Cole Hurwitz

General Information

Affiliation *Postdoctoral Research Scientist, Zuckerman Institute, Columbia University.*

Supervisor Dr. Liam Paninski

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Education

2017–2022 **PhD**, ANC, Informatics Forum, University of Edinburgh, UK, Scalable software and models for large-scale extracellular recordings, supervised by Dr. Matthias Hennig.

2013–2017 **BA Logic, Information, and Computation**, University of Pennsylvania, Philadelphia, Minor in Mathematics and Computer Science, *summa cum laude*.

Publications

- Towards robust and generalizable representations of extracellular data using contrastive learning. Ankit Vishnu*, Charlotte Loh*, Julien Boussard, Akash Srivastava, Liam Paninski, **Cole Hurwitz**. $*$ - Equal Contribution.*Advances in Neural Information Processing Systems 36 (NeurIPS)*. 2023
- Density-based neural decoding of electrophysiological data. Yizi Zhang*, Tianxiao He*, Julien Boussard, **Cole Hurwitz**, Erdem Varol, Charlie Windolf, Olivier Winter, Matt Whiteway, The International Brain Laboratory, Liam Paninski. $*$ - Equal Contribution.*Advances in Neural Information Processing Systems 36 (NeurIPS)*. 2023
- Spike sorting pipeline for the International Brain Laboratory. International Brain Laboratory, ..., **Cole Hurwitz**, ... *figshare.com*. 2022
- Targeted Neural Dynamical Modeling. **Cole Hurwitz**, Akash Srivastava, Kai Xu, Justin Jude, Matthew Perich, Lee Miller, Matthias Hennig *Advances in Neural Information Processing Systems 34 (NeurIPS)*. 2021
- Building population models for large-scale neural recordings: opportunities and pitfalls. **Cole Hurwitz***, Nina Kudryashova*, Arno Onken, Matthias H. Hennig. $*$ - Equal Contribution, *Current Opinion in Neurobiology 70, Pages 64-73*. 2021
- SpikeInterface, a unified framework for spike sorting. Alessio Buccino*, **Cole Hurwitz***, Jeremy Magland, Samuel Garcia, Joshua Siegle, Roger Hurwitz, and Matthias Hennig. $*$ - Equal Contribution, *eLife*. 2020
- SpikeForest, reproducible web-facing ground-truth validation of automated neural spike sorters. Jeremy Magland, James Jun, Elizabeth Lovero, Alexander J Morley, **Cole Hurwitz**, Alessio Buccino, Samuel Garcia, Alex Barnett. *eLife*. 2020
- Scalable Spike Source Localization in Extracellular Recordings using Amortized Variational Inference. **Cole Hurwitz**, Kai Xu, Akash Srivastava, Alessio Buccino, and Matthias Hennig. *Advances in Neural Information Processing Systems 32 (NeurIPS)*. 2019

- Scaling Spike Detection and Sorting for Next Generation Electrophysiology. Matthias Hennig, **Cole Hurwitz**, and Martino Sorbaro. In press. *In Vitro Neuronal Networks - From Culturing Methods to Neuro-Technological Applications*. 2019

Preprints

- Ultra-high density electrodes improve detection, yield, and cell type specificity of brain recordings. Zhiwen Ye, Andrew M. Shelton, Jordan R. Shaker, Julien Boussard, Jennifer Colonell, Sahar Manavi, Susu Chen, Charlie Windolf, **Cole Hurwitz**, Tomoyuki Namima, Federico Pedraja, Shahaf Weiss, Bogdan Raducanu, Torbjørn V. Ness, Gaute T. Einevoll, Gilles Laurent, Nathaniel B. Sawtell, Wyeth Bair, Anitha Pasupathy, Carolina Mora Lopez, Barun Dutta, Liam Paninski, Joshua H. Siegle, Christof Koch, Shawn R. Olsen, Timothy D. Harris, Nicholas A. Steinmetz. $*$ - Equal Contribution., *biorxiv.com*. 2023
- Lightning Pose: improved animal pose estimation via semi-supervised learning, Bayesian ensembling, and cloud-native open-source tools. Dan Biderman*, Matthew R Whiteway*, **Cole Hurwitz**, Nicholas Greenspan, Robert S Lee, Ankit Vishnubhotla, Michael Schartner, Julia M Huntenburg, Richard Warren, Federico Pedraja, Dillon Noone, The International Brain Laboratory, John P Cunningham, Nathaniel Sawtell, Liam Paninski. $*$ - Equal Contribution., *biorxiv.com*. 2023
- DARTsort: A modular drift tracking spike sorter for high-density multi-electrode probes. Charlie Windolf*, Julien Boussard*, **Cole Hurwitz***, Hyun Dong Lee, Liam Paninski. $*$ - Equal Contribution., *biorxiv.com*. 2023
- Reproducibility of in-vivo electrophysiological measurements in mice. International Brain Laboratory, ..., **Cole Hurwitz**, ... *biorxiv.com*. 2022
- not-so-BigGAN: Generating High-Fidelity Images on Small Compute with Wavelet-based Super-Resolution. Seungwook Han*, Akash Srivastava*, **Cole Hurwitz***, Prasanna Sattigeri, David D. Cox. $*$ - Equal Contribution. *arXiv*. 2020
- Improving the Reconstruction of Disentangled Representation Learners via Multi-Stage Modelling. Akash Srivastava*, Yamini Bansal*, Yukun Ding*, **Cole Hurwitz***, Kai Xu, Bernhard Egger, Prasanna Sattigeri, Josh Tenenbaum, David D. Cox, Dan Gutfreund. $*$ - Equal Contribution. *arXiv*. 2020

Software contributions

- EKS: An ensembling and smoothing framework for pose estimation.
- DARTsort: A modular drift tracking spike sorter for high-density multi-electrode probes.
- CEED: Contrastive Embeddings of Extracellular Data.
- TNDM: Targeted Neural Dynamical modeling.
- SpikeInterface: A unified framework for spike sorting.
- HS2: A spike sorting algorithm for dense multielectrode arrays. Real-time speeds for datasets from >4000 electrodes.

Work Experience

2022–present **Postdoctoral Researcher**, Columbia University.
Currently performing research and supervising students to develop state-of-the-art pose estimation, spike sorting, and neural decoding algorithms.

2021 **Research Intern**, FRL Research.
Performed research into processing algorithms for EMG-based brain computer interfaces . Improved performance and benchmarking of spike decomposition algorithms for EMG.

2020 **Research Intern**, MIT-IBM AI Lab.
Performed research into generative modeling, representation learning, and inverse rendering.

2019–2020 **Research Assistant**, University of Edinburgh, Scotland.
Performed research into deep generative modeling as applied to neural data analysis and built general-purpose software for spike sorting.

2016–2016 **Teaching Assistant**, University of Pennsylvania, Philadelphia.
Taught recitations and graded assignments/tests for an introductory calculus course.

2014–2016 **Athlete Tutor**, University of Pennsylvania, Philadelphia.
Tutored student-athletes in introductory calculus and physics.

Experience

2019 **Summer course**, *MLSS 2019: London*, UCL, Covers topics ranging from optimization and Bayesian inference to deep learning, reinforcement learning and Gaussian processes.

2019 **Workshop Organizer**, University of Edinburgh, Edinburgh.
Workshop: "Spike Sorting and Reproducibility for Next Generation Electrophysiology".

2018 **Summer course**, *OCNC: OIST Computational Neuroscience Course*, OIST, Covers methods, neurons, networks, and behavior. Two week project on deep spiking neural networks.

Awards and Honors

PhD NeurIPS travel award (£1400)

PhD OCNC travel award (£500)

BA Thouron Award – Two year UK postgraduate study fellowship

BA Phi Beta Kappa

BA CSCAA Scholar All-American

BA 2016 USA Swimming Olympic Trials Qualifier

BA 2013-2017 Ivy League Championship Swimming Finalist

Programming Languages and Tools

Languages Python

Tools pytorch, tensorflow, scikit-learn, SciPy, SpikeInterface