David Zoltowski

zoltowski@princeton.edu, 765-586-9013
davidzoltowski.com

Princeton Neuroscience Institute, Rm 232D
Princeton, NJ 08544

Research Interests

Statistical models of neural activity, probabilistic machine learning, latent variable models, dynamical systems, scalable and approximate inference, and randomized algorithms.

Education

09/2017 – present
Princeton, NJ

Princeton University, *Ph.D. Candidate in Neuroscience*
Graduate Certificate in Statistics and Machine Learning
Advised by Professor Jonathan Pillow

09/2015 - 09/2016
Cambridge, UK

University of Cambridge, *M.Phil. in Engineering*
Advised by Professor Máté Lengyel

08/2011 - 05/2015
East Lansing, MI

Michigan State University, *B.S. in Electrical Engineering*
Concentration in Biomedical Engineering

Research Experience

09/2016 – present

Pillow Lab and Laboratory for Intelligent Probabilistic Systems, Princeton University

- **Recurrent state-space models for decision-making**
  Proposing a unifying and general framework for modeling neural data with latent decision-making dynamics. Developed inference algorithm using variational and Laplace approximations. Advised by Jonathan Pillow and Scott Linderman.
- **Rethinking the randomized singular value decomposition**
  Developing an efficient probabilistic algorithm to improve the accuracy of randomized singular value decompositions. Advised by Ryan Adams.
- **Neural dynamics during decision-making**
  Modeled the latent dynamics of spike trains from monkey parietal cortex during sensory decision-making. Advised by Jonathan Pillow.
- **Fast and scalable inference for Poisson GLMs**
  Developed efficient methods to approximately fit Poisson generalized linear models using a single pass over the dataset. Advised by Jonathan Pillow.

09/2015 - 09/2016

Computational & Biological Learning Lab, University of Cambridge

- **The role of time in perceptual decision-making**
  Compared probabilistic sampling and evidence accumulation models of human perceptual decisions. Advised by Máté Lengyel.

08/2013 – 05/2015 Undergraduate Research Assistant, Michigan State University

- **Tracking and summarization of EEG brain states**
  Used tensor decomposition approaches to track and detect change points in EEG recordings of human brain activity. Advised by Selin Aviyente.

06/2013 – 08/2013 NSF Summer Research Experience for Undergraduates, University of Minnesota

- **Designing sparse controllers for spatially-invariant systems**
  Devised and implemented an efficient algorithm for the design of sparse, distributed optimal controllers for spatially-invariant systems. Advised by Mihailo Jovanović.

Publications

Submitted **David Zoltowski**, Jonathan Pillow, and Scott Linderman. "A recurrent state-space modeling framework for unifying models of perceptual decision-making." *Under review.*

Submitted Stephen Keeley, **David Zoltowski**, Yiyi Yu, Jacob Yates, Spencer Smith, and Jonathan Pillow. "Efficient non-conjugate Gaussian process factor models for spike count data using polynomial approximations." arXiv, 1906.03318. *Under review.*

Neuron **David Zoltowski**, Kenneth Latimer, Jacob Yates, Alexander Huk, and Jonathan Pillow. "Discrete stepping and nonlinear ramping dynamics underlie spiking responses of LIP neurons during decision-making." *Neuron,* 2019.

NeurIPS 2018 **David Zoltowski** and Jonathan Pillow. "Scaling the Poisson GLM to massive neural datasets." *32nd Conference on Neural Information Processing Systems (NeurIPS 2018).*

IEEE TBME Arash Mahyari, **David Zoltowski**, Edward Bernat, and Selin Aviyente. "A tensor decomposition based approach for detecting dynamic network states from EEG." *IEEE Transactions on Biomedical Engineering*, 2017.

EMBS 2014 **David Zoltowski**, Edward Bernat, and Selin Aviyente. "A Graph Theoretic Approach to Dynamic Functional Connectivity Tracking and Network State Identification." *Proceedings of the 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, 2014.

ACC 2014 **David Zoltowski**, Neil Dhingra, Fu Lin, and Mihailo Jovanovic. "Sparsity-promoting optimal control of spatially-invariant systems." *Proceedings of the 2014 American Control Conference*, 2014.

Abstracts

Cosyne 2019 Ádám Koblinger, **David Zoltowski**, József Fiser, and Máté Lengyel. Noise or signal? Psychophysical evidence for the role of sensory variability. Cosyne Abstracts 2019, Lisbon, Portugal.

Cosyne 2018	**David Zoltowski**, Kenneth Latimer, Alexander Huk, and Jonathan Pillow. Extending models of latent dynamics in area LIP during perceptual decision-making. Cosyne Abstracts 2018, Denver, CO, USA.
SFN 2017	**David Zoltowski**, Kenneth Latimer, Alexander Huk, and Jonathan Pillow. Extending models of latent dynamics in area LIP during perceptual decision-making. Washington, DC: Society for Neuroscience, 2017. Online.
SFN 2016	**David Zoltowski**, Ádám Koblinger, József Fiser, and Máté Lengyel. The role of time in perceptual decision-making. Program No. 267.11. 2016 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2016. Online.

Software

SSMDM	A recurrent state-space framework for modeling neural activity during decision-making
SSM (contributor)	Contributing inference algorithms for recurrent switching linear dynamical systems
paGLM	Fast and scalable approximate inference for Poisson generalized linear models

Honors and Awards

2018-20	NIH T32 Training Grant in Quantitative Neuroscience, Princeton University
2018	McDonnell Fellows in Neuroscience, Princeton University
2015-16	Churchill Scholarship, University of Cambridge
2015	Michigan State University Board of Trustees' Award (top graduating GPA, 4.0/4.0)
2015	Tau Beta Pi Laureate Award (one of five awarded in USA)
2015	Capital-One NCAA Academic All-American, Second Team
2014	Goldwater Scholarship
2014	Tau Beta Pi, Engineering Honor Society
2013	Eta Kappa Nu, IEEE Student Honor Society
2011-15	Honors College National Scholarship, Michigan State University

Academic Service and Teaching

2019	Reviewer for *AISTATS 2020*
2019	Reviewer for *NeurIPS 2019* (top 400 reviewer award)
2019	Assistant in Instruction, From Molecules to Systems to Behavior (NEU 502A, Princeton)
2018	Assistant in Instruction, Mathematical Tools for Neuroscience (NEU 314, Princeton)

Other Education

2018	Machine Learning Summer School (MLSS). Buenos Aires, Argentina.