

Eric L. Denovellis, Ph.D.

CONTACT INFORMATION

675 Nelson Rising Ln.
UCSF
San Francisco, CA 94158
USA

Email: eric.denovellis@ucsf.edu
Website: edenovellis.com
GitHub: github.com/edeno
ORCID: [0000-0003-4606-087X](https://orcid.org/0000-0003-4606-087X)
Google Scholar: [Eric Denovellis](https://scholar.google.com/citations?user=EricDenovellis)

RESEARCH INTERESTS

I develop scalable, interpretable algorithms and tools to decode, categorize, and visualize neural representations—particularly in the hippocampus. My methodological focus is on marked point process switching state space models for characterizing replay dynamics. I work closely with experimental collaborators to ensure these methods are usable on large-scale data, and I build open-source infrastructure to make advanced computational techniques accessible to the broader neuroscience community.

EDUCATION

Boston University, Boston, Massachusetts USA
Graduate Program for Neuroscience
Ph.D. in Computational Neuroscience, September 2016

Thesis: [Task Switching in the Prefrontal Cortex](#)
Advisor: Daniel H. Bullock

University of California, Santa Barbara, Santa Barbara, California USA
B.S., Mathematics and B.A., Philosophy with High Honors, June 2007

RESEARCH EXPERIENCE

University of California, San Francisco, San Francisco, California USA
Research Scientist **September 2019 – Present**
Researcher in the Department of Physiology. Developing marked point process state space models for interpreting and categorizing hippocampal replay and other neural representations. Leading a team of two computational scientists in building and maintaining lab data processing pipelines. Collaborating with and mentoring trainees on statistical analyses.

Boston University, Boston, Massachusetts USA
Postdoctoral Researcher **September 2016 – August 2019**
Researcher in the Mathematics and Statistics Department. Research focused on communication between the hippocampus and other brain areas during the reactivation of memory. Involves work in state space modeling, point processes, and signal processing.

Graduate Student **September 2009 – September 2016**
Includes doctoral and masters level coursework in mathematics, statistics, computational modeling, and neuroscience as well as research into the neural and computational correlates of task switching.

TEACHING

National Centre for Biological Sciences, Bangalore, India
Visiting Instructor **February – March 2026**
Computational neuroscience course covered open data use and visualization, spectral analysis of local field potentials, spike-stimulus analysis, neural decoding, and clusterless decoding approaches. Four weeks of instruction (two 1.5-hour lectures per week).

University of California, San Francisco

Lecturer, NS219 Encoder-Decoder Models for Neuroscience

May 2024

Switching state space models to characterize non-local activity in the hippocampus.

Boston University

Instructor, CELEST Summer Program for Undergraduate Interns

June – August 2015

Taught Matlab programming course to underrepresented undergraduate students in STEM.

Teaching Fellow, CAS NE 340

January – May 2014

Introduction to Computational Models of Skilled Decision and Action. Delivered lectures on task switching and Matlab programming; assisted with computer lab sessions.

Teaching Fellow, CAS CN 570

January – May 2011

Neural and Computational Models of Conditioning, Reinforcement, Motivation and Rhythm. Designed final project assignment using a neural network model for visually-guided reaching that integrates motor and visual sensory feedback.

University of California, Santa Barbara

Mathematics Tutor, Campus Learning Assistance Services

September 2005 – June 2007

Tutored students in calculus and linear algebra.

PUBLICATIONS

Sun, X., Comrie, A.E., Kahn, A.E., Monroe, E.J., Joshi, A., Guidera, J.A., **Denovellis, E.L.**, Krausz, T.A., Zhou, J., Thompson, P., Hernandez, J., Yorita, A., Haque, R., Berke, J.D., Daw, N.D., and Frank, L.M. (2026). Meta-learning is expressed through altered prefrontal cortical dynamics. Preprint. [doi:10.64898/2026.01.01.697272](https://doi.org/10.64898/2026.01.01.697272)

Lee, K.H.*, **Denovellis, E.L.***, Ly, R., Magland, J., Soules, J., Gramling, D.P., Guidera, J.A., Nev-ers, R., Adenekan, P., Bray, S., et al. (2025). Spyglass: a data analysis framework for reproducible and shareable neuroscience research. eLife reviewed preprint. [doi:10.7554/eLife.108089.1](https://doi.org/10.7554/eLife.108089.1)

Coulter, M.E., Gillespie, A.K., Chu, J., **Denovellis, E.L.**, Nguyen, T.T.K., Liu, D.F., Wadhvani, K., Sharma, B., Wang, K., Deng, X., et al. (2025). Closed-loop modulation of remote hippocampal representations with neurofeedback. Neuron. [doi:10.1016/j.neuron.2024.12.023](https://doi.org/10.1016/j.neuron.2024.12.023)

Comrie, A.E., Monroe, E.J., Kahn, A.E., **Denovellis, E.L.**, Joshi, A., Guidera, J.A., Krausz, T.A., Berke, J.D., Daw, N.D., and Frank, L.M. (2024). Hippocampal representations of alternative possibilities are flexibly generated to meet cognitive demands. Preprint. [doi:10.1101/2024.09.23.613567](https://doi.org/10.1101/2024.09.23.613567)

Chu, J.P., Coulter, M.E., **Denovellis, E.L.**, Nguyen, T.T.K., Liu, D.F., Deng, X., Eden, U.T., Kemere, C.T., and Frank, L.M. (2024). RealtimeDecoder: A fast software module for online clusterless decoding. bioRxiv. [doi:10.1101/2024.05.03.592417](https://doi.org/10.1101/2024.05.03.592417)

Guidera, J.A., Gramling, D.P., Comrie, A.E., Joshi, A., **Denovellis, E.L.**, Lee, K.H., Zhou, J., Thompson, P., Hernandez, J., Yorita, A., et al. (2024). Regional specialization manifests in the reliability of neural population codes. bioRxiv. [doi:10.1101/2024.01.25.576941](https://doi.org/10.1101/2024.01.25.576941)

Gillespie, A.K., Astudillo Maya, D.A., **Denovellis, E.L.**, Desse, S., and Frank, L.M. (2024). Neurofeedback training can modulate task-relevant memory replay rate in rats. eLife reviewed preprint. [doi:10.7554/eLife.90944.2](https://doi.org/10.7554/eLife.90944.2)

Joshi, A., **Denovellis, E.L.**, Mankili, A., Meneksedag, Y., Davidson, T.J., Gillespie, A.K., Guidera,

J.A., Roumis, D., and Frank, L.M. (2023). Dynamic synchronization between hippocampal representations and stepping. *Nature*. doi:10.1038/s41586-023-05928-6

Denovellis, E.L., Myroshnychenko, M., Sarmashghi, M., and Stephen, E.P. (2022). Spectral Connectivity: a python package for computing multitaper spectral estimates and frequency-domain brain connectivity measures on the CPU and GPU. *Journal of Open Source Software*. doi:10.21105/joss.04840

Gillespie, A.K., Astudillo Maya, D.A., **Denovellis, E.L.**, Liu, D.F., Kastner, D.B., Coulter, M.E., Roumis, D.K., Eden, U.T., and Frank, L.M. (2021). Hippocampal replay reflects specific past experiences rather than a plan for subsequent choice. *Neuron*. doi:10.1016/j.neuron.2021.07.029

Denovellis, E.L., Gillespie, A.K., Coulter, M.E., Sosa, M., Chung, J.E., Eden, U.T., and Frank, L.M. (2021). Hippocampal replay of experience at real-world speeds. *eLife*. doi:10.7554/eLife.64505

Denovellis, E.L., Frank, L.M., and Eden, U.T. (2019). Characterizing hippocampal replay using hybrid point process state space models. 2019 53rd Asilomar Conference on Signals, Systems, and Computers. doi:10.1109/ieeconf44664.2019.9048688

Buschman, T.J.*, **Denovellis, E.L.***, Diogo, C.*, Bullock, D., and Miller, E.K. (2012). Synchronous Oscillatory Neural Ensembles for Rules in the Prefrontal Cortex. *Neuron*. doi:10.1016/j.neuron.2012.09.029

* **Co-first authors**

SOFTWARE PACKAGES

spectral_connectivity — Multitaper spectral estimation and frequency-domain connectivity analysis (coherence, Granger causality, phase-lag index) for electrophysiological data. Supports GPU acceleration. **134 stars, 47 forks**. Published in *Journal of Open Source Software*: doi:10.21105/joss.04840.

Spynlass (co-first author) — Data analysis framework for reproducible neuroscience research. Integrates NWB data standards, DataJoint pipelines, SpikeInterface, and DeepLabCut into a unified platform for multi-lab collaboration. **107 stars, 52 forks**. Preprint: doi:10.7554/eLife.108089.1.

replay_trajectory_classification — State-space models for decoding hippocampal replay trajectories and classifying their dynamics using sorted or clusterless spikes. **52 stars, 19 forks**. Published in *eLife*: doi:10.7554/eLife.64505.

SpectraVis — Interactive D3.js web application for exploring task-related functional brain connectivity over time and frequency. **37 stars, 12 forks**.

RasterVis — Interactive D3.js web application for visualizing spike rasters across neurons, trials, and experimental conditions. **12 stars, 4 forks**. Demo: neurophysvis.github.io/RasterVis

TALKS

Understanding cognitive representations and dynamics through statistical machine learning. National Centre for Biological Sciences, Bangalore, India, March 2026.

Understanding cognitive representations and dynamics through statistical machine learning. Sainsbury Wellcome Centre/Gatsby Computational Neuroscience Unit, University College London, London, United Kingdom, August 2024.

Understanding cognitive representations and dynamics through statistical machine learning. Computational Neuroscience Center, University of Washington, Seattle, WA, May 2024.

Building Accessible Computational Tools for Modern Systems Neuroscience. Databinge, NeuroImaging and NeuroComputation Centre, University of British Columbia, Vancouver, BC, Canada, Febru-

ary 2024.

Characterizing hippocampal replay using switching point process state space models. Stanford Computational Neuroscience Journal Club, Stanford, CA, August 2020.

Characterizing hippocampal replay using hybrid point process filters. IEEE Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, November 2019.

Using state space models to identify latent temporal dynamics of population spiking activity. The 33rd New England Statistics Symposium, Hartford, CT, May 2019.

[Better Science Code](#). MIT Center for Brains, Minds, and Machines, Cambridge, MA, May 2017.

[Data visualization tools: from classroom to science](#). Inter Science of Learning Centers Conference Workshop, San Diego, CA, June 2015.

Synchronous Neural Ensembles for Rules in the Prefrontal Cortex. The 5th Annual Dana and Betty Fisher Retreat of the Picower Institute, South Yarmouth, MA, June 2012.

Neural Dynamics of Cognitive Flexibility. Fall 2011 Picower Plastic Lunch Series, Massachusetts Institute of Technology, Cambridge, MA, October 2011.

CONFERENCE
PROCEEDINGS

Sun, X., Comrie, A.E., Monroe, E.J, Kahn, A.E., Joshi, A., Guidera, J.A., Tong, L., **Denovellis, E.L.**, Krausz, T.A., Shin, D., Berke, J., Daw, N., Frank, L.M. Dynamic value codes in the medial prefrontal cortex to inform decision-making. Lisbon, Portugal: Computational and Systems Neuroscience (COSYNE) 2024.

Coulter, M.E., Gillespie, A.K., Chu, J., **Denovellis, E.L.**, Nguyen, T., Liu, D.F., Wadhvani, K., Sharma, B., Wang, K., Deng, X., Kemere, C., Eden, U.T., Frank, L.M. Closed-loop modulation of hippocampal representations through neurofeedback. 2023 Neuroscience Meeting Planner. Washington, D.C.: Society for Neuroscience, 2023. [Online](#).

Krausz, T.A., Egert, D., Comrie, A.E., **Denovellis, E.L.**, Daw, N.D., Frank, L.M., Berke, J.D. Hippocampal non-local representations retrieve and update dopaminergic place values. 2023 Neuroscience Meeting Planner. Washington, D.C.: Society for Neuroscience, 2023. [Online](#).

Comrie, A.E., Monroe, E.J., **Denovellis, E.L.**, Joshi, A., Guidera, J.A., Kahn, A.E., Krausz, T.A., Berke, J.D., Daw, N.D., Frank, L.M. Dynamic engagement of non-local spatial representations in the hippocampus during value-guided foraging decisions. 2023 Neuroscience Meeting Planner. Washington, D.C.: Society for Neuroscience, 2023. [Online](#).

Krausz, T.A., Egert, D., Comrie, A.E., **Denovellis, E.L.**, Daw, N.D., Frank, L.M., Berke, J.D. Hippocampal non-local representations retrieve and update dopaminergic place values. Gordon Research Conference: Catecholamines; August 2023; Castelldefels, Spain.

Denovellis, E.L., Guidera, J.A., Frank, L.M. Switching state-space models enable decoding of replay across multiple spatial environments. Montreal, Quebec, CA: Computational and Systems Neuroscience (COSYNE) 2023.

Guidera, J.A., Gramling, D., **Denovellis, E.L.**, Comrie, A., Joshi, A., Zhou, J., Thompson, P., Hernandez, J., Yorita, A., Haque, R., Kirst, C., Frank, L.M. A region-specific code for specific and generalized representations across prefrontal cortex and hippocampus. Montreal, Quebec, CA: Computational and Systems Neuroscience (COSYNE) 2023.

Denovellis, E.L., Joshi, A., Eden, U.T., Frank, L.M. Hippocampal replay outside of sharp wave ripples. Program No. 742.04. 2022 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2022. [Online](#).

Lee, K., **Denovellis, E.L.**, Ly, R., Magland, J., Soules, J., Comrie, A., Guidera, J.A., Nevers, R., Gramling, D., Adenekan, P., Bak, J., Monroe, E., Tritt, A., Ruebel, O., Nguyen, T.T., Yatsenko, D., Chu, J., Kemere, C., Garcia, S., Buccino, A.P., Jones, E.A., Giocomo, L.M., Frank, L.M. Spyglass: a data analysis framework for reproducible and shareable neuroscience research. Program No. 742.16. 2022 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2022. [Online](#).

Chu, J., Coulter, M.E., Liu, D.F., **Denovellis, E.L.**, Frank, L.M., Kemere, C. Real-time decoding with state space models of neural activity. Program No. 742.08. 2022 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2022. [Online](#).

Gillespie, A.K., Astudillo Maya, D.A., **Denovellis, E.L.**, Desse, S., Eden, U.T., Frank, L.M. Real-time feedback can promote task-relevant memory replay. Program No. 742.05. 2022 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2022. [Online](#).

Denovellis, E.L., Frank, L.M. Confidently decoding multiple spatial environments in hippocampal replay. Program No. 66. Santorini, Greece: AREADNE Research in Encoding and Decoding of Neural Ensembles, 2022. [Online](#).

Denovellis, E.L., Gillespie, A.K., Coulter, M.E., Sosa, M., Eden, U.T., Frank, L.M. Hippocampal replay of experience at real-world speeds. Program No. 842.02. 2021 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2021. [Online](#).

Gillespie, A.K., Astudillo Maya, D.A., **Denovellis, E.L.**, Liu, D.F., Kastner, D.B., Coulter, M.E., Roumis, D.K., Eden, U.T., Frank, L.M. Hippocampal replay reflects specific past experiences rather than a plan for subsequent choice. Program No. 842.01. 2021 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2021. [Online](#).

Denovellis, E.L., Gillespie, A.K., Coulter, M.E., Frank, L.M., Eden, U.T. A state space model for characterizing replay dynamics. Program No. 162.04. 2019 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2019. [Online](#).

Gillespie, A.K., Astudillo Maya, D.A., Liu, D.F., Coulter, M.E., **Denovellis, E.L.**, Desse, S., Roumis, D.K., Eden, U.T., Frank, L.M. Operant conditioning of hippocampal sharp wave ripples. Program No. 162.02. 2019 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2019. [Online](#).

Denovellis, E.L., Gillespie, A.K., Coulter, M.E., Frank, L.M., Eden, U.T. A state space model for characterizing trajectory dynamics of non-local spatial firing in hippocampus. Ninth International Workshop Statistical Analysis of Neuronal Data, 2019.

Denovellis, E.L., Stephen, E.P., Eden, U.T., and Kramer, M.A. Interactive data visualization for electrophysiological data. Program No. 703.20. 2018 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2018. [Online](#).

Denovellis, E.L., Buschman, T.J., Diogo, C., Bullock, D., and Miller, E.K. Point process models of anterior cingulate and dorsolateral prefrontal cortical neurons during cognitive control. Program No. 599.12. 2012 Neuroscience Meeting Planner. New Orleans, LA: Society for Neuroscience, 2012. [Online](#).

Buschman, T.J., **Denovellis, E.L.**, Diogo, C., Bullock, D., and Miller, E.K. Dynamic, synchronous,

sub-networks in prefrontal cortex encode stimulus-response rules. Program No. 599.12. 2012 Neuroscience Meeting Planner. New Orleans, LA: Society for Neuroscience, 2012. [Online](#).

Buschman, T.J., **Denovellis, E.L.**, Diogo, C., Bullock, D., and Miller, E.K. Dynamic networks in frontal cortex support the cognitive flexibility to switch between rules. Computational and Systems Neuroscience (COSYNE), Salt Lake City, UT, 2012.

Denovellis, E.L., Buschman, T.J., Diogo, C., Bullock, D., and Miller, E.K. Rule-based task switching in the anterior cingulate and prefrontal cortex. Program No. 405.18. 2011 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2011. [Online](#).

COMMUNITY
SERVICE

Originating team for the Simons SURF program for underrepresented students in STEM **June 2020**

The goal of the Simons Collaboration on the Global Brain (SCGB) Undergraduate Research Fellowship (SURF) Program is to spark and sustain interest in systems and computational neuroscience among undergraduate students from diverse backgrounds underrepresented in neuroscience research. The SCGB supports this program with the recognition that diversity improves scientific innovation and collaboration. SURF provides funds for undergraduate research assistants to work in SCGB-funded laboratories during the academic year under the mentorship of postdoctoral fellows or Ph.D. students to provide personalized guidance to undergraduates. I was part of the team that proposed this program and format.

Co-organizer of CELEST Summer Undergraduate Training Program for NSF funded Science of Learning Center **May 2013 – June 2015**

The program provided research and training experience for under-represented groups in neuroscience. It included professional development seminars covering various issues, including on how graduate training is funded, what a successful graduate application looks like, how implicit bias can influence careers, how to organize scientific presentations, how to write effective papers, and other topics. I helped organize the professional development seminars, led programming tutorials, and led laboratory tours for two summers.

CELEST Student Organization Co-President **May 2011 – June 2016**

In charge of organizing CELEST student events (CELEST is an NSF-funded Science of Learning Center), participating in faculty meetings, scheduling the speaker series.

Computational Neuroscience Student Organization Treasurer **May 2010 – March 2011**

In charge of budgeting funds and reimbursing students.

PROFESSIONAL
EXPERIENCE

Mercer Advisors, Santa Barbara, California USA

Pension Consultant I **October 2007 – July 2009**

In charge of designing and advising clients on pension plans for three national offices. Carried out statistical analysis of pension plans. Attended conferences to keep abreast of IRS rule changes. Designed a computer program to enhance the efficiency of pension plan design and analysis.

PROFESSIONAL
SERVICE

Ad hoc Reviewer: Science **September 2024 – Present**

Ad hoc Reviewer: IEEE Vis Conference **May 2024 – Present**

Ad hoc Reviewer: PLOS Computational Biology **December 2023 – Present**

Ad hoc Reviewer: Neural Computation **November 2023 – Present**

Ad hoc Reviewer: COSYNE Conference **September 2023 – Present**

Ad hoc Reviewer: Journal of Open Source Software **April 2023 – Present**

Ad hoc Reviewer: Journal of Neurophysiology **January 2023 – Present**

Ad hoc Reviewer: eLife **January 2023 – Present**

Member: Society for Neuroscience

May 2011 – Present

HONORS AND
AWARDS

Phi Beta Kappa Scholar, Lambda Chapter
AREADNE 2022 Travel Award

SKILLS

- **Programming:** Python, JAX, Matlab, R, JavaScript, SQL
- **Statistical Methods:** State-space models, point processes, Bayesian inference, time series analysis, neural decoding, spectral analysis
- **Data Infrastructure:** DataJoint, Spyglass, NWB (Neurodata Without Borders), pipeline development, database design
- **Computing:** GPU programming, high-performance computing, real-time systems
- **Visualization:** Interactive web-based tools, D3.js, matplotlib, scientific figure design