JONATHON SHLENS

http://shlens.github.io

EDUCATION

University of California, San Diego *May 2007*
Doctor of Philosophy, Department of Neurosciences, Computational Neuroscience
Thesis: *Synchrony and concerted activity in the neural code of the retina.*
Advanced study in image and signal processing, statistics, machine learning, information theory.

Swarthmore College *May 1999*
Bachelor of Arts with High Honors.
Double major in Computer Science and Physics

RESEARCH EXPERIENCE

Google Research *Mountain View, CA*
Staff Research Scientist Nov 2015 - present
Senior Research Scientist Nov 2012 - Nov 2015
Research Scientist May 2010 - Nov 2012

· Extensive research in deep learning and computer vision technologies. Co-authored 20+ peer-reviewed publications in computer vision and machine learning.
· Taught multiple courses on deep learning and vision both internally and externally at universities, professional societies and graduate summer schools. Mentored 7 graduate-level and 4 undergraduate-level interns during summers.
· Built distributed scalable deep learning systems as an early member of *Google Brain* team. Co-inventor and developer of *TensorFlow*, an open-source machine learning and deep learning system (`http://tensorflow.org`).

Howard Hughes Medical Institute & New York University May 2009 - May 2010
Associate Research Fellow *New York City, NY*

· Developed optimization strategies for extracting sparse signals from noisy data employing ideas from machine learning and convex optimization.
· Mentored and taught graduate students and post-doctoral researchers in the domains of information theory, statistics and neuroscience.

University of California, Berkeley July 2007 - May 2009
Miller Fellow *Berkeley, CA*

· Developed statistical tools for the analysis of neural data exploiting techniques from digital signal processing, dimensional reduction, Bayesian statistics, information theory and graphical models.
· Oversaw collaboration with independent research groups that lead to 5 journal publications.

Salk Institute for Biological Studies September 2001 - May 2007
Graduate Researcher *La Jolla, CA*

· Developed and implemented techniques for *in vitro* retina experiments in team environment, including technology for electrical recordings and visual stimulation. Performed intricate micro-dissections of biological tissue and electrophysiological experiments to characterize the light-driven activity of the retina.

· Wrote and managed collaborative code base in Java and C/C++ for the analysis of electrophysiological neural data. Employed machine learning and statistical signal processing for extracting information for electrical signal of retina.
· Lectured and instructed classes in statistics, physics, machine learning, and neurobiology at UC San Diego. Authored 5 peer-reviewed journal publications, presented research at 20+ conferences and awarded Ph.D. for dissertation.

Pixar Animation Studios August 1999 - August 2001
Research Engineer *Emeryville, CA*

· Researched and developed a color coordination system that transfers digital images to motion picture film (PixarVision ®) used in several films: Toy Story 2, Monsters Inc, Finding Nemo.
· Developed adaptive models of film exposure in color space employing dimensional reduction techniques and psychophysical measurements.

AWARDS AND RECOGNITIONS

- Best Paper Award (2013) IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Portland, OR.
- Miller Research Fellow (2008-2009). University of California, Berkeley. Berkeley, CA.
- NSF Fellow in "Vision and Learning in Humans and Machines" (2005-2007) University of California, San Diego, La Jolla, CA.
- Burroughs Wellcome LJIS Graduate Fellow (2003-2005) University of California, San Diego, La Jolla, CA.
- Brass Shim Award for Excellence (2001). Pixar Animation Studios, Research and Development.
- Phi Beta Kappa Honors Society (1999) Swarthmore College, Swarthmore, PA.
- SURF undergraduate research fellowships (1997, 1998) California Institute of Technology, Pasadena, CA.

PUBLICATIONS – PEER REVIEWED CONFERENCES

22. Simon Kornblith, **Jonathon Shlens**, Quoc V. Le (2019) Do Better ImageNet Models Transfer Better? *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR).* **Selected for oral presentation.**
21. Liang-Chieh Chen, Maxwell D.Collins, Yukun Zhu, George Papandreou, Barret Zoph, Florian Schroff, Hartwig Adam, **Jonathon Shlens** (2018) Searching for Efficient Multi-Scale Architectures for Dense Image Prediction *Neural Information Processing Systems (NIPS)*
20. Chenxi Liu, Barret Zoph, Maxim Neumann, **Jonathon Shlens**, Wei Hua, Li-Jia Li, Li Fei-Fei, Alan Yuille, Jonathan Huang, Kevin Murphy (2018) Progressive Neural Architecture Search. *European Conference on Computer Vision (ECCV)* **Selected for oral presentation.**
19. Lane McIntosh, Niru Maheswaranathan, David Sussillo, **Jonathon Shlens** (2018) Recurrent Segmentation for Variable Computational Budgets. *Workshop on Efficient Deep Learning for Computer Vision at CVPR*

18. Guangyu Robert Yang, Igor Ganichev, Xiao-jing Wang, **Jonathon Shlens**, David Sussillo (2018) A Dataset and Architecture Visual Reasoning with a Working Memory. *European Conference on Computer Vision (ECCV)*

17. Barret Zoph, Vijay Vasudevan, **Jonathon Shlens**, Quoc Le, (2018) Learning Transferable Architectures for Scalable Image Classification. *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*. **Selected for spotlight presentation.**

16. Nishal Shah, Alan Litke, EJ Chichilnisky, Yoram Singer, **Jonathon Shlens** (2018) Learning a neural response metric for retinal prosthesis. *International Conference on Learning Representations (ICLR)*.

15. Golnaz Ghiasi, Honglak Lee, Manjunath Kudlur, Vincent Dumoulin, **Jonathon Shlens** (2017) Exploring the structure of a real-time, arbitrary neural artistic stylization network *British Machine Vision Conference (BMVC)*. **Selected for oral presentation**.

14. Sergio Guadarrama, Ryan Dahl, David Bieber, Mohammad Norouzi, **Jonathon Shlens**, Kevin Murphy. (2017) PixColor: Pixel recursive colorization. *British Machine Vision Conference (BMVC)*. **Selected for oral presentation**.

13. Ryan Dahl, Mohammad Norouzi, **Jonathon Shlens**. (2017) Pixel recursive super-resolution. *IEEE International Conference on Computer Vision (ICCV)*.

12. Augustus Odena, Christopher Olah, **Jonathon Shlens** (2017) Conditional Image Synthesis With Auxiliary Classifier GANs. *Proceedings of the 34th International Conference of Machine Learning (ICML)*.

11. Esteban Real, **Jonathon Shlens**, Stefano Mazzocchi, Xin Pan, Vincent Vanhoucke (2017) YouTube-BoundingBoxes: A Large High-Precision Human-Annotated Data Set for Object Detection in Video *Proceedings of IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*

10. Vincent Dumoulin, **Jonathon Shlens** and Manjunath Kudlur (2017) A Learned Representation for Artistic Style. *International Conference on Learning Representations (ICLR)* Conference proceedings.

9. Tianqi Chen, Ian Goodfellow, **Jonathon Shlens**, (2016) Net2Net: Accelerating Learning via Knowledge Transfer. *International Conference on Learning Representations (ICLR)*. Conference proceedings. **Selected for oral presentation**.

8. Alireza Makhzani, **Jonathon Shlens**, Navdeep Jaitly, Ian Goodfellow (2016) Adversarial Autoencoders *International Conference on Learning Representations (ICLR)*. Workshop proceedings.

7. Christian Szegedy, Vincent Vanhoucke, Sergey Ioffe, **Jonathon Shlens**, Zbigniew Wojna (2016) Rethinking the Inception Architecture for Computer Vision. *Proceedings of IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*

6. Ian Goodfellow, **Jonathon Shlens**, Christian Szegedy. (2015) Explaining and Harnessing Adversarial Examples. *International Conference on Learning Representations (ICLR)*. Conference proceedings.

5. Sudheendra Vijayanarasimhan, **Jonathon Shlens**, Rajat Monga, Jay Yagnik. Deep Networks With Large Output Spaces. (2015) *International Conference on Learning Representations (ICLR)*. Workshop proceedings.

4. Mohammad Norouzi, Tomas Mikolov, Samy Bengio, Yoram Singer, **Jonathon Shlens**, Andrea Frome, Greg Corrado, Jeffrey Dean (2014). Zero-Shot Learning by Convex Combination of Semantic Embeddings. *International Conference on Learning Representations (ICLR)*. Conference proceedings. **Selected for oral presentation**.

3. Andrea Frome*, Greg Corrado*, **Jonathon Shlens***, Samy Bengio, Jeff Dean, Marc-Aurelio Ranzato and Tomas Mikolov (2013). DeViSE: A Deep Visual-Semantic Embedding Model. *Neural Information Processing Systems (NIPS)*

2. Thomas Dean, Mark Ruzon, Mark Segal, Jonathon Shlens, Sudheendra Vijayanarasimhan, Jay Yagnik (2013) Fast, Accurate Detection of 100,000 Object Classes on a Single Machine. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)* **Awarded best paper**.

1. Thomas Dean, Greg Corrado and **Jonathon Shlens** (2013). Three controversial hypotheses concerning computation in the primate cortex. *Association for the Advancement of Artificial Intelligence (AAAI)*

PUBLICATIONS - PEER REVIEWED JOURNAL ARTICLES

16. Jonathan W. Pillow*, **Jonathon Shlens***, E. J. Chichilnisky and Eero Simoncelli (2013) A model-based spike sorting algorithm for removing correlation artifacts in multi-neuron recordings. *PLoS One* 8: 5

15. Eizaburo Doi, Jeffrey L. Gauthier, Greg D. Field, **Jonathon Shlens**, Alexander Sher, Martin Greschner, Timothy A. Machado, Lauren H. Jepson, Keith Mathieson, Deborah E. Gunning, Alan M. Litke, Liam Paninski, E. J. Chichilnisky and Eero P. Simoncelli (2012) Efficient Coding of Spatial Information in the Primate Retina. *Journal of Neuroscience* 32:46

14. Michael Vidne, Yashar Ahmadian, **Jonathon Shlens**, Jonathan W. Pillow, Jayant Kulkarni, Alan M. Litke, E. J. Chichilnisky, Eero Simoncelli, Liam Paninski (2012) Modeling the impact of common noise inputs on the network activity of retinal ganglion cells. *Journal of Computational Neuroscience* 33:1

13. Greg Field , Jeff Gauthier, Alexander Sher, Martin Greschner, Timothy Machado, Lauren Jepson, Jonathon Shlens, Deborah Gunning, Keith Mathieson, Wladyslaw Dabrowski, Liam Paninski, Alan Alan Litkend E.J. Chichilnisky (2010). Functional connectivity in the retina at the resolution of photoreceptors. *Nature*: 467, 673-677.

12. Martin Greschner, **Jonathon Shlens**, Tina Bakolitsa, Greg Field , Jeff Gauthier, Lauren Jepson, Alexander Sher, Alan Alan Litkend E.J. Chichilnisky (2010) Correlated firing among major ganglion cell types in primate retina. *Journal of Physiology* Oct 11.

11. **Jonathon Shlens**, Greg Field , Jeff Gauthier, Martin Greschner, Alexander Sher, Alan Alan Litkend E.J. Chichilnisky (2009) The structure of large-scale synchronized firing in primate retina. *Journal of Neuroscience*: 29, 5022-5031

10. Greg Field, Martin Greschner, Jeffrey Gauthier, **Jonathon Shlens**, Alexander Sher, Alan Alan Litkend E.J. Chichilnisky (2009) High sensitivity rod photoreceptor input to blue-yellow color opponent pathway in primate retina. *Nature Neuroscience* 12, 1150.

9. Jeff Gauthier, Greg Field , Alexander Sher, Martin Greschner, **Jonathon Shlens**, Alan Alan Litkend E.J. Chichilnisky (2009) Receptive fields in primate retina are coordinated to sample visual space more uniformly. *PLoS Biology* 7, e63.

8. Jeff Gauthier, Greg Field , Alexander Sher, **Jonathon Shlens**, Martin Greschner, Alan Alan Litkend E.J. Chichilnisky (2009) Uniform signal redundancy of parasol and midget ganglion cells in primate retina. *Journal of Neuroscience*: 29,4675-4680

7. **Jonathon Shlens**, Fred Rieke, E.J. Chichilnisky (2008) Synchronized firing in the retina. *Current Opinions in Neurobiology*: 16, 396-402

6. Jonathan Pillow, **Jonathon Shlens**, Liam Paninski, Alexander Sher, Alan Litke, E.J. Chichilnisky and Eero Simoncelli (2008) Spatiotemporal correlations and visual signaling in a complete neuronal population *Nature*: 454:995-999

5. **Jonathon Shlens**, Matthew Kennel, Henry Abarbanel and E.J. Chichilnisky (2007) Estimating information rates in neural spike trains with confidence intervals. *Neural Computation*: 19, 1683-1719

4. Greg Field, Alexander Sher, Jeff Gauthier, Martin Greschner, **Jonathon Shlens**, Alan Alan Litkend E.J. Chichilnisky (2007) Spatial properties and functional organization of small bistratifed cells in primate retina. *Journal of Neuroscience*: 270 13261

3. Dumitru Petrusca, Matthew Grivich, Alexander Sher, Greg Field, Jeff Gauthier, **Jonathon Shlens**, E.J. Chichilnisky and Alan Litke (2007) Identification and characterization of a Y-like primate retinal ganglion cell type. *Journal of Neuroscience*: 27 11019

2. **Jonathon Shlens**, Greg Field, Jeff Gauthier, Matthew Grivich, Dumitru Petrusca, Alexander Sher, Alan Alan Litkend E.J. Chichilnisky (2006) The structure of multi-neuron firing patterns in primate retina. **Journal of Neuroscience**: 26, 8254-8266

1. Matthew Kennel, **Jonathon Shlens**, Henry Abarbanel and E.J. Chichilnisky (2005) Estimating entropy rates with Bayesian confidence intervals *Neural Computation*: 17, 1531-1576

*** Denotes equal contribution of authors.**

TECHNICAL REPORTS

3. Jasmine Collins, Johannes Ballé, **Jonathon Shlens** (2018) *Accelerating Training in Deep Networks with a Standardization Loss.* Technical report from Women in Machine Learning (WiML) workshop. `https://arxiv.org/abs/1903.00925`

2. Martin Abadi, Ashish Agarwal, Paul Barham, Eugene Brevdo, Zhifeng Chen, Craig Citro, Greg S. Corrado, Andy Davis, Jeffrey Dean, Matthieu Devin, Sanjay Ghemawat, Ian Goodfellow, Andrew Harp, Geoffrey Irving, Michael Isard, Yangqing Jia, Rafal Jozefowicz, Lukasz Kaiser, Manjunath Kudlur, Josh Levenberg, Dan Mane, Rajat Monga, Sherry Moore, Derek Murray, Chris Olah, Mike Schuster, **Jonathon Shlens**, Benoit Steiner, Ilya Sutskever, Kunal Talwar, Paul Tucker, Vincent Vanhoucke, Vijay Vasudevan, Fernanda Viegas, Oriol Vinyals, Pete Warden, Martin Wattenberg, Martin Wicke, Yuan Yu, and Xiaoqiang Zheng. (2015) *TensorFlow: Large-Scale Machine Learning on Heterogeneous Distributed Systems.* White paper available at `http://tensorflow.org/`

1. Samy Bengio, Jeff Dean, Dumitru Erhan, Eugene Ie, Quoc Le, Andrew Rabinovich, **Jonathon Shlens**, Yoram Singer (2013) *Using Web Co-occurrence Statistics for Improving Image Categorization* `https://arxiv.org/abs/1312.5697`

PATENTS

9. Lane McIntosh, David Sussillo, Niru Maheswaranathan, **Jonathon Shlens** "Recurrent Segmentation for Variable Computational Budgets." Provisional US patent filed on 11/20/2017.

8. Barret Zoph, Vijay Vasudevan, **Jonathon Shlens**, Quoc Le. "Neural Architecture Search Using a Performance Prediction Neural Network". Provisional US patent filed on 02/02/2018.

7. Sergio Guadarrama, Ryan Dahl, Mohammad Norouzi, Kevin Murphy, **Jonathon Shlens**, David Bieber. "PixColor: Pixel Recursive Colorization". Provisional US patent application filed on 05/7/2017.

6. Vincent Dumoulin, **Jonathon Shlens**, Manjunath Kudlur. "Stylzing Input Images". Provisional US patent application filed on 11/4/2016.

5. Tianqi Chen, Ian Goodfellow, **Jonathon Shlens**. "Generating Larger Neural Networks". Provisional US patent application filed on 11/12/2015.

4. George Toderici, Sami Abu-El-Haija and **Jonathon Shlens**. "Selecting Representative Video Frames For Videos". Provisional US patent application filed on 06/24/2015.

3. Jeffrey Dean, Quoc Le, **Jonathon Shlens**, Samuel Bengio, Yoram Singer. "Label Consistency for Image Analysis". Provisional US patent application awarded 05/16/2017; US Patent #9,652,695

2. Sanketh Shetty, **Jonathon Shlens** and Hrishikesh Aradhye. "Mechanism For Automatic Quantification Of Multimedia Production Quality". Provisional US patent application awarded on 02/15/2012; US Patent #9,009,083

1. Quoc Le, Gregory Corrado, **Jonathon Shlens**, Marc'Aurelio Ranzato. "Generating Labeled Images". Provisional US patent application awarded on 09/27/2012, US Patent #9,256,807,.

0. Daniel Ford, Carrie Bostock, Nissan Hajaj, Eric Tassone, **Jonathon Shlens**. "Estimating Rate of Change of Documents". Provisional US patent application filed on 01/23/2012.

INVITED TALKS

- "Learning architectures for visual representation" (August 2018). Methods in Computational Neuroscience 30th Anniversary Symposium. Cambridge, MA
- "Learning architectures for visual representation" (May 2018). MIT Center for Mind, Brains and Machines. Cambridge, MA
- "Deep learning in image and video processing". (January 2018) Invited tutorial at Electronic Imaging, *Society of Imaging Science and Technology (IS & T)*, Burlingame, CA. `http://www.imaging.org`
- "Learning architectures for visual representation" (January 2018). MIT AI-X Summit. Mountain View, CA
- "Learning representations of the visual world" (November 2017). Center for Mind, Brain and Computation. Stanford University, CA
- "Learning representations of the visual world" (September 2017). Vector Institute, University of Toronto, Canada
- "Deep Learning and Vision" (April 2017). Machine Learning Seminar Seminar, CERN particle physics laboratory, Geneva, Switzerland
- "Towards a learned representation for artistic style" (April 2017). Distinguished Scientist Seminar, Department of Computer Science, University of Miami, Miami, FL.
- "Towards a learned representation for artistic style" (March 2017). Stanford Center for Image Systems Engineering, Stanford University, CA.
- "Deep learning in image and video processing". (October 2016) Invited tutorial at International Conference in Image Processing (ICIP), *Institute for Electrical and Electronic Engineers (IEEE)*, Phoenix, AZ. `http://2016.ieeeicip.org`

- "Building vision systems with modern machine learning" (March 2016) Department of Electrical Engineering and Computer Science. University of Michigan, Ann Arbor, MI.
- "Vision and images in the era of modern machine learning" (March 2016) Symposium on Information and Entropy, Department of Physics. University of Michigan, Ann Arbor, MI.
- "Towards Tools for Understanding the Neural Code" (November 2015) Allen Institute for Brain Science *and* Computational Neuroscience Seminar, University of Washington, Seattle, WA.
- "Engineering a large-scale vision system by leveraging semantic knowledge" (July 2014). Stanford Center for Image Systems Engineering, Stanford University, CA.
- "Engineering a large-scale vision system by leveraging semantic knowledge" (April 2014). Gonda Multidisciplinary Brain Research Center, Bar-Ilan University, Tel-Aviv, IL.
- "Engineering a large-scale vision system by leveraging semantic information" (October 2013). Department of Bioengineering, UC San Diego, La Jolla, CA.
- "Engineering a large-scale vision system" (September 2013). Qualcomm Research and Brain Corporation. San Diego, CA
- "Learning from video with deep networks" (March 2013) American Association for the Advancement of Artificial Intelligence (AAAI), Mountain View, CA.
- "Working with high dimensional sensory data" (October 2009) *Audio Engineering Society*, Workshop on Lies, Damn Lies and Statistics, New York City, 2009
- "Exploring the network structure of populations of neurons using maximum entropy techniques" (March 2009) *Computational and Systems Neuroscience* Workshop on Dimensionality Reduction for Multi-channel Neural Recordings, Salt Lake City, UT.
- "Synchrony and multi-neuron firing patterns in the neural code of the retina." (2008) Max Plank Institute for Medical Research, Heidelberg, Germany.
- "Spatial organization of concerted activity in the primate retina." (2008) American Physical Society, Symposium on Statistical Mechanics in the Brain.
- "Exploring the network structure of primate retina using maximum entropy methods." (2007) Gatsby Computational Neuroscience Unit, University College of London, London, UK.
- "Estimating information rates in retinal ganglion cells (with confidence intervals)" (2007) Gatsby Computational Neuroscience Unit, University College of London, London, UK.
- "Exploring the network structure of primate retina using maximum entropy methods." (2007) Computational Biomedicine Seminar Series. Cornell University, Weill School of Medicine, New York City, NY.
- "Exploring the network structure of primate retina using maximum entropy methods" (2007) *Computational and Systems Neuroscience*, Workshop on Information-Theoretic Methods Measures and Methods in Neuroscience, Salk Lake City, UT.
- "The structure of multi-neuron firing patterns in the primate retina" (2006) UC San Diego Neurosciences Retreat, Lake Arrowhead, CA
- "Estimating information rates in retinal ganglion cells (with confidence intervals)" (2005) Max Planck Institute for Systems Neurobiology, Martinsried, Germany
- "Estimating entropy rates and information rates in retinal spike trains" (2003) *Neural Information Processing Systems*, Workshop on Entropy Estimation, Vancouver, BC.

TEACHING EXPERIENCE

Guest Lecturer and Instructor

- "Introduction to convolutional neural networks" (July 2018) Lecturer at *CIFAR Deep Learning Summer School*. Toronto, CA. 2 hours of lecture.
- "Deep learning and vision" (July 2018) Lecturer at *Computational Neuroscience: Vision*. Cold Spring Harbor Laboratory, NY. 3 hours of lecture.
  `http://meetings.cshl.edu/courses`
- "Another perspective on computational neuroscience". (October 2016) Guest lecturer in *Systems Neuroscience*. Neuroscience Department, Stanford University. 2 hours of lecture.
  `http://neurobiology.stanford.edu/courses.html`
- "Convolutional neural networks and big data" (July 2016) Lecturer at *Computational Neuroscience: Vision*. Cold Spring Harbor Laboratory, NY. 3 hours of lecture.
  `http://meetings.cshl.edu/courses`
- "Deep learning and vision" (August 2016). Lecturer and instructor at *Machine learning summer school*, Arequipa, Peru. 6 hours of lectures plus exercises. `http://mlss.cc/`
- "Directions in convolutional neural networks". Guest lecturer in *Convolutional Neural Networks for Visual Recognition*. Computer Science Department, Stanford University, CA. 2 hours of lecture. `http://cs231n.stanford.edu/`.
- "Another perspective on computational neuroscience". (December 2015) Guest lecturer in *Systems Neuroscience*. Neuroscience Department, Stanford University. 2 hours of lecture. `http://neurobiology.stanford.edu/courses.html`.
- "Deep learning and vision". (May 2015 - present) Lecturer and instructor at over a dozen Google internal classes on machine learning. 2 hour of lectures for each session.

Miscellaneous Teaching

- Managed or co-managed 7 graduate students and 4 undergraduates students visiting Google as summer interns. Many of these summer research projects ended up as published research at academic conferences.
- Teaching Assistant, Division of Biology, University of California, San Diego (2004-2005). Provided lectures and led discussion on cellular neurophysiology, systems neurobiology and computational neurobiology. Wrote and graded homework assignments and exams.
- Guest Lecturer, Department of Physics, University of California, San Diego (2003-2004). Organized unit with lectures on information theory and neural coding for upper division biophysics courses.
- Triathlon Coach, Leukemia and Lymphoma Society, Team in Training (2002-2006). 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.

Tutorials

Published on `arxiv.org` tutorials on machine learning, statistics and computational neuroscience that have been employed by many faculty in their teaching material.

- *Tutorial on Independent Component Analysis.* (`https://arxiv.org/abs/1404.2986`)
- *Tutorial on Principal Component Analysis.* (`https://arxiv.org/abs/1404.1100`). Cited by **2000 articles** as of September 2016.
- *A Light Discussion and Derivation of Entropy.* (`http://arxiv.org/abs/1404.1998`)
- *Notes on Kullback-Leibler Divergence and Likelihood.* (`http://arxiv.org/abs/1404.2000`)
- *Notes on Generalized Linear Models of Neurons.* (`http://arxiv.org/abs/1404.1999`)

CONFERENCE ABSTRACTS

28. Nishal Shah, Nora Brackbill, Ryan Samarakoon, Colleen Rhoades, Alexandra Kling, Alexander Sher, Alan Litke, Yoram Singer, **Jonathon Shlens**, E.J. Chichilnisky "Learning variability in the neural code of the retina.". *Computational and Systems Neuroscience*, (2019)
27. Jasmine Collins, Johannes Ballé, **Jonathon Shlens** "Accelerating Training in Deep Networks with a Standardization Loss.". *Women in Machine Learning (WiML)*, (2018)
26. Keren Gu, Brandon Yang, Jiquan Ngiam, Quoc Le, **Jonathon Shlens** "Using videos to evaluate image model robustness.". *Women in Machine Learning (WiML)*, (2018)
25. Guangyu Robert Yang, Igor Ganichev, Xiao-Jing Wang, **Jonathon Shlens**, David Sussillo "A dataset and architecture for visual reasoning with a working memory." (2018)
24. Nishal Shah, Nora Brackbill, Colleen Rhoades, Alexandra Tikidji-Hamburyan, Georges Goetz, Alan Litke, Alexander Sher, Vineet Gupta, Yoram Singer, E.J. Chichilnisky, **Jonathon Shlens** "Learning nonlinear models for visual computation in populations of retinal ganglion cells". *Computational and Systems Neuroscience*, (2017)
23. Yashar Ahmadian, Jonathan Pillow, **Jonathon Shlens**, Eero Simoncelli, EJ Chichilnisky, Liam Paninski, "A decoder-based spike train metric for analyzing the neural code in the retina". *Computational and Systems Neuroscience*, (2009)
22. Vidne M, Kulkarni J, Yashar Ahmadian, Jonathan Pillow, **Jonathon Shlens**, EJ Chichilnisky, Eero Simoncelli, Liam Paninski, "Inferring functional connectivity in an ensemble of retinal ganglion cells sharing a common input", Computational and Systems Neuroscience, 2009
21. Martin Greschner, **Jonathon Shlens**, Greg Field, Jeffrey Gauthier, Alexander Sher, Alan Litke, EJ Chichilnisky, "Synchronized firing across cell types in the primate retina." *Society for Neuroscience*, 2008.
20. Jonathan Pillow, **Jonathon Shlens**, Liam Paninski, Alexander Sher, Alan Litke, EJ Chichilnisky, Eero Simoncelli. "The effects of correlated neural activity on single-neuron spiking variability in the primate retina." *Computational and Systems Neuroscience*, 2008.
19. **Jonathon Shlens**, Greg Field, Jeffrey Gauthier, Martin Greschner, Alexander Sher, Alan Litke, EJ Chichilnisky, "Spatial organization of large-scale concerted activity in the primate retina." *Computational and Systems Neuroscience*, 2008.
18. **Jonathon Shlens**, Greg Field, Jeffrey Gauthier, Martin Greschner, Alexander Sher, Alan Litke, EJ Chichilnisky, "Spatial organization of large-scale concerted activity in the primate retina." *Neural Coding, Computation and Dynamics*, 2007.

17. **Jonathon Shlens**, Greg Field, Jeffrey Gauthier, Martin Greschner, Alexander Sher, Alan Litke, EJ Chichilnisky, "Spatial organization of large-scale concerted activity in the primate retina." *Society for Neuroscience*, 2007.

16. Jonathan Pillow, **Jonathon Shlens**, Liam Paninski, Alexander Sher, Alan Litke, EJ Chichilnisky, Eero Simoncelli "Deciphering correlations: Bayesian decoding of multi-neuronal spike trains in primate retina." *Computational and Systems Neuroscience*, 2007.

15. Greg Field, Jeffrey Gauthier, Martin Greschner, **Jonathon Shlens**, Alexander Sher, Alan Litke, EJ Chichilnisky, "Pathways and properties of rod and cone signals emanating from the primate retina." *Society for Neuroscience*, 2007.

14. Jeffrey Gauthier, Greg Field, Martin Greschner, **Jonathon Shlens**, Alexander Sher, Alan Litke, EJ Chichilnisky, "Fine structure and interdigitation of receptive field mosaics in primate retina." *Society for Neuroscience*, 2007.

13. Jonathan Pillow, **Jonathon Shlens**, Liam Paninski, Alexander Sher, Alan Litke, EJ Chichilnisky, Eero Simoncelli "Correlations and coding with multineuronal spike trains in primate retina" *Society for Neuroscience*, 2007.

12. **Jonathon Shlens**, Greg Field, Jeffrey Gauthier, Martin Greschner, Alexander Sher, Alan Litke, EJ Chichilnisky, "Spatial structure of large-scale synchrony in the primate retina." *Computational and Systems Neuroscience*, 2007.

11. Alexander Sher, Greg Field, Jeffrey Gauthier, Dumitru Petrusca, Matthew Grivich, **Jonathon Shlens**, Alan Litke, EJ Chichilnisky, "Magnitude of S-cone inputs to parasol cells in primate retina." *Society for Neuroscience*, 2006.

10. Greg Field, Alexander Sher, Jeffrey Gauthier, Dumitru Petrusca, Matthew Grivich, **Jonathon Shlens**, Alan Litke, EJ Chichilnisky, "Functional organization of blue-on ganglion cells in the primate retina." *Society for Neuroscience*, 2006.

9. **Jonathon Shlens**, Greg Field, Jeffrey Gauthier, Matthew Grivich, Dumitru Petrusca, Alexander Sher, Alan Litke, EJ Chichilnisky, (2006) "Probing the structure of multi-neuron firing patterns in the primate retina using maximum entropy methods." *Statistical Analysis of Neuronal Data*, 2006.

8. **Jonathon Shlens**, Greg Field, Jeffrey Gauthier, Matthew Grivich, Dumitru Petrusca, Alexander Sher, Alan Litke, EJ Chichilnisky, (2006) "Probing the structure of multi-neuron firing patterns in the primate retina using maximum entropy methods." *Computational and Systems Neuroscience*, 2006.

7. Jeffrey Gauthier, Dumitru Petrusca , Matthew Grivich, Alexander Sher, **Jonathon Shlens**, Greg Field, Alan Litke, EJ Chichilnisky, "Receptive field mosaics of parasol and midget ganglion cells in the primate retina." *Society for Neuroscience*, 2005.

6. Jonathan Pillow, **Jonathon Shlens**, Liam Paninski, Eero Simoncelli, EJ Chichilnisky, "Modeling the correlated spike response of a cluster of primate retinal ganglion cells." *Society for Neuroscience*, 2005.

5. Dumitru Petrusca , Matthew Grivich, Alexander Sher, Greg Field, Jeffrey Gauthier, **Jonathon Shlens**, EJ Chichilnisky, Alan Litke, "Physiological characterization of a new macaque retinal ganglion cell class" *Society for Neuroscience*, 2005.

4. Matthew Grivich, Alexander Sher, Dumitru Petrusca, Greg Field, **Jonathon Shlens**, Jeffrey Gauthier, EJ Chichilnisky, Alan Litke, "Classification of guinea pig retinal ganglion cells using large scale multielectrode recordings." *Society for Neuroscience*, 2005.

3. Jonathan Pillow, **Jonathon Shlens**, Liam Paninski, Eero Simoncelli, EJ Chichilnisky, "Modeling of multi-neuronal responses in macaque retinal ganglion cells." *Computational and Systems Neuroscience*, 2005.

2. **Jonathon Shlens**, Matthew Kennel, Henry Abarbanel, EJ Chichilnisky, "Estimating entropy rates and information rates in spike trains with confidence intervals." *Computational and Systems Neuroscience*, 2004.

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SERVICE

Reviewing

- Program committee for NIPS conference (2016, 2017, 2018)
- Conference reviewer: Neural Information Processing Systems (2013-2015), International Conference on Learned Representations (2014-2018) and International Conference on Machine Learning (2016-2018).
- Journal reviewer: Journal of Neuroscience, Neural Computation, Journal of Computational Neuroscience, Journal of Neurophysiology, Vision Research, Nature