

General Information

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

Experience

2022–present **Postdoctoral Research Scientist**, Columbia University, International Brain Laboratory, and the NSF AI Institute for Artificial and Natural Intelligence.
Performing research and supervising students to develop state-of-the-art pose estimation, spike sorting, and neural decoding algorithms. Leading the development of large-scale models of neurophysiological data from multiple animals and brain regions (i.e., neurofoundation models).
2021 **Research Intern**, Facebook Reality Labs.
Performed research into signal processing algorithms for EMG-based brain computer interfaces. Improved performance and evaluation of spike sorting algorithms for EMG.
2020 **Research Intern**, MIT-IBM AI Lab.
Performed research into generative modeling, representation learning, and inverse rendering. Developed state-of-the-art approaches for image modeling using VAEs and GANs.
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 that is widely used in academia.

Technical Skills

Programming Python (PyTorch, NumPy, SciPy, scikit-learn, pandas, Jupyter), CUDA, Bash, Git.
Machine Learning Transformers, RNNs, CNNs, and MLPs; sequence and time-series modeling; latent variable models; self- and semi-supervised learning; contrastive and generative modeling; multimodal representation learning; domain adaptation and transfer learning.
Neuroscience Neural decoding/encoding, neurofoundation models, spike sorting, electrophysiology, electromyography, cell-type and brain-region classification, behavioral analysis.
Data & Infrastructure Large-scale dataset curation; HPC/SLURM job scheduling; reproducible ML pipelines (conda/mamba, Docker); experiment tracking (TensorBoard/Wandb).

Publications

- [Improved calibration-free multi-view pose estimation with the variance-inflated Ensemble Kalman Smoother](#). Lenny Aharon, Keemin Lee, ..., **Cole Hurwitz**, Liam Paninski, Matthew R Whiteway. CVPR 2025 Workshop: CV4Animals (Oral).
- [Neural Encoding and Decoding at Scale](#). Yizi Zhang*, Yanchen Wang*, Mehdi Azabou, ..., Liam Paninski, **Cole Hurwitz**. ICML (spotlight) 2025. *equal contribution.
- [Reproducibility of in-vivo electrophysiological measurements in mice](#). International Brain Laboratory, ..., **Cole Hurwitz**, ... *eLife* 2025.
- [In vivo cell-type and brain region classification via multimodal contrastive learning](#). Han Yu, Hanrui Lyu, Ethan YiXun Xu, Charlie Windolf, Eric Kenji Lee, Fan Yang, Andrew M. Shelton, ..., Liam Paninski, **Cole Hurwitz**. ICLR (spotlight) 2025.
- [Towards a “universal translator” for neural dynamics at single-cell, single-spike resolution](#). Yizi Zhang, Yanchen Wang, Donato Jiménez Benetó, Zixuan Wang, Mehdi Azabou, Blake Richards, Olivier Winter, Eva Dyer, Liam Paninski, **Cole Hurwitz**. NeurIPS 2024.
- [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**, ..., John P Cunningham, Nathaniel Sawtell, Liam Paninski. * - Equal Contribution., *Nature Methods* 2024.
- [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. 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. NeurIPS 2023.
- [Spike sorting pipeline for the International Brain Laboratory](#). International Brain Laboratory, ..., **Cole Hurwitz**, 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

- [Self-supervised pretraining of vision transformers for animal behavioral analysis and neural encoding](#) . Yanchen Wang, Han Yu, Ari Blau, Yizi Zhang, The International Brain Laboratory, Liam Paninski, **Cole Hurwitz**, Matt Whiteway. *arXiv*. 2025
- [BAND: Behavior-Aligned Neural Dynamics is all you need to capture motor corrections](#). Nina Kudryashova, **Cole Hurwitz**, Matthew Perich, Matthias Hennig. *bioRxiv*. 2025
- [Exploiting correlations across trials and behavioral sessions to improve neural decoding](#). Yizi Zhang*, Hanrui Lyu*, **Cole Hurwitz**, Shuqi Wang, Charles Findling, Felix Hubert, Alexandre Pouget; International Brain Laboratory, Erdem Varol, Liam Paninski. * - Equal Contribution., *bioRxiv*. 2024
- [Ultra-high density electrodes improve detection, yield, and cell type identification in neuronal recordings](#). Zhiwen Ye*, Andrew M Shelton*, Jordan R Shaker, . . . , **Cole Hurwitz** . . . , Nicholas A Steinmetz. * - Equal Contribution., *bioRxiv*. 2024
- [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*. 2023
- [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

Invited Talks

- 2025 **Washington University in St. Louis** , *Building towards a brain-wide foundation model at single-cell, single-spike resolution*, 2025 Next Gen Symposium.
- 2025 **Bernstein Conference**, *Modeling neural activity and behavior at scale*, Workshop: Toward a joint definition of neural-behavioral states.
- 2025 **University College London**, *Building towards a brain-wide foundation model at single-cell, single-spike resolution*, Gatsby Tri-Center Annual Meeting.
- 2025 **Flatiron Institute**, *Building towards a brain-wide foundation model at single-cell, single-spike resolution*, International Brain Laboratory Annual Meeting.
- 2024 **University of Edinburgh**, *Drift-aware electrophysiology with DREDge and DARTsort*, Workshop: Tools and Methods for Next Generation Electrophysiology.
- 2024 **Cosyne**, *A simple deep ensembling and Kalman smoothing approach to pose tracking*, Workshop: I Can't Believe It's Not Better!.
- 2023 **Columbia University**, *Towards robust and generalizable representations of extracellular data using contrastive learning*, ZIPS - Zuckerman Institute Postdoctoral Seminar Series.
- 2019 **Allen Institute for Brain Science**, *SpikeInterface, a unified framework for spike sorting*.
- 2019 **University of Edinburgh**, *SpikeInterface, a unified framework for spike sorting*, Workshop: Spike Sorting and Reproducibility for Next Generation Electrophysiology.
- 2018 **Flatiron Institute**, *Scalable Spike Localization in Extracellular Recordings using Amortized Variational Inference*.

Community leadership

- 2025 **Workshop organizer**, *NeurIPS*, [Foundation Models for the Brain and Body](#). A 1-day workshop to catalyze the next generation of AI models that can capture the complexity of the brain, body, and behavior at scale.
- 2025-present **Researchers Representative**, International Brain Laboratory (IBL).
- 2025 **Workshop organizer**, *Cosyne*, [Building a foundation model for the brain: datasets, theory, and models](#). A 2 day workshop on neurofoundation models.
- 2024 **Co-chair**, Zuckerman Institute Postdoctoral Seminar (ZIPS).
- 2023 **Seminar Organizer**, Zuckerman Institute Postdoctoral Seminar (ZIPS).

Mentoring

- 2024 **Renee Tung (with Liam Paninski)**.
MD-PhD student - Medical Scientist Training Program, Columbia University
- 2024 **Hanrui Lyu (with Liam Paninski)**.
Research Assistant, Columbia University
- 2024 **Ethan Yixun Xu (with Liam Paninski)**.
Research Assistant, Columbia University
- 2024 **Yanchen Wang (with Liam Paninski)**.
Research Engineer, Stanford
- 2024 **Zixuan Wang (with Liam Paninski)**.
Undergraduate student, Columbia University
- 2023-present **Yizi Zhang (with Liam Paninski)**.
Ph.D. student - Dept. of Statistics, Columbia University
- 2023-present **Han Yu (with Liam Paninski)**.
Ph.D. student - Fu Foundation School of Engineering and Applied Science, Columbia University
- 2023 **Ankit Vishnubhotla (with Liam Paninski)**.
Masters student - Dept. of Computer Science, Columbia University

Teaching

- 2025 **Tutorial**, *Cosyne*, Foundations of Transformers in Neuroscience.
Helped participants with code and questions during the session as a teaching assistant.
- 2025 **Guest Lecture**, *NYU*, Neuroinformatics .
Presented slides for a lecture on neural decoding, encoding, and self-prediction. Introduced neurofoundation models: large-scale models trained on data from many animals and brain regions.
- 2024 **Guest Lecture**, *Columbia*, Statistical analysis of neural data.
Created slides for a lecture on neural decoding, encoding, and self-prediction. Introduced neurofoundation models: large-scale models trained on data from many animals and brain regions.
- 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.

Software

- [SpikeInterface](#): A unified framework for spike sorting.

- [IBL Foundation Model](#): A novel self-supervised modeling approach for population activity in which the model alternates between masking out and reconstructing neural activity across different time steps, neurons, and brain regions.
- [EKS](#): An ensembling and smoothing framework for pose estimation.
- [DARTsort](#): A modular drift tracking spike sorter for high-density multi-electrode probes.
- [CEED](#): A novel contrastive learning framework, CEED (Contrastive Embeddings for Extracellular Data), for high-density extracellular recordings
- [TNDM](#): A nonlinear state-space model, Targeted Neural Dynamical Modeling (TNDM), that jointly models neural activity and behavior
- [HS2](#): A spike sorting algorithm for dense multielectrode arrays. Real-time speeds for datasets from >4000 electrodes.

Awards and Honors

PhD NeurIPS travel award (£1400)
 PhD OCNC travel award (£500)
 PhD Machine Learning Summer School (MLSS) Travel Award
 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