
Jonathon D. Shlens

Curriculum Vitae

Academic Background

- Doctor of Philosophy**, University of California, San Diego Sept. 2001 - Aug 2007
Department of Neurosciences, Computational Neuroscience
Thesis: *Synchrony and concerted activity in the neural code of the retina.*
Advanced study in machine learning, information theory and systems neuroscience.
- Bachelor of Arts with High Honors**, Swarthmore College Sept. 1995 - June 1999
Double major in Physics and Computer Science.
- Summer Student**, Marine Biological Laboratory Summer 2003
Course in Methods in Computational Neuroscience

Fellowships and Awards

- Miller Research Fellowship July 2008 - present
NSF Fellow in Vision and Learning in Humans and Machines May 2005 – May 2007
Burroughs Wellcome LJIS Graduate Fellow Sept. 2003 – May 2005
Pixar Animation Studios, Brass Shim Photoscience Award July 2001
High Honors from Swarthmore College June 1999
Phi Beta Kappa Honors Society June 1999
SURF Fellowships, California Institute of Technology Summer 1997, 1998

Research Experience

- Miller Institute Fellow**, University of California, Berkeley July 2008 - present
Develop statistical tools for the analysis of neural data exploiting techniques from digital signal processing, dimensional reduction, Bayesian statistics, information theory and graphical models. Instruct and mentor students and post-doctoral researchers.
- Research Fellow**, Salk Institute for Biological Studies Aug 2007 - present
Develop and implement techniques for *in vitro* retina experiments in team environment, including dissections, recording technology, automated on-line analysis software (Java, C/C++) and visual stimulation. Currently a visiting research fellow (1 week per month).
- Graduate Research**, Salk Institute for Biological Studies Sept. 2001- Aug 2007
Perform large-scale *in vitro* electrophysiological experiments in retina and devise algorithms for the analysis of neural data. Dissertation focused on how synchronized activity influences signaling visual information from the eye to the brain.
- Research Engineer**, Pixar Animation Studios Aug. 1999 – Aug. 2001
Researched and helped develop a color coordination system that transfers digital images to motion picture film (PixarVision®). Maintained, calibrated and improved the optics design

and software interface of a laser-based film printing system and color scanning system. Developed adaptive numerical models of film exposure in color space.

Undergraduate Research Fellow, California Institute of Technology Summer 1997, 1998
Designed and researched artificial neural networks specializing in time-series prediction. Applications included predicting electrical power demand, financial indices and an earthquake early warning system. SURF Fellowships.

Journal Articles

Shlens J, Field GD, Gauthier JL, Greschner M, Sher A, Litke AM, Chichilnisky EJ. "Synchronized firing in a complete population code." *submitted*.

Gauthier J, Field GD, Greschner M, **Shlens J**, Sher A, Litke AM, Chichilnisky EJ. "Receptive field mosaics of parasol and midget ganglion cells in the primate retina." *submitted*.

Gauthier J, Field GD, Greschner M, **Shlens J**, Sher A, Litke AM, Chichilnisky EJ. "Receptive fields in primate retina are coordinated to more uniformly sample visual space." *submitted*.

Pillow J, **Shlens J**, Paninski L, Sher A, Litke A, Chichilnisky EJ, Simoncelli E. (2008) "Spatio-temporal correlations and visual signalling in a complete neuronal population." **Nature**, *in press*.

Field GD, Sher A, Gauthier J, Greschner M, **Shlens J**, Litke AM, Chichilnisky EJ. (2007) "Spatial properties and functional organization of small bistratified cells in primate retina." **Journal of Neuroscience**, 27 (48): 13261-13272.

Petrusca D, Grivich MI, Sher A, Field GD, Gauthier JL, **Shlens J**, Chichilnisky EJ, Litke AM. (2007) "Identification and characterization of a Y-like primate retinal ganglion cell type." **Journal of Neuroscience**, 27(41): 11019-11027. (*)

Shlens J, Field GD, Gauthier JL, Grivich MI, Petrusca D, Sher A, Litke AM, Chichilnisky EJ, (2006) "The structure of multi-neuron firing patterns in primate retina." **Journal of Neuroscience**, 26(32): 8254-8266. (*)

Shlens J, Kennel M, Abarbanel HDI, Chichilnisky EJ, (2007) "Estimating information rates in neural spike trains with confidence intervals." **Neural Computation**, 19 (7).

Kennel M, **Shlens J**, Abarbanel HDI, Chichilnisky EJ, (2005) "Estimating entropy rates with Bayesian confidence intervals." **Neural Computation**, 17: 1531-1576.

(*) Articles cited by **Faculty of 1000 Biology**.

Invited Talks

"Synchrony and multi-neuron firing patterns in the neural code of the retina." **Max Plank Institute for Medical Research**, Heidelberg, Germany, 2008.

"Spatial organization of concerted activity in the primate retina." **American Physical Society**, Symposium on Statistical Mechanics in the Brain, 2008.

"Exploring the network structure of primate retina using maximum entropy methods." **Gatsby Computational Neuroscience Unit, University College of London**, 2007.

"Exploring the network structure of primate retina using maximum entropy methods." **Cornell University, Weill School of Medicine**, Computational Biomedicine Seminar Series, 2007.

"Exploring the network structure of primate retina using maximum entropy methods." **Computational and Systems Neuroscience**, Workshop on Information-Theoretic Methods Measures and Methods in Neuroscience, Salk Lake City, 2007.

"The structure of multi-neuron firing patterns in the primate retina." **UC San Diego Neurosciences Retreat**, Lake Arrowhead, CA, 2006.

"Estimating information rates in retinal ganglion cells (with confidence intervals)." **Max Planck Institute for Systems Neurobiology**, Martinsried, Germany, 2005.

"Estimating entropy rates and information rates in retinal spike trains." **Neural Information Processing Systems**, Workshop on Entropy Estimation, Vancouver, BC, 2003.

Teaching Experience

Teaching Assistant, Division of Biology Spring 2004, 2005
Provided lectures and led discussion on cellular neurophysiology, systems neurobiology and computational neurobiology. Wrote and graded homework assignments and exams.

Triathlon Coach, Leukemia and Lymphoma Society, Team in Training Sept. 2003 – Aug 2007
Trained, recruited and instructed several hundred novices to successfully complete triathlons and fundraise for non-profit foundation. Expanded program by founding new team specializing in long distance (Ironman) triathlons.

Guest Lecturer, Department of Physics Winter 2004, 2005
Organized unit with lectures on information theory and neural coding for upper division biophysics courses.

Lab Instructor, Neuroscience Boot Camp Sept. 2003, 2004
Instructed new graduate students on basics of electrophysiology. Developed lab instruction, provided lectures, and one-on-one instruction.

Abstracts and Conferences

Greschner M, **Shlens J**, Field GD, Gauthier JL, Sher A, Litke AM, Chichilnisky EJ, "Synchronized firing across cell types in the primate retina." **Society for Neuroscience**, 2008.

Pillow J, **Shlens J**, Paninski L, Sher A, Litke A, Chichilnisky EJ, Simoncelli E. "The effects of correlated neural activity on single-neuron spiking variability in the primate retina." **Computational and Systems Neuroscience**, 2008.

Shlens J, Field GD, Gauthier JL, Greschner M, Sher A, Litke AM, Chichilnisky EJ, "Spatial organization of large-scale concerted activity in the primate retina." **Computational and Systems Neuroscience**, 2008.

Shlens J, Field GD, Gauthier JL, Greschner M, Sher A, Litke AM, Chichilnisky EJ, "Spatial organization of large-scale concerted activity in the primate retina." **Neural Coding, Computation and Dynamics**, 2007.

Shlens J, Field GD, Gauthier JL, Greschner M, Sher A, Litke AM, Chichilnisky EJ, "Spatial organization of large-scale concerted activity in the primate retina." **Society for Neuroscience**, 2007.

Pillow JW, **Shlens J**, Paninski L, Sher A, Litke AM, Chichilnisky EJ, Simoncelli E "Deciphering correlations: Bayesian decoding of multi-neuronal spike trains in primate retina." **Computational and Systems Neuroscience**, 2007.

Field GD, Gauthier JL, Greschner M, **Shlens J**, Sher A, Litke AM, Chichilnisky EJ, "Pathways and properties of rod and cone signals emanating from the primate retina." **Society for Neuroscience**, 2007.

Gauthier JL, Field GD, Greschner M, **Shlens J**, Sher A, Litke AM, Chichilnisky EJ, "Fine structure and interdigitation of receptive field mosaics in primate retina." **Society for Neuroscience**, 2007.

Pillow JW, **Shlens J**, Paninski L, Sher A, Litke AM, Chichilnisky EJ, Simoncelli E "Correlations and coding with multi-neuronal spike trains in primate retina." **Society for Neuroscience**, 2007.

Shlens J, Field GD, Gauthier JL, Greschner M, Sher A, Litke AM, Chichilnisky EJ, "Spatial structure of large-scale synchrony in the primate retina." **Computational and Systems Neuroscience**, 2007.

Sher A, Field GD, Gauthier J, Petrusca D, Grivich MI, **Shlens J**, Litke AM, Chichilnisky EJ, "Magnitude of S-cone inputs to parasol cells in primate retina." **Society for Neuroscience**, 2006.

Field GD, Sher A, Gauthier J, Petrusca D, Grivich MI, **Shlens J**, Litke AM, Chichilnisky EJ, "Functional organization of blue-on ganglion cells in the primate retina." **Society for Neuroscience**, 2006.

Shlens J, Field GD, Gauthier JL, Grivich MI, Petrusca D, Sher A, Litke AM, Chichilnisky EJ, (2006) "Probing the structure of multi-neuron firing patterns in the primate retina using maximum entropy methods." **Statistical Analysis of Neuronal Data**, 2006.

Shlens J, Field GD, Gauthier JL, Grivich MI, Petrusca D, Sher A, Litke AM, Chichilnisky EJ, (2006) "Probing the structure of multi-neuron firing patterns in the primate retina using maximum entropy methods." **Computational and Systems Neuroscience**, 2006.

Gauthier J, Petrusca D , Grivich MI, Sher A, **Shlens J**, Field GD, Litke AM, Chichilnisky EJ, "Receptive field mosaics of parasol and midget ganglion cells in the primate retina." **Society for Neuroscience**, 2005.

Pillow J, **Shlens J**, Paninski L, Simoncelli E, Chichilnisky EJ, "Modeling the correlated spike response of a cluster of primate retinal ganglion cells." **Society for Neuroscience**, 2005.

Petrusca D , Grivich MI, Sher A, Field GD, Gauthier J, **Shlens J**, Chichilnisky EJ, Litke AM, "Physiological characterization of a new macaque retinal ganglion cell class." **Society for Neuroscience**, 2005.

Grivich MI, Sher A, Petrusca D, Field GD, **Shlens J**, Gauthier J, Chichilnisky EJ, Litke AM, "Classification of guinea pig retinal ganglion cells using large scale multielectrode recordings." **Society for Neuroscience**, 2005.

Pillow J, **Shlens J**, Paninski L, Simoncelli E, Chichilnisky EJ, "Modeling of multi-neuronal responses in macaque retinal ganglion cells." **Computational and Systems Neuroscience**, 2005.

Shlens J, Kennel M, Abarbanel HDI, Chichilnisky EJ, "Estimating entropy rates and information rates in spike trains with confidence intervals." **Computational and Systems Neuroscience**, 2004.

Shlens J, Kennel M, Abarbanel HDI, Chichilnisky EJ, "Reliably estimating information rates in retinal spike trains at fine temporal resolution." **Society for Neuroscience**, 2003.