Shashank Singh

Curriculum Vitae
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CONTACT INFORMATION

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EDUCATION

Ph.D.	Statistics & Machine Learning, Carnegie Mellon University	Expected 2019
M.S.	Machine Learning, Carnegie Mellon University	2017
M.S.	Mathematical Sciences, Carnegie Mellon University	2014
	Thesis: *Concentration Inequalities for Density Functionals*	
B.S.	Mathematical Sciences, Carnegie Mellon University	2014
B.S.	Computer Science, Carnegie Mellon University	2014

WORK EXPERIENCE

2018 Sep-Dec	Applied Scientist Intern at Amazon Web Services. (New York, NY) *Performed research on deep neural network compression for computer vision (see paper "DARC: Differentiable ARchitecture Compression").*
2015 May-Aug	Software Engineering Intern at Google, Inc. (Mountain View, CA) *Designed, implemented, and tested anomaly detection pipeline for detecting fraudulent activity amongst billions of daily user engagements with online products.*

FELLOWSHIPS

2017-	R. K. Mellon Foundation Presidential Fellow in Life Sciences (1 year grad. funding)
2015-	NSF Graduate Research Fellow (3 years graduate funding)
2012-2013	Undergraduate Research Fellow in Computational Neuroscience, Center for the Neural Basis of Cognition, Carnegie Mellon University. (1 year research stipend)

PUBLICATIONS

Working Papers

Singh, S. & Póczos, B. *Minimax Distribution Estimation in Wasserstein Distance*.

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

Papers Under Review

Uppal, A., **Singh, S.** & Póczos, B. *Nonparametric Density Estimation under Besov IPM Losses*.

Singh, S., Khetan, A., & Karnin, Z. *DARC: Differentiable ARchitecture Compression*.

Kim, J.*, **Singh, S***., Keebler, E., Thiessen, E. D., & Fisher, A. V. *Measuring Selective Sustained Attention in Children with TrackIt and Eye-Tracking*.

Rashid, S., Long, Z., **Singh, S.**, Kohram, M., Navlakha, S., Salman, H., Oltvai, Z.N., Bar-Joseph, Z. *Adjustment in tumbling rates improves bacterial chemotaxis on obstacle-laden terrains*.

Journal Articles

2019 | Rashid, S., **Singh, S.**, Navlakha, S., & Bar-Jospeph, Z. "A Bacterial based Distributed Gradient Descent Model for Mass Scale Evacuations". Accepted to *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 Proceedings

2018 | **Singh, S.**, Uppal, A., Li, B., Li, C.-L., Zaheer, M., & Póczos, B. *Nonparametric Density Estimation under Adversarial Losses*. Accepted as Poster Presentation at Neural Information Processing Systems (NIPS). (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)

Technical Reports

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

PRESENTATIONS

Conference/Workshop Talks

2017 *On the Reconstruction Risk of Convolutional Sparse Dictionary Learning*. 55th Annual Allerton Conference on Communication, Control, and Computing. At the Allerton Retreat Center, Monticello, IL, USA, on October 4. (20 minutes)

Nonparanormal Information Estimation: Realistic High-Dimensional Dependence Estimation. 34st International Conference on Machine Learning (ICML). At the International Convention Center, Sydney, Australia, August 8. (20 minutes)

2014 *Low-Communication Distributed Optimization via E. Coli Swarm Foraging*. 2nd Workshop on Biological Distributed Algorithms, Austin, TX, Oct 12. (20 minutes)

Exponential Concentration Inequality for a Rényi Divergence Estimator. At 31st International Conference on Machine Learning (ICML), Beijing, China, June 22. (20 minutes)

Other Talks and Poster Presentations

2018 *Nonparametric Density Estimation under Adversarial Losses*. Poster at Neural Information Processing Systems (NeurIPS), Montreal, Canada.

Minimax Reconstruction Risk of Convolutional Sparse Dictionary Learning. Poster at International Conference on Artificial Intelligence and Statistics (AISTATS), Lanzarote, Spain.

2017 *Nonparanormal Information Estimation.* Poster at International Conference on Machine Learning (ICML), Sydney, Australia.

Predicting Enhancer-Promoter Interaction using only Genomic Sequence Features. Poster at Cold Spring Harbor Laboratory Meeting on Systems Biology: Global Regulation of Gene Expression. Cold Spring Harbor, NY, USA, Feb. 28.

2016 *Predicting Enhancer-Promoter Interaction from Genomic Sequence with Deep Learning*. Poster at NIPS Workshop on Machine Learning in Computational Biology, Barcelona, Spain, Dec 10.

Finite-Sample Analysis of Fixed-k Nearest Neighbor Density Functional Estimators. Poster, Neural Information Processing Systems (NIPS), Barcelona, Spain, Dec 6.

Efficient Nonparametric Smoothness Estimation. Poster at Neural Information Processing Systems (NIPS), Barcelona, Spain, Dec 5.

2014 *Exponential Concentration of a Density Functional Estimator*. Poster at Neural Information Processing Systems (NIPS), in Montreal, Canada.

Exponential Concentration Inequality for a Rényi-α Divergence Estimator. Poster at International Conference on Machine Learning (ICML), Beijing, China.

2012 *Neuronal interaction and dynamics of uncertainty resolution in V2.* CNBC Undergraduate Program in Neural Computation, in Pittsburgh, PA, USA.

2011 *Temporal evolution of probabilistic population codes for stereo vision in V1.* Meeting of the Minds CMU Research Symposium, in Pittsburgh, PA, USA.

OPEN-SOURCE SOFTWARE

Some free, open-source software that I have authored in connection to my scientific projects:

2018 *eyetracking*. Hidden Markov Model and pre-processing utilities for decoding visual object-tracking experiments, written to support a CogSci 2018 paper.
Python. `https://github.com/sss1/eyetracking`

2017 *convolutional-dictionary*. An implementation of convolutional sparse dictionary learning and related simulations, written to support an AISTATS 2018 paper.
MATLAB. `https://github.com/sss1/convolutional-dictionary`

2017 *nonparanormal-information*. Estimators for entropy and mutual information assuming a nonparanormal model, written to support an ICML 2017 paper.
MATLAB. `https://github.com/sss1/nonparanormal-information`

2016 | *sobolev-estimation*. Nonparametric estimators for Sobolev norms, distances, and inner products of probability densities, written to support a NIPS 2016 paper. MATLAB. `https://github.com/sss1/sobolev-estimation`

MENTORING AND TEACHING EXPERIENCE

Mentoring of MS Students

Rui Peng	MS in Machine Learning Project: Reconstructing Hi-C Interactions from Sequence 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

As Teaching Assistant 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

PROFESSIONAL ACTIVITIES AND AFFILIATIONS

Reviewer for the following journals:
Journal of Machine Learning Research (JMLR)
Machine Learning Journal (MLJ)
IEEE Transactions on Information Theory

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

Student Member of:
Institute of Mathematical Statistics (IMS)
Society for Industrial and Applied Mathematics (SIAM)