Shashank Singh

Curriculum Vitae
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CONTACT INFORMATION

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EDUCATION

Ph.D.	Statistics & Machine Learning, Carnegie Mellon University	Aug 2019
	Thesis: *Estimating Probability Distributions and Their Properties*	
M.S.	Machine Learning, Carnegie Mellon University	Aug 2017
M.S.	Mathematical Sciences, Carnegie Mellon University	May 2014
	Thesis: *Concentration Inequalities for Density Functionals*	
B.S.	Mathematical Sciences, Carnegie Mellon University	May 2014
B.S.	Computer Science, Carnegie Mellon University	May 2014

RESEARCH INTERESTS

Theory: Statistical Machine Learning (especially nonparametric methods, fundamental limits of learning from data, generative modeling, and causal inference), Information Theory

Applications: Computational Biology (genomics, biological systems modeling), Cognitive Science (behavior modeling, cognitive development), Epidemiological Forecasting

EMPLOYMENT

2019 Sep-Present	Software Engineer at Google, Cloud AI Deployments Team (Pittsburgh, PA) *Designed, implemented, and evaluated machine learning systems for industrial and public sector applications (see, e.g., paper "Interpretable COVID-19 Forecasting").*
2018 Sep-Dec	Applied Scientist Intern at Amazon Web Services (New York, NY) *Developed new algorithms to compress deep neural networks used in computer vision (see paper "DARC: Differentiable ARchitecture Compression").*
2015 May-Aug	Software Engineering Intern at Google (Mountain View, CA) *Designed, implemented, and tested anomaly detection pipeline for detecting fraudulent activity amongst billions of daily user engagements with online products.*

FELLOWSHIPS AND AWARDS

2019	NeurIPS 2019 Honorable Mention for Outstanding Paper (3/6743 submissions)
2017	Mellon Foundation Presidential Fellow in Life Sciences (1 year graduate funding)
2015	National Science Foundation Graduate Research Fellow (3 years graduate funding)
2012	Undergraduate Research Fellow in Computational Neuroscience, Center for the Neural Basis of Cognition, Carnegie Mellon University. (1 year research stipend)

PUBLICATIONS

Journal Articles

2020 Kim, J., **Singh, S**., Thiessen, E. D., & Fisher, A. V. "A Hidden Markov Model for Analyzing Eye-Tracking of Moving Objects". In *Behavior Research Methods*.

2019 Rashid, S., Long, Z., **Singh, S.**, Kohram, M., Vashistha, H., Navlakha, S., Salman, H., Oltvai, Z. N., Bar-Joseph, Z. "Adjustment in tumbling rates improves bacterial chemotaxis on obstacle-laden terrains". In *Proceedings of the National Academy of Sciences (PNAS)*.

Rashid, S., **Singh, S.**, Navlakha, S., & Bar-Joseph, Z. "A Bacterial based Distributed Gradient Descent Model for Mass Scale Evacuations". In *Swarm and Evolutionary Computation*.

2018 **Singh, S.**, Yang, Y., Póczos, B., & Ma, J. "Predicting Enhancer-Promoter Interaction from Genomic Sequence with Deep Neural Networks". *Quantitative Biology*, Special Issue on Applications of Deep Learning to Biology.

Conference Papers

2020 Kim, J., **Singh, S**., Thiessen, E. D., & Fisher, A. V. *Staying and Returning Dynamics of Sustained Attention in Young Children*. Full paper accepted as Poster Presentation in Annual Meeting of the Cognitive Science Society (CogSci). (63% accept rate)

2019 Uppal, A., **Singh, S.** & Póczos, B. *Nonparametric Density Estimation & Convergence of GANs under Besov IPM Losses*. Oral Presentation in Neural Information Processing Systems (NeurIPS). (21.0% accept rate; **Honorable Mention for Outstanding Paper Award**; 0.4% of accepted papers)

2018 **Singh, S.**, Uppal, A., Li, B., Li, C.-L., Zaheer, M., & Póczos, B. *Nonparametric Density Estimation under Adversarial Losses*. Accepted as Poster Presentation in Neural Information Processing Systems (NeurIPS). (20.8% accept rate)

Kim, J., **Singh, S.**, Vande Velde, A., Thiessen, E.D., & Fisher, A.V. *A Hidden Markov Model for Analyzing Eye-Tracking of Moving Objects*. Full paper presented orally in Annual Meeting of the Cognitive Science Society (CogSci). (22.5% accept rate)

Singh, S., Póczos, B., & Ma, J. *Minimax Reconstruction Risk of Convolutional Sparse Dictionary Learning*. International Conference on Artificial Intelligence and Statistics (AISTATS). (33.2% accept rate)

2017 **Singh, S.** & Póczos, B. *Nonparanormal Information Estimation*. International Conference on Machine Learning (ICML). (25.5% accept rate)

Yang, Y., Zhang, R., **Singh, S.**, & Ma, J. *Exploiting sequence-based features for predicting enhancer-promoter interactions*. Full Paper in Intelligent Systems for Molecular Biology (ISMB). (16.5% accept rate; F1000Prime Recommended)

2016 **Singh, S.**, Du, S., & Póczos, B. *Efficient Nonparametric Smoothness Estimation*. Neural Information Processing Systems (NIPS). (22.7% accept rate)

Singh, S. & Póczos, B. *Finite-Sample Analysis of Fixed-k Nearest Neighbor Density Functional Estimators*. Neural Information Processing Systems (NIPS). (22.7% accept rate)

Singh, S., Rashid, S., Navlakha, S., & Bar-Joseph, Z. *Distributed Gradient Descent in Bacterial Food Search*. Full Paper in Research in Computational Molecular Biology (RECOMB). (20.6% accept rate)

2014 **Singh, S.** & Póczos, B. *Exponential Concentration of a Density Functional Estimator*. Neural Information Processing Systems (NIPS). (24.7% accept rate)

Singh, S. & Póczos, B. *Generalized Exponential Concentration Inequality for Rényi Divergence Estimation*. International Conference on Machine Learning (ICML). (Cycle 1; 14.7% accept rate; **1 of 18 papers nominated for JMLR fast-track**)

Workshop Papers

2020 Arik, S. O., Li, C.-L., Nikoltchev, M., Sinha, R., Epshteyn, A., Yoon, J., Le, L., Menon, V., **Singh, S.**, Sonthalia, Y., Nakhost, H., Zhang, L., Kanal, E., & Pfister, T. *Interpretable Covid-19 Forecasting*. ICML Workshop on Healthcare Systems, Population Health, and the role of Health-tech.

Singh, S., Khetan, A., & Karnin, Z. *DARC: Differentiable ARchitecture Compression*. ICLR Workshop on Neural Architecture Search.

2017 **Singh, S.**, Póczos, B., & Ma, J. *Minimax Reconstruction Risk of Convolutional Sparse Dictionary Learning*. 55th Annual Allerton Conference on Communication, Control, and Computing.

2016 | **Singh, S.**, Yang, Y., Póczos, B., and Ma, J. *Predicting Enhancer-Promoter Interaction from Genomic Sequence with Deep Learning*. NIPS Workshop on Machine Learning in Computational Biology.

2014 | **Singh, S.**, Navlakha, S., and Bar-Joseph, Z. *Distributed and computationally efficient belief propagation based on swarms of foraging bacteria*.

Technical Reports

2018 | **Singh, S.**, Sriperumbudur, B.K., & Póczos, B., *Nonparametric estimation of Fourier-weighted inner products*.

2016 | **Singh, S.** & Póczos, B. *Analysis of k-Nearest Neighbor Distances with Application to Entropy Estimation*.

OTHER PROFESSIONAL ACTIVITIES

Reviewer for the following journals:
Journal of Machine Learning Research (JMLR)
Bernoulli
IEEE Transactions on Information Theory
Machine Learning Journal (MLJ)
PLOS ONE
Communications on Pure and Applied Analysis

Reviewer for the following conferences:
Neural Information Processing Systems (NIPS) Conference, 2016–2020
International Conference on Machine Learning (ICML), 2018–2020
– 2019 Top 5% Reviewer (awarded free ICML registration)
Artificial Intelligence and Statistics (AISTATS), 2017–2020
Conference on Learning Theory (COLT), 2018
IEEE International Symposium on Information Theory (ISIT), 2019
International Joint Conference on Artificial Intelligence (IJCAI), 2016
Biological Distributed Algorithms Workshop (BDA), 2016

Mentoring of PhD Students

Ananya Uppal	PhD in Mathematical Sciences Project: *Density Estimation under Besov IPM Losses*	03/18-Present

Mentoring of MS Students

Rui Peng	MS in Machine Learning Project: *Predicting Higher-order Chromatin Interaction from Human Gene Sequence with Deep Neural Networks* Member of Data Analysis Project Committee	08/16-12/17
Boyue Li	MS in Biotech. Innovation and Computation Project: *Estimating KL Divergence in Exponential Families*	08/17-08/18

Teaching Assistantships at Carnegie Mellon University

10-704	Information Processing and Learning *Professor Aarti Singh*	Fall 2016
36-462	Data Mining *Professor Max G'Sell*	Spring 2015
36-309	Experimental Design for Behavioral and Social Sciences *Professor Howard Seltman*	Fall 2014
21-373	Algebraic Structures *Professor Rick Statman*	Fall 2013
15-251	Great Theoretical Ideas in Computer Science *Professors Ryan O'Donnell & Danny Sleator*	Spring 2012
15-211	Fundamental Data Structures and Algorithms *Professors Jim Morris & Chris Langmead*	Fall 2011