

DAN BIDERMAN, CURRICULUM VITAE

PhD Student
Center for Theoretical Neuroscience
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(last updated September 26, 2022)

INTERESTS

I work on data-efficient and compute-efficient machine learning algorithms and their application for neuroscience. I have extensive experience in deep learning, Gaussian Processes, generative models, and physical simulation. I have co-developed open-source projects that are used daily in science and industry. The goal of my work is to shed new light on classical machine learning algorithms, develop new ones, and deploy them at scale for neuroscience.

EDUCATION

- 2018– COLUMBIA UNIVERSITY (New York, NY, USA)
Ph.D., Neuroscience (Expected 2024)
M.S., Neuroscience (2020)
Advisor: John P. Cunningham
Committee: Daniel Wolpert (chair), Liam Paninski, Ashok Litwin-Kumar, Nathaniel Sawtell
Thesis: Scalable Machine Learning Algorithms with Applications to Neuroethology
- 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 Psychology (2018)
Advisor: Liad Mudrik
Thesis: Contextual effects on the perception of ambiguous objects (psychophysics and hierarchical Bayesian models)

MILITARY SERVICE

- 2008–2013 ISRAELI NAVAL INTELLIGENCE (Tel Aviv, Israel)
Lieutenant; last role: Special Operations Section Chief
First in Class, Intelligence Officers Training (2009)
First in Class, Intelligence Analysts Training (2008)

PUBLICATIONS

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

- [A1] 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.
- [A2] 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.
- [A3] **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.
- [A4] **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.
- [A5] 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.
- [A6] **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.

SELECTED OPEN SOURCE SOFTWARE

Lightning Pose Ecosystem

- 2021– **Lightning Pose** (117 stars and 15 forks; manuscript in prep.)
A suite of semi-supervised pose estimation networks implemented in PyTorch Lightning. Efficient GPU video loading using NVIDIA-DALI.
<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>

INVITED TALKS

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 stronger animal pose estimation via semi-supervised learning

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: Cerebellar Motor Control of the Mormyrid Fish's Elephant Nose

July. 2021 Neurotheory meeting, Columbia University

SELECTED ABSTRACTS

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

2017 Outstanding Graduate Student Award (Social Sciences Department, Tel Aviv University)

2017	Student Travel Award, for the <i>Vision Sciences Society Conference (VSS)</i> (Tampa, Florida, USA, May 2017), Sagol School of Neuroscience, Tel Aviv University.
2016	Student Travel Award, for an advanced course on <i>Consciousness: from Theory to Practice</i> (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 ASSISTANTSHIPS

Columbia University

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 (2022–2023)
 NeurIPS workshop: Differentiable Computer Vision, Graphics and Physics for Machine Learning (2020)
 Computational Cognitive Neuroscience (2018–2019)

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 Extramural Advisory Committee meeting (May 2020)
 Zuckerman Institute Scientific Writing Workshop, Columbia University (Oct. 2019)
 Center for Theoretical Neuroscience Retreat (Palisades, New Jersey, USA, Sep. 2019)