DAN BIDERMAN, CURRICULUM VITAE

Postdoctoral Scholar
Linderman and Ré Labs
Stanford Statistics and Computer Science

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(last updated August 15, 2024)

INTERESTS

I build efficient AI systems for vision, language, and timeseries data, with particular applications in neuroscience. I work to better understand models' inner workings and share open-source software for science.

EDUCATION

2018–2024 COLUMBIA UNIVERSITY (New York, NY, USA)
PhD, Neurobiology & Behavior (2024)
MSc, Neurobiology & Behavior (2020)
Advisor: John P. Cunningham
Committee: Daniel Wolpert (chair), Liam Paninski, Ashok Litwin-Kumar, Alexander Rush
Thesis: Resource-Efficient Machine Learning Systems: From Natural Behavior to Natural Language

2013–2018 TEL AVIV UNIVERSITY (Israel)
The Adi Lautman Interdisciplinary Program for Outstanding Students (2013-2017)
The university's excellence program; leading directly to a Master's degree.
[See background and notable alumni]
Coursework: Cognitive Sci., Math, Neurobiology, History and Philosophy of Science
M.A., Cognitive Science (2018)
Advisor: Liad Mudrik
Thesis: Contextual effects on the perception of ambiguous objects (psychophysics and hierarchical Bayesian GLMs)

PROFESSIONAL EXPERIENCE

August 2024 – Present — STANFORD STATISTICS AND COMPUTER SCIENCE DEPARTMENTS
Postdoctoral Scholar
Advisors: Christopher Ré and Scott Linderman

November 2023 – June 2024 — MOSAIC ML / DATABRICKS
Part-time Student Researcher, NLP post-training team. Parameter-efficient finetuning for code and math (supervisor: Sam Havens)

May–August 2023 — MOSAIC ML / DATABRICKS
Research Intern, NLP data team (supervisor: Cody Blakeney)

PUBLICATIONS

* *denotes equal author contribution (shared first-authorship).*

[A1] Jakub Smékal, Jimmy Smith, Michael Kleinman, **Dan Biderman**, and Scott W. Linderman. Towards a theory of learning dynamics in deep state space models. In *ICML 2024 Workshop on Next Generation of Sequence Modeling Architectures*, 2024. Selected for Spotlight Presentation.

[A2] **Dan Biderman**, Jacob Portes, Jose Javier Gonzalez Ortiz, Mansheej Paul, Philip Greengard, Connor Jennings, Daniel King, Sam Havens, Vitaliy Chiley, Jonathan Frankle, Cody Blakeney, and John Patrick Cunningham. LoRA learns less and forgets less. *Transactions on Machine Learning Research*, 2024. Featured Certification.

[A3] The International Brain Laboratory, Kush Banga, Julius Benson, Jai Bhagat, **Dan Biderman**, Daniel Birman, Niccolò Bonacchi, Sebastian A Bruijns, Robert A Campbell, Matteo Carandini, Gaëlle A Chapuis, Anne K Churchland, M Felicia Davatolhagh, Hyun Dong Lee, Mayo Faulkner, Berk Gerçek, Fei Hu, Julia M Huntenburg, Cole Hurwitz, Anup Khanal, Christopher Krasniak, Guido T Meijer, Nathaniel J Miska, Zeinab Mohammadi, Jean-Paul Noel, Liam Paninski, Alejandro Pan-Vazquez, Noam Roth, Michael Schartner, Karolina Socha, Nicholas A Steinmetz, Karel Svoboda, Marsa Taheri, Anne E Urai, Miles Wells, Steven J West, Matthew R Whiteway, Olivier Winter, and Ilana B Witten. Reproducibility of in-vivo electrophysiological measurements in mice. *Revision Under Review, bioRxiv*, 2023.

[A4] **Dan Biderman***, Matthew R Whiteway*, Cole Hurwitz, Nicholas R Greenspan, Robert S Lee, Ankit Vishnubhotla, Michael Schartner, Julia M Huntenburg, Anup Khanal, Guido T Meijer, and others. Lightning pose: improved animal pose estimation via semi-supervised learning, bayesian ensembling, and cloud-native open-source tools. *Nature Methods*, 2024.

[A5] Matthew R Whiteway, **Dan Biderman**, Yoni Friedman, Mario Dipoppa, E Kelly Buchanan, Anqi Wu, John Zhou, Niccolò Bonacchi, Nathaniel J Miska, Jean-Paul Noel, and others. Partitioning variability in animal behavioral videos using semi-supervised variational autoencoders. *PLoS computational biology*, 17(9):e1009439, 2021.

[A6] Andres Potapczynski*, Luhuan Wu*, **Dan Biderman***, Geoff Pleiss, and John P. Cunningham. Bias-free scalable Gaussian processes via randomized truncations. In *International Conference on Machine Learning*, 2021.

[A7] **Dan Biderman**, Christian A Naesseth, Luhuan Wu, Taiga Abe, Alice C Mosberger, Leslie J Sibener, Rui Costa, James Murray, and John P Cunningham. Inverse articulated-body dynamics from video via variational sequential Monte Carlo. In *Neural Information Processing Systems Workshop on Differentiable Computer Vision, Graphics, and Physics in Machine Learning* ***(Oral)***, 2020.

[A8] **Dan Biderman**, Yarden Shir, and Liad Mudrik. B or 13? Unconscious top-down contextual effects at the categorical but not the lexical level. *Psychological science*, 31(6):663–677, 2020.

[A9] Eleanor Batty, Matthew Whiteway, Shreya Saxena, **Dan Biderman**, Taiga Abe, Simon Musall, Winthrop Gillis, Jeffrey Markowitz, Anne Churchland, John P Cunningham, and others. Behavenet: nonlinear embedding and Bayesian neural decoding of behavioral videos. *Advances in Neural Information Processing Systems*, 32, 2019.

[A10] **Dan Biderman***, Natalie Biderman*, Alon Zivony, and Dominique Lamy. Contingent capture is weakened in search for multiple features from different dimensions. *Journal of Experimental Psychology: Human Perception and Performance*, 43(12):1974, 2017.

[A11] Rony Hirschorn, **Dan Biderman**, Natalie Biderman, Itai Yaron, Rotem Bennet, Meir Plotnik, and Liad Mudrik. Multi-trial intattenrional blindness in virtual reality. *Under Revision, Behavior Research Methods*, 2023.

[A12] Amir Tal, May Sar-Shalom, Tzahi Krawitz, **Dan Biderman**, and Liad Mudrik. Awareness is needed for contextual effects in ambiguous object recognition. *Cortex*, 173:49–60, 2024.

SELECTED OPEN SOURCE SOFTWARE

Lightning Pose Ecosystem

2021– **Lightning Pose** (232 stars and 34 forks)
A widely-used package for semi-supervised pose estimation from video.
https://github.com/danbider/lightning-pose

2021– **Pose Tracking Diagnostics**
A set of unsupervised diagnostic metrics for model comparison and Streamlit dashboards.
https://github.com/paninski-lab/tracking-diagnostics

2021 **Lightning Pose App**
a cloud-deployed application supporting image annotation, accelerated training and evaluation. Builds on Lightning.ai.
https://github.com/Lightning-AI/lightning-pose-app

Scalable Gaussian Processes (GPs)

2022– **Cyclic GPs**
a PyTorch implementation of cyclic reduction for accelerated GP learning and inference.
https://github.com/cunningham-lab/cyclic-gps

2021 **Randomized Telescoped GPs**
Performs Unbiased Randomized Truncation of scalable GP algorithms in GPyTorch.
https://github.com/cunningham-lab/RTGPS

LLM evaluation

2023 **LLM evaluation dashboard**
A streamlit app comparing different LLMs' performance on numerous evaluation metrics from MosaicML's "Model Gauntlet".
https://github.com/mosaicml/llm-eval-dashboard

INVITED TALKS

Resource-constrained machine learning systems for neuroscience and beyond

Jan. 2024 Presentation at the Center for Computational Mathematics, Flatiron Institute
Oct. 2023 Presentation at the Linderman and Ré Labs, Stanford University

Behavioral video analysis: a new frontier for systems neuroscience

Nov. 2023 NSF AI Institute for Artificial and Natural Intelligence (ARNI) kickoff meeting, Columbia University

Inverse Articulated-Body Dynamics from Video via Variational Sequential Monte Carlo

Sep. 2021	Zuckerman Institute Open House for Simons-Emory Motor Control Consortium, (virtual)
Oct. 2020	Theoretical Neuroscience Seminar, University of Oregon (virtual)
Sep. 2020	Neurotheory meeting, Columbia University (virtual)

Lightning Pose: better, faster and easier animal pose estimation via semi-supervised learning

October 2023	Presentation at Flatiron Institute's Center for Computational Neuroscience (New York, NY, USA)
June 2023	Presentation at NIH U19 BRAIN site-visit at Columbia University (New York, NY, USA)
June 2022	Featured Developer at Lightning.ai's first developers conference (New York, NY, USA)
June 2022	Gatsby Computational Neuroscience Tri-Center Meeting, Hebrew University (Jerusalem, Israel)
May 2022	AiCure (virtual)
Apr. 2022	Neurotheory meeting, Columbia University
Dec. 2021	Lightning.ai (New York, NY, USA)
Nov. 2021	Special Seminar on Pose Estimation, Siegelbaum Lab, Columbia University (virtual)

The Elephant in the room: Cerbellar Motor Control of the Mormyrid Fish's Elephant Nose

July. 2021	Neurotheory meeting, Columbia University

SELECTED ABSTRACTS

Mar. 2023	**Biderman, D., Whiteway, M, et al.,** Lightning Pose— Pose estimation made better, faster and easier via video semi-supervised learning on the cloud. *COSYNE 2023: Computational and Systems Neuroscience* (Montréal, Canada)
Apr. 2022	**Biderman, D. et al.,** Lightning Pose—A suite of semi-supervised networks for robust video tracking with minimal manual annotation. *From Neuroscience to Artificially Intelligent Systems* (Cold Spring Harbor Laboratory, NY, USA)
May 2017	**Biderman, D. et al.,** Context modulation of ambiguous object perception in the absence of awareness *Vision Sciences Society conference (VSS)* (Tampa, Florida, USA)
Mar. 2020	Batty*, E., Whiteway*, M., Saxena, S., **Biderman, D.**, ... , Linderman, s., Paninski, L. (2020). BehaveNet: Nonlinear embedding and Bayesian neural decoding of behavioral videos. *Computational and Systems Neuroscience* (COSYNE).
Nov. 2019	Batty*, E., Whiteway*, M., Saxena, S., **Biderman, D.**, ... , Linderman, s., Paninski, L. (2019). BehaveNet: Nonlinear embedding and Bayesian neural decoding of behavioral videos. *Conference of the Society for Neuroscience* (SFN).

HONORS AND AWARDS

2022–Present	Lightning AI Academic Ambassador

2017	Oustanding Graduate Student Award (Social Sciences Department, Tel Aviv University)
2017	Student Travel Award, for the *Vision Sciences Society Conference (VSS)* (Tampa, Florida, USA, May 2017), Sagol School of Neuroscience, Tel Aviv University.
2016	Student Travel Award, for an advanced course on *Consciousness: from Theory to Practice* (Brassenone, Italy, August 2016). The Adi Lautman Interdisciplinary program for outstanding students.
2015	Outstanding Achievements Award, the Adi Lautman Interdisciplinary Program for Outstanding Students
2013–2017	Adi Lautman Interdisciplinary Program Merit Scholarship (full-tuition recipient)

TEACHING

Columbia University

Fall 2022/2023	GR6103 — Statistical Analysis of Neural Data (Prof. Liam Paninski). Guest lecture on modeling animal behavior.
Spring 2020	NBHVG4360 — Introduction to Theoretical Neuroscience (Asst. for Prof. Ashok Litwin-Kumar)

STUDENT MENTORSHIP

07/21 – 07/22	Nicholas Greenspan, Columbia College Computer Science (Pose Estimation, Gaussian Processes)
07/20 – 07/21	Sunand Raghupathi, Columbia College Applied Physics (3D Reconstruction, Pose Estimation)

PROFESSIONAL SERVICE

Conference Reviewer

NeurIPS workshop: Gaussian Processes, Spatiotemporal Modeling, and Decision-making Systems (2022)
Artificial Intelligence and Statistics (2022)
NeurIPS workshop: Differentiable Computer Vision, Graphics and Physics for Machine Learning (2020)
Computational Cognitive Neuroscience (2018–2019)

Journal Reviewer

iScience

Organizing Committee Member

Zuckerman Institute Open House for Simons-Emory Motor Control Consortium (virtual, Sep. 2021)
Zuckerman Institute Motor Control Club, Columbia University (2020–)
Student Moderator for NeuroNex Extrenal Advisory Committee meeting (May 2020)
Zuckerman Institute Scientific Writing Workshop, Colubmia University (Oct. 2019)
Center for Theoretical Neuroscience Retreat (Palisades, New Jersey, USA, Sep. 2019)