

Curriculum Vitae (.pdf)
Liam Paninski
December 7, 2011

Current position

Associate Professor, Department of Statistics, Center for Theoretical Neuroscience, and Doctoral Program in Neurobiology and Behavior, Columbia University (2008-present).

Education

New York University; Ph.D., Neural Science, 2003.

Brown University; B.S., Neuroscience, 1999.

Previous experience

Assistant Professor, Department of Statistics, Center for Theoretical Neuroscience, and Doctoral Program in Neurobiology and Behavior, Columbia University (2005-8).

Senior research fellow, Gatsby Computational Neuroscience Unit, University College London, 2004-5.

Postdoctoral fellow, Center for Neural Science, HHMI, NYU: May-Dec 2003.

Papers

Sadeghi et al. (2012). Inferring retinal cone locations and functional connectivity from ganglion cell recordings. In preparation.

Ramirez, A. & Paninski, L. (2012). Fast encoding model estimation via expected log-likelihoods. In preparation.

Vidne, M. & Paninski, L. (2012). Sequential Markov chain Monte Carlo. In preparation.

Smith, C., Bahk, J., Gohil, C. & Paninski, L. (2012). Computing loss of efficiency in optimal Bayesian decoders given noisy or incomplete spike trains. Draft under circulation.

Pakman, A., Huggins, J., & Paninski, L. (2012). Fast penalized state-space methods for inferring dendritic synaptic connectivity. Draft under circulation.

Pnevmatikakis, E., Kelleher, K., Chen, R., Josic, K., Saggau, P. & Paninski, L. (2011). Fast nonnegative spatiotemporal calcium smoothing in dendritic trees. Submitted.

Mishchenko, Y. & Paninski, L. (2011) Bayesian compressed sensing approach to reconstructing neural connectivity from subsampled anatomical data. Submitted.

Pnevmatikakis & Paninski, L. (2011). Fast interior-point inference in high-dimensional sparse, penalized state-space models. Under review.

Smith, C., Wood, F. & Paninski, L. (2011). Low rank continuous-space graphical models. Under review.

Doi et al. (2011). Efficient coding and redundancy in a complete retinal population. Under review.

Paninski, L., Rahnema Rad, K., Huggins, J., & Pnevmatikakis, E. (2011) Fast low-SNR Kalman filtering, with applications to high-dimensional smoothing. Under review.

Vidne et al. (2011). The impact of common noise on the activity of a large network of retinal ganglion cells. Under minor revisions.

Paninski, L., Vidne, M., DePasquale, B., & Ferreira, D. (2011). Inferring synaptic inputs given a noisy voltage trace. In press, *Journal of Computational Neuroscience*.

- Rahnama Rad, K. & Paninski, L. (2011). Information rates and optimal decoding in large neural populations. NIPS.
- Huggins, J. & Paninski, L. (2011). Optimal experimental design for sampling voltage on dendritic trees. In press, *J. Comput. Neuro.*
- Nazarpour, K., Ethier, C., Paninski, L., Rebesco, J., Miall, C., & Miller, L. (2011). EMG prediction from motor cortical recordings via a non-negative point process filter. In press, *IEEE Transactions on Biomedical Engineering.*
- Mishchenko, Y. & Paninski, L. (2011). Efficient methods for sampling spike trains in networks of coupled neurons. In press, *Annals of Applied Statistics.*
- Ahmadian, Y., Packer, A., Yuste, R. & Paninski, L. (2011). Designing optimal stimuli to control neuronal spike timing. *J. Neurophys.* 106: 1038-1053.
- Butts, D., Weng, C., Jin, J. Alonso, J.-M. & Paninski, L. (2011). Temporal precision in the visual pathway through the interplay of excitation and stimulus-driven suppression *J. Neurosci.* 31: 11313-11327.
- Mishchenko, Y., Vogelstein, J. & Paninski, L. (2011). A Bayesian approach for inferring neuronal connectivity from calcium fluorescent imaging data. *Annals of Applied Statistics* 5: 1229-1261.
- Ramirez, A., Ahmadian, Y., Schumacher, J., Schneider, D., Woolley, S. & Paninski, L. (2011). Incorporating naturalistic correlation structure improves spectrogram reconstruction from neuronal activity in the songbird auditory midbrain. *J. Neurosci.* 31: 3828-42.
- Escola, S., Fontanini, A., Katz, D. & Paninski, L. (2011). Hidden Markov models for the inference of neural states and improved estimation of linear receptive fields. *Neural Computation* 23: 1071-1132.
- Calabrese, A. & Paninski, L. (2011). Kalman filter mixture model for spike sorting of non-stationary data. *J. Neurosci. Methods* 196: 159-169.
- Calabrese, A., Schumacher, J., Schneider, D., Woolley, S. & Paninski, L. (2011). A penalized GLM approach for estimating spectrotemporal receptive fields from responses to natural sounds. *PLoS One* 6(1): e16104.
- Lewi, J., Schneider, D., Woolley, S. & Paninski, L. (2011). Automating the design of informative sequences of sensory stimuli. *Journal of Computational Neuroscience* 30: 181-200 (special issue on methods of information theory in neuroscience research).
- Ahmadian, Y., Pillow, J. & Paninski, L. (2011). Efficient Markov Chain Monte Carlo methods for decoding population spike trains. *Neural Computation* 23: 46-96.
- Pillow, J., Ahmadian, Y. & Paninski, L. (2011). Model-based decoding, information estimation, and change-point detection in multi-neuron spike trains. *Neural Computation* 23: 1-45.
- Vogelstein, J., Packer, A., Machado, T., Sippy, T., Babadi, B., Yuste, R. & Paninski, L. (2010). Fast non-negative deconvolution for spike train inference from calcium imaging. *J. Neurophys.* 104: 3691-3704
- Field, G., Gauthier, J., Sher, A. et al. (2010). Functional connectivity in the retina at the resolution of photoreceptors. *Nature* 467, 673-677.
- Rahnama Rad, K. & Paninski, L. (2010). Efficient estimation of two-dimensional firing rate surfaces via Gaussian process methods. *Network: Computation in Neural Systems* 21: 142-68.
- Paninski, L., Ahmadian, Y., Ferreira, D., Koyama, S., Rahnama, K., Vidne, M., Vogelstein, J. & Wu, W. (2010). A new look at state-space models for neural data. *Journal of Computational Neuroscience* (special issue on statistical analysis of neural data) 29: 107-126.

- Koyama, S. & Paninski, L. (2010). Efficient computation of the most likely path in integrate-and-fire and more general state-space models. *Journal of Computational Neuroscience* 29: 89-105.
- Lawhern, V., Wu, W., Hatsopoulos, N. & Paninski, L. (2010). Population neuronal decoding using a generalized linear model with hidden states. *J. Neurosci. Methods* 189: 267-280.
- Babadi, B., Casti, A., Xiao, Y. & Paninski, L. (2010). A generalized linear model of the impact of direct and indirect inputs to the lateral geniculate nucleus. *Journal of Vision* 10: 22.
- Field, R., Lary, J., Cohn, J., Paninski, L. & Shepard, K. (2010). A low-noise, single-photon avalanche diode in standard 0.13 micron complementary metal-oxide-semiconductor process. *Applied Physics Letters* 97, 211111.
- Paninski, L. (2010). Fast Kalman filtering on quasilinear dendritic trees. *Journal of Computational Neuroscience* 28: 211-28.
- Lalor, E., Ahmadian, Y. & Paninski, L. (2009). The relationship between optimal and biologically plausible decoding of stimulus velocity in the retina. *Journal of the Optical Society of America A (special issue on ideal observers and efficiency)* 26: B25-42.
- Vogelstein, J., Watson, B., Packer, A., Yuste, R., Jedynak, B. & Paninski, L. (2009). Spike inference from calcium imaging using sequential Monte Carlo methods. *Biophysical Journal* 97: 636-655.
- Wu, W., Kulkarni, J., Hatsopoulos, N. & Paninski, L. (2009). Neural decoding of goal-directed movements using a linear state-space model with hidden states. *IEEE Trans. Neural Systems and Rehabilitation Engineering* 17: 370-378.
- Escola, S., Eisele, M., Miller, K. & Paninski, L. (2009). Maximally reliable Markov chains under energy constraints. *Neural Computation* 21: 1863-912.
- Toyozumi, T., Rahnama Rad, K. & Paninski, L. (2009). Mean-field approximations for coupled populations of generalized linear model spiking neurons. *Neural Computation* 21, 1203-1243.
- Huys, Q. & Paninski, L. (2009). Smoothing of, and parameter estimation from, noisy biophysical recordings. *PLOS Computational Biology* 5: e1000379.
- Lewi, J., Butera, R. & Paninski, L. (2009). Sequential optimal design of neurophysiology experiments. *Neural Computation* 21: 619-687.
- Fudenberg, G. Paninski, L. (2009). Bayesian image recovery for low-SNR dendritic structures. *IEEE Trans. Image Processing* 18: 471-482.
- Lewi, J., Butera, R., Schneider, D., Woolley, S. & Paninski, L. (2008). Designing neurophysiology experiments to optimally constrain receptive field models along parametric submanifolds. *NIPS*.
- Paninski, L. (2008). A coincidence-based test for uniformity given very sparsely-sampled discrete data. *IEEE Transactions on Information Theory* 54: 4750-4755.
- Pillow, J., Shlens, J., Paninski, L., Sher, A., Litke, A., Chichilnisky, E. & Simoncelli, E. (2008). Spatiotemporal correlations and visual signaling in a complete neuronal population. *Nature* 454: 995-999.
- Paninski, L. & Yajima, M. (2008). Undersmoothed kernel entropy estimators. *IEEE Transactions on Information Theory* 54: 4384-4388.
- Kulkarni, J. & Paninski, L. (2008). Efficient analytic computational methods for state-space decoding of goal-directed movements. *IEEE Signal Processing Magazine* 25 (special issue on brain-computer interfaces): 78-86.
- Ahrens, M., Paninski, L. & Sahani, M. (2008). Inferring input nonlinearities in neural encoding models. *Network: Computation in Neural Systems* 19: 35-67.

- Paninski, L., Haith, A. & Szirtes, G. (2008). Differentiable integral equation methods for computing likelihoods in the stochastic integrate-and-fire model. *J. Comput. Neuroscience* 24: 69-79.
- Kulkarni, J. & Paninski, L. (2007). Common-input models for multiple neural spike train data. *Network: Computation in Neural Systems* 18: 375-407.
- Lewi, J., Butera, R. & Paninski, L. (2007). Efficient active learning with generalized linear models. *Artificial Intelligence and Statistics (AISTATS)* 11.
- Townsend, B., Paninski, L. & Lemon, R. (2006). Linear encoding of muscle activity in primary motor cortex and cerebellum. *J. Neurophys.* 96: 2578-92.
- Huys, Q., Ahrens, M. & Paninski, L. (2006). Efficient estimation of detailed single-neuron models. *Journal of Neurophysiology* 96: 872-890.
- Paninski, L. (2006). The spike-triggered average of the integrate-and-fire cell driven by Gaussian white noise. *Neural Computation* 18: 2592-2616.
- Paninski, L. (2006). The most likely voltage path and large deviations approximations for integrate-and-fire neurons. *Journal of Computational Neuroscience* 21: 71-87.
- Pillow, J., Paninski, L., Uzzell, V., Simoncelli, E. & Chichilnisky, E. (2005). Structure and precision of retinal responses analyzed with a noisy integrate-and-fire model. *J. Neurosci.* 25: 11003-13.
- Paninski, L. (2005). Inferring prior probabilities from Bayes-optimal behavior. *Advances in Neural Information Processing* 18.
- Shoham, S., Paninski, L., Fellows, M., Hatsopoulos, N., Donoghue, J. & Normann, R. (2005). Optimal decoding for a primary motor cortical brain-computer interface. *IEEE Transactions on Biomedical Engineering* 52: 1312-1322.
- Paninski, L. (2005). Asymptotic theory of information-theoretic experimental design. *Neural Computation* 17: 1480-1507.
- Paninski, L. (2004). Log-concavity results on Gaussian process methods for supervised and unsupervised learning. *Advances in Neural Information Processing* 17.
- Paninski, L. (2004). Variational minimax estimation of discrete distributions under Kullback-Leibler loss. *Advances in Neural Information Processing* 17.
- Paninski, L. (2004). Maximum likelihood estimation of cascade point-process neural encoding models. *Network: Computation in Neural Systems* 15: 243-262.
- Paninski, L., Pillow, J. & Simoncelli, E. (2004). Comparing integrate-and-fire-like models estimated using intra- and extra-cellular data. *Neurocomputing* 65: 379-385.
- Paninski, L., Pillow, J. & Simoncelli, E. (2004). Maximum likelihood estimation of a stochastic integrate-and-fire neural encoding model. *Neural Computation* 16: 2533-2561.
- Paninski, L. et al. (2004). Superlinear population encoding of dynamic hand trajectory in primary motor cortex. *Journal of Neuroscience* 24: 8551-8561.
- Paninski, L. (2004). Estimating entropy on m bins given fewer than m samples. *IEEE Transactions on Information Theory* 50: 2200-2203.
- Paninski, L., Fellows, M., Hatsopoulos, N. & Donoghue, J. (2004). Spatiotemporal tuning properties for hand position and velocity in motor cortical neurons. *Journal of Neurophysiology* 91: 515-532.
- Hatsopoulos, N., Paninski, L. & Donoghue, J. (2003). Sequential movement representations based on correlated neuronal activity. *Experimental Brain Research* 149: 478-486.

Serruya, M., Hatsopoulos, N., Paninski, L., Fellows, M. & Donoghue, J. (2003). Robustness of neuroprosthetic decoding algorithms. *Biological Cybernetics* 88: 219-228.

Paninski, L. (2003). Estimation of entropy and mutual information. *Neural Comp.* 15: 1191-1253.

Paninski, L. (2003). Convergence properties of three spike-triggered analysis techniques. *Network: Computation in Neural Systems* 14: 437-464. (Special issue on natural scene statistics and neural codes.)

Paninski, L., Lau, B. & Reyes, A. (2003). Noise-driven adaptation: *in vitro* and mathematical analysis. *Neurocomputing* 52: 877-883.

Serruya, M., Hatsopoulos, N., Paninski, L., Fellows, M. & Donoghue, J. (2002). Instant neural control of a movement signal. *Nature* 416: 141-142.

Paninski, L. & Hawken, M. (2001). Stochastic optimal control and the human oculomotor system. *Neurocomputing*, 38-40: 1511-1517.

Hatsopoulos, N., Ojakangas, C., Paninski, L. & Donoghue, J. (1998). Information about movement direction obtained from synchronous activity of motor cortical neurons. *PNAS* 95: 15706-11.

Book

Paninski, L., Eden, U., Brown, E. & Kass, R. (2011) *Statistical analysis of neurophysiological data*. Under contract, Springer.

Invited book chapters

Yuste, R., Watson, B., Paninski, L., Vogelstein, J. (2009). Imaging action potentials with calcium indicators. *Imaging Neurons: A Laboratory Manual*, 2ed., eds. Yuste, R. & Konnerth, A., CSHL Press.

Paninski, L., Kass, R., Brown, E. & Iyengar, I. (2008). Statistical analysis of neuronal data via integrate-and-fire models. *Stochastic Methods in Neuroscience*, eds. Laing, C. & Lord, G., Oxford.

Paninski, L., Pillow, J. & Lewi, J. (2007). Statistical models for neural encoding, decoding, and optimal stimulus design. *Computational Neuroscience: Progress in Brain Research*, eds. Cisek, P., Drew, T. & Kalaska, J.

Simoncelli, E., Paninski, L., Pillow, J. & Schwartz, O. (2004). Characterization of neural responses with stochastic stimuli. Chapter 23 of *The New Cognitive Neurosciences*, 3ed, ed. Gazzaniga, M..

Grants

Collaborative Research in Computational Neuroscience, NEI R01 EY018003, co-PI w/ E. Simoncelli and E.J. Chichilnisky, 2006-.

Gatsby Initiative in Brain Circuitry Pilot Grant, co-PI w/ S. Woolley, 2006-8.

Alfred P. Sloan Research Fellowship, 2007.

NSF Faculty Early Career Development (CAREER) IOS-0641912, 2007-

McKnight Scholar award, 2008-.

Collaborative Research in Computational Neuroscience, NSF IIS-0904353, co-PI w/ R. Yuste, 2009-.

DARPA award, Reliable Neural-interface Technology program, co-PI w/ B. Pesaran, 2011-.

Awards and Honors

“Scientist to watch,” *The Scientist* magazine, June 2007.
Named one of top 35 innovators under 35 years old by *Technology Review* MIT, 2006.
Honorable mention, outstanding student paper award (to J. Lewi), NIPS, 2006.
Royal Society International Research Fellowship, 2004.
Best student paper award (w/ J. Pillow), NIPS, 2003.
Howard Hughes Medical Institute Predoctoral Fellowship in Biological Sciences, 1999.
National Science Foundation Predoctoral Fellowship, 1999.
Royce Fellowship, Brown University, 1998.

Selected Teaching

Co-instructor, Statistical analysis and modeling of neural systems (NYU), 2002.
Invited lecturer, Advanced European computational neuroscience course (Obidos), 2004.
STAT4107, Statistical inference, Columbia University, 2005.
STAT4315, Linear regression models, Columbia University, 2006.
STAT4109, Probability and statistical inference, Columbia University, 2006-2010.
STAT8285, Statistical analysis and modeling of neural spike train data, Columbia, 2007,9,11.
Invited lecturer, Program in Comput. Bio., Gulbenkian Science Institute, Lisbon, 2007.
Invited lecturer, Computational Modeling of Neuronal Systems, NYU, 2007.
Invited lecturer, Ignorance, Columbia University Biology Dept., 2008.
Invited lecturer, Princeton PICASso program, 2008.
Invited lecturer, Okinawa Computational Neuroscience Course, 2009.
Invited lecturer, Kyoto University workshop on state-space analysis in neuroscience, 2010.

Advising

Postdoctoral research advisor: J. Kulkarni, Q. Huys, Y. Ahmadian, Y. Mishchenko, L. Badel, E. Pnevmatikakis, K. Sadeghi, A. Pakman
Ph.D. research advisor: S. Escola, J. Vogelstein, J. Lewi, M. Nikitchenko, K. Rahnama Rad, M. Vidne, A. Ramirez, D. Ferreira, A. Calabrese, C. Smith, T. Machado, D. Pfau
M.A. research advisor: M. Yajima, C. Gohil, J. Bahk
Undergraduate research advisor: G. Fudenberg, J. Huggins

Other duties

Action editor: *J. Comput. Neuro.*
Program committee: COSYNE.
Reviewer: Bayesian Analysis; COLT08; CRC Press; Frontiers in Computational Neuroscience; IEEE Transactions on: Biomedical Engineering, Information Theory, Pattern Analysis and Machine Intelligence, Neural Networks, and Signal Processing; ISIT08; *J. Comput. Neuro.*; *J. Machine Learning Research*; *J. Neurophysiology*; *J. Neuroscience*; *J. Optical Soc. Am. A*; *J. Physics A*; *J. Vision*; *Machine Learning*, *Nature*; *Nature Neuroscience*; *Network: Computation in Neural Systems*; *Neural Computation*; *Neuron*; *NIPS*; Oxford University Press; PNAS; *Science*; *SIAM J. Applied Math*; *Statistics in Medicine*; *Technometrics*.
Invited participant: NSF Workshop, “Brain Science at the Interface,” 2007.
NSF review panelist: 2007-9.
Co-organizer: Statistical analysis of neural data meeting, 2010-12.
Co-organizer: COSYNE workshop on new techniques for online neural characterization and optimal control, 2011.