# DAN BIDERMAN, CURRICULUM VITAE

PhD Student
Center for Theoretical Neuroscience
Zuckerman Institute, Columbia University

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(last updated May 17, 2024)

## INTERESTS

I develop efficient machine learning systems – for video, text, and timeseries – that are used daily in neuroscience and industry.

## EDUCATION

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| 2018– | COLUMBIA UNIVERSITY (New York, NY, USA) <br> **Ph.D., Neuroscience** (Expected June 2024) <br> **M.S., Neuroscience** (2020) <br> Advisor: John P. Cunningham <br> Committee: Daniel Wolpert (chair), Liam Paninski, Ashok Litwin-Kumar, Alexander Rush <br> Thesis: Resource-efficient Machine Learning Systems: From Natural Behavior to Natural Language |
| 2013–2018 | TEL AVIV UNIVERSITY (Israel) <br> **The Adi Lautman Interdisciplinary Program for Outstanding Students** (2013-2017) <br> The university's excellence program; leading directly to a Master's degree. <br> [See background and notable alumni] <br> Coursework: Cognitive Sci., Math, Neurobiology, History and Philosophy of Science <br> **M.A., Cognitive Science** (2018) <br> Advisor: Liad Mudrik <br> Thesis: Contextual effects on the perception of ambiguous objects (psychophysics and hierarchical Bayesian models) |

## PROFESSIONAL EXPERIENCE

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| May 2023– | MOSAIC ML / DATABRICKS <br> Student Researcher, NLP team. Parameter-efficient finetuning, evaluation, code generation (supervisor: Jonathan Frankle) |

## MILITARY SERVICE

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

# PUBLICATIONS

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

[A1] **Dan Biderman**, Jose Gonzalez Ortiz, Jacob Portes, Mansheej Paul, Philip Greengard, Connor Jennings, Daniel King, Sam Havens, Vitaliy Chiley, Jonathan Frankle, Cody Blakeney, and John P. Cunningham. Lora learns less and forgets less, 2024.

[A2] 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.

[A3] **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. *BioRxiv*, In Press.

[A4] 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.

[A5] 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.

[A6] **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.

[A7] **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.

[A8] 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.

[A9] **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.

[A10] 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.

[A11] 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** (208 stars and 28 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*

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| 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*

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| 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*

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| July. 2021 | Neurotheory meeting, Columbia University |


## SELECTED ABSTRACTS

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| 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

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| 2022 | Lightning AI Academic Ambassador |
| 2017 | Oustanding Graduate Student Award (Social Sciences Department, Tel Aviv University) |

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| 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

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| 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

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| 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)

### 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)