

Eric L. Denovellis

CONTACT INFORMATION

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USA

RESEARCH INTERESTS

Probabilistic machine learning, state space time series models, point processes, large datasets, interactive data visualization, prefrontal cortex, hippocampus, cognitive flexibility, task switching, computational neuroscience

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

ACADEMIC 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 the interpreting and categorizing hippocampal replay and other neural representations. 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 focuses 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 Fellow

January, 2014 - May, 2014

CAS NE 340 - Introduction to Computational Models of Skilled Decision and Action. Gave lecture on Matlab. I gave a lecture on task switching, led a Matlab tutorial, and assisted lectures in the computer lab.

Teaching Fellow

January, 2011 - May, 2011

CAS CN 570 - Neural and Computational Models of Conditioning, Reinforcement, Motivation and Rhythm. I created a final project assignment and neural network model inspired by Bullock et al. (1993) and Grosse-Wentrup and Vidal (2007). The project challenges the student to understand how the brain learns to perform visually-guided reaches by integrating both motor and visual sensory feedback. In order to complete the assignment, the student must show understanding of the neural network model by adding additional features to the model and by critiquing the added features.

University of California, Santa Barbara, Santa Barbara, California USA

Campus Learning Assistance Services - Mathematics Tutor **September, 2005 - June, 2007**
I tutored students in college level mathematics courses including calculus and linear algebra.

PUBLICATIONS,
PREPRINTS

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. *JOSS* 7, 4840. 10.21105/joss.04840.

Gillespie, A.K., Astudillo Maya, D.A., **Denovellis, E.L.**, Desse, S., and Frank, L.M. (2022). Neurofeedback training can modulate task-relevant memory replay in rats. *bioRxiv*, 2022.10.13.512183. 10.1101/2022.10.13.512183.

Joshi A., **Denovellis, E.L.**, Mankili A., Meneksedag Y., Davidson T., Gillespie A.K., Guidera, J.A., Roumis, D., and Frank, L.M. (2022). Dynamic Synchronization between Hippocampal Spatial Representations and the Stepping Rhythm. *bioRxiv preprint:30*.

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* S0896627321005730.

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* 10, e64505.

Denovellis, E.L., Frank, L.M., and Eden, U.T. (2019). Characterizing hippocampal replay using hybrid point process state space models. In 2019 53rd Asilomar Conference on Signals, Systems, and Computers, (Pacific Grove, CA, USA: IEEE), pp. 245–249.

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* 76, 838–846.

* Co-first authors

SOFTWARE
PACKAGES

Denovellis, E.L.. (2022). [Eden-Kramer-Lab/replay_trajectory_classification](#): 1.3.5 (v v1.3.5). Zenodo. [doi:10.5281/zenodo.7126995](#). **30 stars. 8 forks. 165,240 downloads.**

A state space modeling package for decoding hippocampal replay trajectories and determining their type using sorted or clusterless data

Denovellis, E.L., Myroshnychenko, M., Sarmashghi, M. and Stephen, E.P. (2022). [Eden-Kramer-Lab/spectral_connectivity](#): 1.0.3 (v1.0.3). Zenodo. [doi:10.5281/zenodo.7080364](#). **79 stars. 36 forks. 29,404 downloads.**

Toolbox for multitaper spectral estimation and frequency domain functional and directed connectivity analysis for electrophysiological data

Denovellis, E.L. and Stephen, E.P. (2018). [NeurophysVis/SpectraVis](#): v1.1.0 (1.1.1). Zenodo. [doi:10.5281/zenodo.1218014](#). **38 stars. 11 forks.**

An interactive web-based neuroscience app for analyzing task-related functional networks over time and frequency

Denovellis, E.L.. (2018). [NeurophysVis/RasterVis](#): v0.0.1 (0.0.1). Zenodo. [doi:10.5281/zenodo.1218012](#).

8 stars. 3 forks.

An interactive web-based neuroscience app for analyzing electrophysiological spiking along many different dimensions for many different neurons. Example: <https://neuropsychvis.github.io/RasterVis/public/>

TALKS

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. Red Jacket Resort. 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

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., Giacomo 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. Chicago, IL: Society for Neuroscience, 2022. [Online](#). [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. (2012). Dynamic networks in frontal cortex support the cognitive flexibility to switch between rules. Poster presented at the Computational and systems neuroscience (Cosyne) meeting, Salt Lake City, UT.

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](#).

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
MEMBERSHIPS

Society for Neuroscience

May, 2011 - Present

HONORS AND
AWARDS

Phi Beta Kappa Scholar, Lambda Chapter
AREADNE 2022 Travel Award

SKILLS

- Statistical Packages: Matlab, R
- Languages: Python, Javascript

- Signal processing