of centrality in random growing trees." *Statistics seminar, Department of Statistics, The Wharton School, University of Pennsylvania, March 2016*

"Persistence of centrality in random growing trees." *Probability seminar, Department of Mathematical Sciences, University of Delaware, February 2016*

"Persistence of centrality in random growing trees." *CS Theory seminar, Computer and Information Sciences, University of Pennsylvania, February 2016*

"Persistence of centrality in random growing trees." *ITA workshop, La Jolla, February 2016*

"A geometric analysis of the AWGN channel with a (σ, ρ)-power constraint." *ISIT-2015, Hongkong, June 2015*

"On the geometry of convex typical sets." *Semi-plenary session at ISIT-2015, Hongkong, June 2015*

"Convex geometric tools in information theory." *Networking and Communications Seminar, UC Berkeley, May 2015*

"Convex geometric tools in information theory." *ITA workshop, La Jolla, February 2015*

"A geometric analysis of the AWGN channel with a (σ, ρ)-power constraint." *IIT-Bombay, Mumbai, January 2015*

"An energy harvesting AWGN channel with a finite battery." *ISIT-2014, Hawaii, July 2014*

"Convex relative entropy decay in Markov chains." *Conference on Information Sciences and Systems (CISS), Princeton, March 2014*

"The entropy power inequality and Mrs. Gerber's lemma for groups of order 2^n." *ISIT-2013, Istanbul, July 2013*

Teaching Experience

Part III: Concentration Inequalities
Instructor at the University of Cambridge **Michaelmas 2021, Lent 2023-24**
Instructor for 25-35 students.

Part IB: Optimisation
Instructor at the University of Cambridge **Easter 2021, 2023-24**
Instructor for 150 students.

ECE 203: Signals, Information, and Computation
Instructor for ECE 203 at UW-Madison **Fall 2018 and Spring 2019**
Instructor for the undergraduate course with 130 students.

ECE 729: Information Theory

Instructor for ECE 729 at UW-Madison **Spring 2017 and Fall 2019**
Instructor for the graduate course titled "Information Theory."

ECE 611: Introduction to Doctoral Research
Instructor for ECE 611 at UW-Madison **Spring 2020**
Professional development for first-year Ph.D. students in the ECE Department

ECE 730: Modern probability theory and stochastic processes
Instructor for ECE 730 at UW-Madison **Fall 2016, 2017**
Instructor for the graduate course titled "Modern probability theory and stochastic processes."

EE-126: Probability and random processes
Graduate student instructor for EE-126 at UC Berkeley **Spring 2015**
GSI for the undergraduate course EE-126: Probability and random processes. Workload of 20 hours/week, which involved holding regular discussion sessions and office hours every week, preparing exams and homeworks, and grading.
Instructor: Prof. Abhay Parekh

EE-226A: Random processes and systems
Graduate student instructor for EE-226A at UC Berkeley **Fall 2014**
GSI for the graduate course EE-226A: Random processes and systems. Workload of 10 hours/week, which involved holding regular discussion sessions and office hours every other week, preparing homeworks, and grading.
Instructor: Prof. Thomas Courtade

Guest lecturer: "Introduction to Stochastic Processes" (STAT433, Instructor: Elchanan Mossel) and "Statistical Inference" (STAT431, Instructor: Po-Ling Loh) at the University of Pennsylvania, Spring 2016.

Professional Service

Member of the Steering Committee for Beyond I.I.D. Workshops, (2023-current)

Organizer of the Information Theory Seminar at Cambridge, (2022-present)

Associate Editor for the IEEE Transactions on Information Theory, (2021-current)

Guest Editor for the *Entropy* special issue "Entropy and information inequalities" (2017-2019)

Senior Program Committee member, Conference on Learning Theory, 2021-2024

Program committee member for the IEEE International Symposium on Information Theory, 2018-2021, 2023-24.

Reviewer for IEEE Transactions on Information Theory; IEEE International Symposium on Information Theory; Information Theory Workshop; MDPI Entropy; Conference on Learning Theory (COLT); International Conference on Machine Learning (ICML); International Conference on Learning Representations (ICLR); Conference on Neural Information Processing Systems (NeurIPS); Annals of Applied Probability (APP); Annals of Statistics (AOS), AMS: Mathematical Reviews