Daniel N. Hill

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Research Positions

Senior Applied Scientist, 2018-present
Amazon.com, Search, Berkeley, CA

I manage a machine learning team focused on bandit methods and session-awareness for autocomplete and product search.

Applied Scientist, 2015-2018
Amazon.com, Personalization, Palo Alto, CA

Developed ranking algorithms using multi-armed bandit methods, diversification, and personalization.

Created the engine for a multivariate testing system in which experiments with over 100 treatments converge 10 times faster than traditional A/B testing.

Senior Data Scientist, 2013-2015
Integral Ad Science, New York, NY

Led causal analysis project to estimate the return on investment of digital ad campaigns using observational analysis when A/B tests are unavailable. Collaborated with Prof. Foster Provost of NYU and Prof. Alan Hubbard of Berkeley.

Post-doctoral Researcher, 2010-2012
Technical University of Munich, Germany
Advisor: Prof. Arthur Konnerth

Performed high-speed calcium imaging in vivo to understand information processing within the dendrites of L5 cortical neurons. Collaborated with Nobel laureate Bert Sakmann.

PhD Student, 2003-2009
UCSD Neurophysics Lab, San Diego, CA
Advisor: Prof. David Kleinfeld

Recorded and analyzed multi-channel electrophysiological and videographic data sets to investigate control of the whisker system by primary motor cortex.

Built a biomechanical simulator of the whisking apparatus based on my data.

Developed a MATLAB toolbox called UltraMegaSort2000 which is used for analyzing electrophysiological data by dozens of research labs worldwide.

Research Assistant, 2001-2002
Los Alamos National Laboratory, New Mexico
Advisor: Dr. Garrett Kenyon

Coded neural network model of retina to test hypothesis about Benham's Top illusion.

Research Assistant, 2001
Los Alamos National Laboratory, New Mexico
Advisor: Dr. Bill Hlavacek

Implemented and parallelized clustering algorithms that I applied to DNA sequences, genome expression patterns, and lightning classification.

Education

Computational Neuroscience, PhD, 2009
University of California, San Diego

Electrical and Computer Engineering, MS, 2008
Specialization in Intelligent Systems, Robotics, and Control.
Univiersity of California, San Diego

Summer course in Neuroinformatics, 2006
Marine Biology Laboratory, Woods Hole, MA

Computer Science, BS, 2002
Concentration in Artificial Intelligence.
Rochester Institute of Technology

Fellowships

NRSA, National Institutes of Health, 2006-2008

IGERT, National Science Foundation, 2002-2005

Patents

Hill DN, Tsemekhman K. Methods, systems, and media for identifying automatically refreshed advertisements. U.S. Patent Application 14/329,514, filed August 2014. Patent Pending.

Participation in Scientific Community

Neural Information Processing Systems Workflow, Workflow Chair 2017
Organized review process for 3,300 submissions and 2,200 reviewers.

Program Committee. ICML, ICLR, DAPA workshop at WSDM, J. Neuroscience.

AMC Summer School on Data Science and Big Data, Contributor 2017
Developed class materials for full-day course on recommender systems

Neuroinformatics Summer Course, Lecturer 2008-2012
Marine Biology Laboratory, Woods Hole, MA

Chronux Project, Scientific Software Contributor 2006-2009
Open-source, community-driven, NIH-sponsored software project. I developed software to perform spike sorting, a signal detection and data clustering problem encountered in systems neuroscience.

Papers

Sen R, Rakhlin A, Ying L, Kidambi R, Fostesr D, Hill DN, Dhillon IS. Top-k eXtreme Contextual Bandits with Arm Hierarchy. Submitted. (2021)

Yadav N, Sen R, **Hill DN**, Mazumdar A, Dhillon IS. Session-Aware Query Auto-completion using Extreme Multi-label Ranking. Submitted. (2021)

Ai Q, **Hill DN**, Vishwanathan SVN, Croft WB. A Zero Attention Model for Personalized Product Search. In Proceedings of the 28th ACM International Conference on Information and Knowledge Management. (2019)

Hill DN, Nassif H, Liu Y, Iyer A, Vishwanathan SVN. An efficient bandit algorithm for realtime multivariate optimization. In Proceedings of the 23rd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining. (2017) **Winner of audience appreciation award.**

Teo CH, Nassif H, **Hill D**, Srinivasan S, Goodman M, Mohan V, Vishwanathan SVN. Adaptive, Personalized Diversity for Visual Discovery. In Proceedings of the 10th ACM Conference on Recommender Systems, pp. 35-38. (2016) **Oral presentation. Winner of best paper award.**

Hill DN, Moakler R, Hubbard AE, Tsemekhman V, Provost F, Tsemekhman K. Measuring causal impact of online actions via natural experiments: application to display advertising. In Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, pp. 1839-1847. (2015) **Oral presentation.**

Hill DN, Varga Z, Jia H, Sakmann B, Konnerth A. Multibranch activity in basal and tuft dendrites during firing of layer 5 cortical neurons in vivo. PNAS. 110(33):13618-13623 (2013)

Grienberger C, Rochefort NL, Adelsberger H, Henning HA, **Hill DN**, Reichwald J, Staufenbiel M, Konnerth A. Staged decline of neuronal function in vivo in an animal model of Alzheimer's disease. Nat Commun. 3:774. (2012)

Hill DN, Curtis J, Moore JD, Kleinfeld D. Primary motor cortex reports efferent control of vibrissa position on multiple timescales. Neuron. 72(2):344-56 (2011).

Rochefort NL, Narushima M, Grienberger C, Marandi N, **Hill DN**, Konnerth A. Development of direction selectivity in mouse cortical neurons. Neuron. 71(3):425-32 (2011).

Hill DN, Mehta SB, Kleinfeld D. Quality metrics to accompany spike sorting of extracellular signals. J. Neurosci. 31:8699-8705 (2011)

Wolfe J, **Hill DN**, Pahlavan S, Drew PJ, Kleinfeld D, Feldman DE. Texture coding in the rat whisker system: slip-stick versus differential encoding. PLoS Biology. 6(8):1661-1677 (2008).

Hill DN, Bermejo R, Zeigler HP, Kleinfeld D. Biomechanics of the vibrissa motor plant in rat: Rhythmic whisking consists of triphasic neuromuscular activity. J Neurosci. 28(13):3438-55 (2008).

Kenyon GT, **Hill D**, Theiler J, George JS, Marshak DW. A theory of the Benham top based on center-surround interactions in the parvocellular pathway. Neural Networks. 17: 773-786 (2004).

Eads D, **Hill D**, Davis S, Perkins S, Ma J, Porter R, Theiler J. Zeus: Genetic algorithms and support vector machines for time series classification. Proc. SPIE. 4787:74-85 (2002).

Book Chapter

Hill DN. What is machine learning? In Artificial Intelligence and Patents: AIPPI Law Series volume 6. Edited by J Osha. Published by Wolter Kluwer. (2021)

Hill DN, Kleinfeld D, Mehta SB. Spike Sorting. In Observed Brain Dynamics. Edited by Mitra P and Bokil H. Published by Oxford Press. (2007)

Invited Talks

Multivariate content optimization: Real-time recommendation and business insights. AI NextCon. Santa Clara, CA (2019)

Adaptive, Personalized Diversity for Visual Discovery. Netflix workshop on Personalization, Recommendation, and Search. Los Altos, CA (2017)

Adaptive, Personalized Diversity for Visual Discovery. BayLearn, Sunnyvale, CA (2017)

Using negative controls to validate and repair a natural online experiment. Conference on Digital Experimentation at MIT, Boston, MA (2014).

How single are my units? Quality metrics in spike sorting. Validation of Automatic Spike-Sorting Methods workshop, Ski, Norway (2011)

The cortical representation of muscle activation in the control of whisking. Barrels XXI, Baltimore, MD (2008)

Triphasic neuromuscular control of whisking. Functional Organization of Barrel Cortex Networks. Alicante, Spain (2008)

Biomechanics, behavior, and encoding in the rat vibrissa system. COSYNE, Park City, UT (2007)

Biomechanics of whisking: whisking consists of 3 phases of muscle activity. Barrels XIX, Atlanta, GA (2006)

Electromyography and kinematics of whisking: a preliminary analysis. Barrels XVII, San Diego, CA (2004)