Todd K. Leen, PhD.

Director of Data Analytics and Professor
Graduate School of Arts and Sciences
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Research Interests

My current work is focused on methods to approximate densities arising from non-linear Markov processes (with applications in domains including learning systems, neural plasticity, and chemical and gene expression networks), and anomaly detection in clinical laboratory tests. Past work included constrained clustering, mixed models for classification and prediction of longitudinal streams (with applications to medicine), fast neural net dynamical surrogates and model-data fusion (applied to large-scale environmental data assimilation), anomaly detection for environmental sensor networks, computer-controlled stimuli for probing sensory systems, ensemble dynamics of spike-timing-dependent plasticity, and nonlinear dimensionality reduction.

Professional Experience

1/16–	**Director** — Data Analytics Program, and Professor, Graduate School of Arts & Sciences, Georgetown University.
8/12–12/15	**Program Manager** — Division of Information and Intelligent Systems Division Computer and Information Science and Engineering (CISE) National Science Foundation.
7/99–3/17	**Professor** — Dept. of Biomedical Engineering, SOM, OHSU; (previously) Dept. of Computer Science and Electrical Engineering, School of Science & Technology, OHSU; (previously) Dept. of Computer Science, OGI.
5/93–7/99	**Associate Professor** — Dept. of Computer Science & Engineering, OGI.
3/90–5/93	**Assistant Professor** — Dept. of Computer Science & Engineering, OGI.
4/89–3/90	**Senior Scientist** — Dept. of Computer Science & Engineering, Oregon Graduate Institute
4/87–4/89	**Research Associate** Robert S. Dow Neurological Sciences Institute Good Samaritan Hospital and Medical Center 1015 NW 22nd Avenue, Portland, OR
12/82–3/87	**Scientist / Engineer** IBM General Technology Division Essex Junction, VT.

Education

1980–1982	**Ph.D.** — Theoretical Physics University of Wisconsin, Milwaukee, WI. Thesis advisors: Leonard Parker, John Friedman.
1977–1980	**M.S.** — Physics. University of Wisconsin, Madison, WI. Thesis advisor: Fred Roesler.
1973–1977	**B.S.**(High Distinction) — Physics, Philosophy minor. Worcester Polytechnic Institute, Worcester, MA.

Publications (some available at `www.ohsu.edu/bme/tleen`)

Ph.D. Thesis

Topics in Gravitation and Gauge Fields, Dept. of Physics, University of Wisconsin, 1982.

Abstracts

- Todd K. Leen. Geocoronal Balmer Alpha Measurements With a Ground-Based Fabrey-Perot. *American Geophysical Union Meeting Abstracts*, 1980.
- Todd K. Leen and G. McCollum. Emergence of Multi-Component Rhythms. *Society for Neuroscience Abstract*, 1988.
- Todd K. Leen. Weight-Space Distributions and Convergence Times for Stochastic Learning. Abstract for *Neural Networks for Computing, Snowbird*, Utah, 1992.
- A.U. Levin and Todd K. Leen. Using PCA to improve generalization in supervised learning. Presented at the *NATO Workshop on Statistics and Neural Networks*, Les Arcs, France, June 1993.
- Todd K. Leen and Nandakishore Kambhatla. Fast Non-Linear Dimension Reductions. Abstract for *Neural Networks for Computing, Snowbird*, Utah, 1993.
- A.U. Levin, Todd K. Leen, and J.E. Moody. PC Pruning, Analysis and Extensions. Abstract for *Neural Networks for Computing, Snowbird*, Utah, 1993.
- Todd K. Leen and G.B. Orr. Stochastic Learning beyond the Diffusion Approximation. Abstract for *Machines That Learn*, Snowbird, Utah, 1995.
- G.B. Orr and Todd K. Leen. Second Order Stochastic Learning Algorithms. Oral presentation and abstract for *Machines That Learn*, Snowbird, Utah, 1995.
- Todd K. Leen and Nandakishore Kambhatla. Regularizing Mixture Regression. Abstract for *Machines that Learn*, Snowbird, Utah, 1996.
- Todd K. Leen and Cynthia Archer. Mixture Models and Non-Uniqueness in Nonlinear PCA. Oral presentation and abstract for *Learning*, Snowbird, Utah, 1999.

- S. Frolov, A.M. Baptista, and T.K. Leen. Calibration of spatio-temporal-varying bottom drag in an estuary with multiple dynamical and error regimes. In AGU Ocean Science meeting, EOS Trans. 84(52), Portland, OR 2004.
- S. Frolov, R. van der Merwe, Z. Lu , T. Leen , and A. Baptista. Fast and Model-Independent Data Assimilation of Estuarine Circulation Using Neural Networks. EOS Trans. AGU, 87(36), Ocean Sci. Meet. Suppl., Abstract OS260-06, 2006.
- S. Frolov, A.M. Baptista, T. Leen, Z. Lu, and R. van der Merwe. Assimilating In-Situ Measurements into a Reduced-Dimensionality Model of an Estuary-Plume System. In Eos Trans. AGU, 87(52), Fall Meeting Supplement, Abstract A31A-0846, San Francisco, CA, 2006.
- Leen, Todd, Lu, Zhengdong, Hayes, Tamara, and Kaye Jeffrey. Detection of Early Cognitive Loss from Medication Adherence Behavior. In *The 2nd International Conference on Technology and Aging*, Toronto, 2007.
- Roberts, Patrick; Leen, Todd; Sawtell, Nathaniel; Hunt, John; Case, Steven. Spatial Stimulation of the Electrosensory System of Mormyrid Electric Fish. Computational Neuroscience Conference. 2010.
- Todd Leen, Patrick Roberts, John Hunt, Amy Boyle, Nathaniel Sawtell, Karina Scalise. An Electrosensory Virtual Reality. *ICJNN*, special neuroscience track IEEE, July, 2011.
- Todd Leen, Patrick Roberts, John Hunt, Amy Boyle, Nathaniel Sawtell, Karina Scalise. Electrosensory Virtual Reality for Studying Spatial-Temporal Processing in Mormyrid Fish. *CRCNS PI Meeting*, October 2011.

Disclosures

- T.K. Leen and H.N. Leighton. Electrostatic Discharge Protect Device for Integrated Bipolar Technology. *IBM Technical Disclosure Bulletin*, 29-10, 4677, 1987.
- Todd Leen, Zhengdong Lu, Rudolph van der Merwe, Sergey Frolov, and Antonio Baptista. Software for Reduced-Dimension Data Assimilation. *OHSU Technology License #1654*, 2012.

Conference Proceedings and Book Chapters (refereed unless otherwise noted)

1. Cole, R., Hammerstrom, D., Leen, T., Gopalakrishnan, M., Inouye, J., Means, E., Muthusamy, Y., Rooker, T., Rudnick, M. Speech Recognition, VLSI & Neural Networks. *Proceeding of Northcon*, 1989.
2. Cole, R.A., Muthusamy, Y.K., Atlas, L., Leen, T., Rudnick, M Speaker-Independent Vowel Recognition Comparison of Backpropagation and Trained Classification Trees. *Proceedings of the IEEE Hawaii International Conference on System Sciences*, 1990.
3. Hammerstrom, D., Leen, T.K., and Means, E. Dynamics and Implementation of Self-Organizing Networks. In *Advanced Neural Computers,* R. Eckmiller (Ed.), Elsevier Science Publishers B.V. (North-Holland), March, 1990.

4. Leen, T.K., Rudnick, M., Hammerstrom, D. Hebbian Learning Improves Classifier Efficiency. *International Joint Conference on Neural Networks*, San Diego, 1990.

5. Leen, T.K. Weight Dynamics of Recurrent Hebbian Networks. *Proceedings of the 34th Annual conference of the International Society for the Systems Sciences*, July, 1990.

6. Leen, T.K. Hebbian Learning Algorithms and Applications. *Proceedings of the 34th Annual conference of the International Society for the Systems Sciences*, July, 1990.

7. Leen, T.K. Weight-Space Dynamics of Recurrent Hebbian Networks. In R. Lipmann, J. Moody, and D. Touretzky (eds.) *Advances in Neural Information Processing Systems 3*, Morgan Kauffman, 1991. This paper was one of fewer than **6 %** of the submissions chosen for oral presentation at the 1990 NIPS conference.

8. Leen, T.K., Webb, Max, Rehfuss, S. Encoding and Classification in a Model of Olfactory Cortex. *International Joint Conference on Neural Networks*, Seattle, 1991.

9. Leen, T.K. Learning in linear feature-discovery networks. Invited paper for *Adaptive Signal Processing*, SPIE Proceedings, **1565**, 472-481, 1991.

10. Leen, T.K., Orr, G.B. Weight-Space Probability Densities and Convergence Times for Stochastic Learning. *International Joint Conference on Neural Networks*, Baltimore, 1992.

11. Shaudys, F., Leen, T.K. Feature Selection for Improved Classification. *International Joint Conference on Neural Networks*, Baltimore, 1992.

12. Leen, T.K. and Orr, G.B. Weight-Space Densities in Stochastic Learning. Proc. Canadian Conf. on Electrical and Computer Eng., ISBN 0-9694170-3-9, Vol.2, pp.MA6.7.1-MA6.7.4, Toronto, Ontario, Sep. 13-16, 1992.

13. Leen, T.K. and Moody, J.E. Weight Space Probability Densities in Stochastic Learning I. Dynamics and Equilibria. In Giles, C.L., Hanson, S.J., and Cowan, J.D. (eds.), *Advances in Neural Information Processing Systems 5*, Morgan Kaufmann Publishers, San Mateo, CA, 1993.

    This paper was one of **6.5 %** of the submissions chosen for oral presentation at the 1992 NIPS conference.

14. Leen, T.K. and Orr, G.B. Weight Space Probability Densities in Stochastic Learning II. Basin-Hopping. In Giles, C.L., Hanson, S.J., and Cowan, J.D. (eds.), *Advances in Neural Information Processing Systems 5*, Morgan Kaufmann Publishers, San Mateo, CA, 1993.

15. Kambhatla, N. and Leen, T.K. Fast, Nonlinear Dimension Reduction. In *IEEE International Conference on Neural Networks*, vol. 3, 1213-1218, IEEE, San Francisco, 1993.

16. Orr, G.B. and Leen, T.K. Momentum and Optimal Stochastic Search. In *Proceedings of the 1993 Connectionist Models Summer School*, M.C. Mozer, P. Smolensky, D.S. Touretzky, J.L. Elman and A.S. Weigend (eds.), Erlbaum Associates, 1993.

17. Leen, T.K. and Orr G.B. Optimal Stochastic Search and Adaptive Momentum. In J.D. Cowan, G. Tesauro, and J. Alspector (eds.), *Advances in Neural Information Processing Systems, 6*, Morgan Kauffman Publishers, 1994.

18. Kambhatla, N. and Leen, T.K. Fast Non-Linear Dimension Reduction. In J.D. Cowan, G. Tesauro, and J. Alspector (eds.), *Advances in Neural Information Processing Systems, 6*, Morgan Kauffman Publishers, 1994.

19. Levin, A.U., Leen, T.K. and Moody, J.E. Fast Pruning Using Principal Components. In J.D. Cowan, G. Tesauro and J. Alspector (eds.), *Advances in Neural Information Processing Systems, 6*, Morgan Kauffman Publishers, 1994.

    This paper is one of **6%** of the submissions chosen for oral presentation at the 1993 NIPS conference.

20. Leen, T.K. From Data Distributions to Regularization in Invariant Learning. In G. Tesauro, D. Touretzky, and T. Leen (eds.), *Advances in Neural Information Processing Systems, 7*, MIT Press, 1995.

21. Kambhatla, N. and Leen, T.K. Classifying with Gaussian Mixtures and Clusters. In G. Tesauro, D. Touretzky, and T. Leen (eds.), *Advances in Neural Information Processing Systems, 7*, MIT Press, 1995.

22. Orr, G.B. and Leen, T.K. Using Curvature Information for Fast Stochastic Search. In M. Mozer, M. Jordan, and T. Petsche (eds.), *Advances in Neural Information Processing Systems 9*, The MIT Press, 1997.

23. Hersh, W., Leen, T.K., Rehfuss, S., and Malveau, S. Automatic Predictions of Trauma Registry Procedure Codes from Emergency Room Dictations. in *MEDINFO 98*, Seoul, South Korea, 1998.

24. Leen, T.K, Schottky B. and Saad, D. Two Approaches to Optimal Annealing. In M. Jordan, M. Kearns, S. Solla (eds.) *Advances in Neural Information Processing Systems 10*, The MIT Press, 1998.

25. Sharma, R.K., Pavel, M., Leen, T.K. Multi-stream Video Fusion Using Local Principal Components Analysis. In *Infrared Technology and Applications XXIV*, Proceedings of SPIE, vol 3436, SPIE, 1998.

26. Leen, T.K. Exact and Perturbation Solutions to the Ensemble Dynamics. *Invited Paper* for *Online Learning in Neural Networks*, D. Saad (ed.), The Newton Institute Series, Cambridge University Press, Cambridge 1998.

27. Kambhatla, N., and Leen, T.K. Dimension Reduction by Local Principal Component Analysis. In *Unsupervised Learning, Foundations of Neural Computation*, G. Hinton and T. Sejnowski (eds.), The MIT Press, 1999. (This volume contains 21 articles previously published in *Neural Computation* that represent **"by topic, the most significant papers that have appeared in the journal over the past ten years."**)

28. Sharma, R., Leen, T.K., and Pavel, M. Probabilistic Sensor Fusion. In M. Kearns, S. Solla, D. Cohn (eds.) *Advances in Neural Information Processing Systems 11*, The MIT Press, 1999.

29. Leen, T.K. and Archer, C. Optimal Dimension Reduction and Transform Coding with Mixture Principal Components. In *International Joint Conference on Neural Networks*, IEEE, 1999.

30. Archer, C. and Leen, T.K. Adaptive Transform Coding as Constrained Vector Quantization. In Bernard Widrow, Ling Guan, Kuldip Palina, Tulay Adali, Jan Larsen, Elizabeth Wilson, and Scott Douglas (eds.), *Neural Networks in Signal Processing X*, IEEE Press, 2000.

31. Archer, C and Leen, T.K. From Mixtures of Mixtures to Adaptive Transform Coding. In T. Leen, T. Dietterich, V. Tresp (eds.) *Advances in Neural Information Processing Systems 13*, The MIT Press, 2001.

32. Archer, Cynthia, and Leen, Todd K. The Coding Optimal Transform. In James A. Storer and Martin Cohn (eds.) *Data Compression Conference 2001*, IEEE Computer Society Press, 2001.

33. Leen, T.K., Archer, C., and Baptista, A. Parameterized Novelty Detection for Environmental Sensor Monitoring. *Advances in Neural Information Processing Systems 16*, Sebastian Thrun, Lawrence K. Saul, and Bernhard Schölkopf (eds.), The MIT Press, 2004.

34. Lu, Zhengdong, and Leen, Todd K. Semi-Supervised Learning with Penalized Probabilistic Clustering. *Advances in Neural Information Processing Systems 17*, Saul, Weiss, Bottou (Eds.), The MIT Press, 2005.

35. Lu, Zhengdong, and Leen, Todd K. Semi-supervised Clustering with Pairwise Constraints: A Discriminative Approach. *Eleventh International Conference on Artificial Intelligence and Statistics*, San Juan, Puerto Rico, 2007.

36. Huang, Y., Erdogmus, D., Lu, Z., and Leen, T.K. Detecting Mild Cognitive Loss with Continuous Monitoring of Medication Adherence. ICASSP 2008, IEEE.

37. Lu, Z., Leen, T.K., Huang, Y., Erdogmus, D. A Reproducing Kernel Hilbert Space Framework for Pairwise Time Series Distances. Twenty-Fifth ICML, Cohen, McCallum, Roweis (Eds.), ACM, 2008.

38. Lu, Zhengdong, Leen, Todd K. Pairwise Constraints as Priors in Probabilistic Clustering. Invited chapter for *Constrained Clustering: Advances in Algorithms, Theory, and Applications*, Sugato Basu, Ian Davidson, and Kiri Wagstaff (Eds.), Chapman & Hall / CRC Data Mining and Knowledge Discovery Series, 2008.

39. Zhengdong Lu, Todd K. Leen, and Jeffrey Kaye. Hierarchical Fisher Kernels for Longitudinal Data. *Advances in Neural Information Processing Systems 21*, Koller, Schuurmans, Bengio, Bottou (Eds.), 2008.

40. Daniel Austin, Todd Leen, Tamara Hayes, Jeffrey Kaye, Holly Jimison, Michael Pavel. Model-Based Inference of Cognitive Processes from Unobtrusive Gait Velocity Measurements. Invited paper for *IEEE Engineering in Medicine and Biology Conference*, 2010.

41. Misha Pavel, Holly Jimison, Tamara Hayes, Nicole Larimer, Stuart Hagler, Yves Vimegnon, Todd Leen, Umut Ozertem. Optimizing Medication Reminders Using a Decision-Theoretic Framework. *MEDINFO 2010*, IOS Press, 2010.

42. Alex Kain and Todd Leen. Compression of Line Spectral Frequency Parameters Unsing the Asynchronous Interpolation Model. *Proceedings of* 7^{th} *ISCA Speech Synthesis Workshop*, Kyoto, Japan, September 2010.

43. Todd K. Leen and Robert Friel. Perturbation Theory for Stochastic Learning Dynamics. *Proceedings of the IJCNN*, IEEE, July, 2011.

44. Todd K. Leen, Deniz Erdogmus, and Steven Kazmierczak. Statistical Error Detection for Clinical Laboratory Tests. *IEEE EMBC*, August 2012.

45. J. Sourati, D. Erdogmus, M. Akcakaya, SC Kazmierczak, T.K. Leen. A Novel Delta Check Method for Detecting Laboratory Errors. *IEEE MLSP 2015*, 2015.

Journal Articles

46. Leen, T.K., Parker, L., Pimentel, L.O. Remote Quantum-mechanical Detection of Gravitational Radiation. *General Relativity and Gravitation*, **15** , 761, 1983.

47. Leen, T.K. Renormalization and Scaling Behavior of non-Abelian Gauge Fields in Curved Spacetime. *Annals of Physics*, **147** , 417, 1983.

48. McCollum, G., Leen, T.K. Form and exploration of mechanical stability limits in erect stance. *Journal of Motor Behavior*, **21**, 255, 1989.

49. Leen, T.K. Theory and practice of proximity correction by secondary exposure. *J. Appl. Physics*, **65**, 1776, 1989.

50. Leen, T.K. Dynamics of learning in linear feature-discovery networks. *Network Computation in Neural Systems* **2**, 85-105, 1991.

51. Leen, T.K. A Coordinate-Independent Center Manifold Reduction. *Physics Letters*, **A-174**, pp 89-93, 1993.

52. Leen, T.K. From Data Distributions to Regularization in Invariant Learning. *Neural Computation*, **7** , 974, 1995.

53. Kambhatla, N., and Leen, T.K. Dimension Reduction by Local Principal Component Analysis. *Neural Computation*, **9**, 1493-1516, 1997. (This paper was one of 21 articles selected for the collection *Unsupervised Learning, Foundations of Neural Computation*, Geoffrey Hinton and Terrence J. Sejnowski (eds), The MIT Press, 1999.)

54. Leen, T.K. and Moody, J.E. Stochastic Manhattan Learning, An Exact Time-Evolution Operator for the Ensemble Dynamics. *Physical Review E*, **56**,pp 1262-1265, 1997.

55. Leen, T.K., Schottky, B., and Saad, D. Optimal asymptotic learning rate Macroscopic versus microscopic dynamics. *Physical Review*, E 59, 985-991, 1999.

56. Wei, W., Leen, T.K., and Barnard, E. A Fast Histogram-Based Postprocessor that Improves Posterior Probability Estimates. *Neural Computation*,**11** , No.5, 1235-1248, 1999.

57. Sharma, R., Leen, T.K., and Pavel, M. Bayesian Image Sensor Fusion Using Local Linear Generative Models. *Optical Engineering*, **40**, 1364-1376, July, 2001.

58. Archer, C., Baptista, A., and Leen, T.K. Fault detection for salinity sensors in the Columbia River Estuary. *Water Resources Research*, **39**, 1060, 2003.

59. Williams, Alan, Roberts, Pat, and Leen, T.K. Stability of Negative-Image Equilibria in Spike-Timing Dependent Plasticity. *Physical Review E*, **68**, 2003.

60. Archer, C., and Leen, T.K. A Generalized Lloyd Type Algorithm for Adaptive Transform Coder Design. *IEEE Transactions on Signal Processing*, **52**, 1, 255-264, 2004.

61. Williams, Alan, Leen, T.K. and Roberts, Patrick D. Random walks for spike-timing-dependent plasticity. *Physical Review E*, **70**, 021916, 2004. (This paper also appears in the *Virtual Journal of Biological Physics Research*.)

62. Kazmierczak, S., Leen, T.K., Erdogmus, D. and Carreira-Perpinan, M. Reduction of multi-dimensional laboratory data to a two-dimensional plot: A novel technique for the identification of laboratory error. *Clin. Chem. Lab. Med.*, **45** (6), 749-52, 2007.

63. Lu, Zhengdong and Leen, T.K. Penalized Probabilistic Clustering. *Neural Computation*, **19**, 1528-1567, 2007.

64. Rudolph van der Merwe, Todd K. Leen, Zhengdong Lu, Sergey Frolov, and Antonio Baptista. Fast Neural Network Surrogates for Very High Dimensional River-Estuary-Ocean Circulation Models. *Neural Networks*, **20**, 462-478, 2007.

65. Segey Frolov, Antonio Baptista, Todd K. Leen, Zhengdong Lu, and Rudolph van der Merwe. Fast Data Assimilation Using a Nonlinear Kalman Filter, and a Model Surrogate: an Application to the Columbia River Estuary. *Dynamics of Atmospheres and Oceans*, DOI 10.1016, **48**, 16-45, 2009.

66. T. Hayes, K. Cobbinah, T. Disongh, J. Kaye, J. Kimel, M. Labhard, T. Leen, J. Lundell, U. Ozertem, M. Pavel, M. Philipose, K. Rhodes, and S. Vurgun. A Study of Medication-Taking and Unobtrusive, Intelligent Reminding. *Telemedicine and e-Health*, DOI: 10.1089/tmj.2009.0033, October 2009.

67. Margaret E. Morris, Qusai Kathawala, Todd K. Leen, Farzin Guilak, William Deleeuw, Michael Labhard, Ethan E. Gorenstein. Mobile Therapy: Case Study Evaluations of a Cell Phone Application for Emotional Self-Awareness. *Journal of Medical Internet Research*, **12**, 2, e10, 2010.

68. Patrick D. Roberts and Todd K. Leen. Anti-Hebbian Spike Timing Dependent Plasticity and Adaptive Sensory Processing. *Front. Comput. Neurosci.*, **4**, 156, DOI: 10.3389/fncom.2010.00156, 2010.

69. Zhengdong Lu and Todd K. Leen. Kernels for Data with Variable Sequence Length and Nonuniform Sampling Intervals. *Neural Computation*, **23** , No. 9, 2390-2420,2011.

70. Todd K. Leen and Robert Friel. Stochastic Perturbation Methods for Spike-Timing-Dependent Plasticity. *Neural Computation*, **24**, 5, 1109-1146, 2012.

71. Todd K. Leen, Robert Friel, and David Nielsen. Approximating Distributions in Stochastic Learning. *Neural Networks*, **32** , 219–228, 2012. (Invited contribution for special issue that included a selection of **∼8% of the papers** from IJCNN 2011.)

72. Jamshid Sourati, Murat Akcakaya, Jennifer G. Dy, Todd K. Leen, and Deniz Erdogmus. Classification Active Learning Based on Mutual Information. *Entropy*, 18, 51, 2016. (doi: 10,3390/e18020051)

73. Jamshid Sourati, Murat Akcakaya, Todd Leen, Deniz Erdogmus, and Jennifer Dy. Asymptotic Analysis of Objectives based on Fisher Information in Active Learning. *Journ. Mach. Learning Res.* to appear 2017.

74. Jamshid Sourati, Murat Akcakaya, Todd Leen, Deniz Erdogmus, and Jennifer Dy. A Probabilistic Active Learning Algorithm Based on Fisher Information Ratio.*IEEE Transactiona on Pattern Analysis and Machine Intelligence*, to appear.

Publications in Preparation – As of July 2017, one journal article is in preparation.

Grants

- NSF-ISS *Intergovernmental Personnel Act (IPA) Assignment*, Todd Leen, 8/12 – 12/15, $702,075.
- NSF-IIS, Smart Health and Wellbeing: *Robustly Detecting Clinical Laboratory Errors* Todd Leen (PI), Deniz Erdogmus (Co-I), 12/11–9/17, $500,000.
- NSF-IIS: *Stochastic Learning — Modeling in Machines and Brains*, Todd Leen (PI), 12/08-11/12, $284,597.
- NSF-CRCNS: *Learning and Processing of Electrosensory Patterns in Mormyrid Electric Fish*, Pat Roberts (PI), T. Leen, Nate Sawtell (Co-PIs), 9/08-8/12, $700,000.
- Intel: *Inference for Mobil Heart Health Technology*, Todd Leen (PI), 6-11/08, $23,000.
- Intel: *OHSU BAIC – Technologies for Behavioral Assessment and Intervention*, Tamara Hayes (PI), Todd Leen (Sub-project PI $324,000), 9/06-9/09.
- NSF Information Technology Research: *Quality-Scalable Information Flow Systems for Environmental Observation and Forecasting*, $4,491,407, 9/01-8/06, Antonio Baptista (PI), Dave Maier, Jon Walpole, Todd Leen (Co-PIs).
- NSF: Effects of Noise on the Electrosensory System of Mormyrid Electric Fish, $390,000, Todd Leen (PI), Pat Roberts (Co-PI), 9/01-8/04.
- NASA: *Model-Biased, Data-Driven Adaptive Failure Prediction*, $565,000, 3/15/2001-3/15/2004, Todd Leen (PI).
- NSF, Information Technology Research: *Statistical Pattern Recognition in Environmental Observation and Forecasting Systems*, $499,065, 9/1/00-9/1/03, Todd Leen (PI), Antonio Baptista (Co-PI).

- NASA: *Local Adaptive Algorithms for Sensor and Data Understanding: Towards Application to NASA Objectives*, 6/2000-8/2000, $60,270.
- NSF: *Probabilistic Models for Nonlinear PCA, Transform Coding, and Fusion*, 9/99-8/01, $137,400.
- NSF: *Fast Non-linear Transforms for Coding and Detection*, 10/97-9/99, $176,389.
- DOE: *Collaborative Research in Information Technology for Health Care Delivery*, Misha Pavel (PI), Todd Leen (PI from 5/97-9/29/97), 9/30/96-9/29/97, $457,967.
- International Human Frontier Science Program Organization: *Dynamics and Geometry in Machine Learning*, (travel grant to facilitate international collaboration), $4,621.
- Metra Biosystems: *Multifactor Analysis for Ultrasound Heel Maps*, Todd Leen (PI), 4/96-12/97, $18,600.
- ONR: *Task-Based Analysis and Stochastic Search in Neural Networks*, Ronald Cole (PI), Etienne Barnard, David Novick and Todd Leen, 6/93-5/95, $355,014.
- AFOSR: *Stochastic Learning Dynamics and Non-Linear Dimension Reduction*, Todd K. Leen (PI), 2/93-2/94, $85,000.
- Electric Power Research Institute: *Dynamics of Neural Learning*, Todd K. Leen (PI), 1/93-12/94, $168,428.
- Adaptive Solutions Inc./OACIS matching grant: *Massively Parallel Contextual Processing for Sequential Classification Tasks*, Todd K. Leen (PI) and Steve Rehfuss, 7/92-7/93, $31,860.
- NSF: *Instrumentation for the Center for Spoken Language Understanding*, Ronald Cole (PI), Mark Fanty, Todd Leen, $51,649.
- Office of Naval Research: *Silicon Association Cortex*, Dan Hammerstrom (PI), Todd Leen, Ronald Cole, 1/90-4/92, $251,628.41.

M.S. Thesis Students

1. Christopher Neil van Halewyn – *Smooth, Low-Lag Representations of Financial Time Series*, MS OGI, 1998.
2. Rafael Fernandez – *Improved Maximum Daily Salinity Predictors for CORIE*, MS OGI/OHSU, 2005. Dr. Fernandez receive his PhD. from Portland State University and is on staff at Microsoft Corp.
3. Frank Adrian – *Exact Ensemble Dynamics for Spike-Timing-Dependent Plasticity*, MS, OHSU, 2008.

Ph.D. Students

1. Nandakishore Kambhatla: *Local models and Gaussian Mixtures for Statistical Data Processing*, OGI, 1996. Dr. Kambhatla was with IBM TJ Watson Research Center and is now with IBM Bangalore, India.

2. Genevieve B. Orr: *Dynamics and Algorithms for Stochastic Search*, OGI, 1996. Dr. Orr is (full) Professor of Computer Science at Willamette University.

3. Ravi Sharma: *Probabilistic Model-based Multisensor Image Fusion*, OGI, 1999. Dr. Sharma is on staff at DigiMarc corporation.

4. Cynthia Archer: *A Framework for Representing Non-Stationary Data With Mixtures of Linear Models*, OGI/OHSU, 2002. Dr. Archer is at FLIR Systems.

5. Zhengdong Lu: *Constrained Clustering and Cognitive Decline Detection*, OGI/OHSU, 2008. Dr. Lu is on staff at Microsoft Research, Asia.

Postdoctoral Students

1. Steve Rehfuss, Text processing for health information systems. Dr. Rehfuss is with Microsoft Corporation.

2. Alex Nelson, Fault detection from helicopter vibration data. Dr. Nelson is with Apple Computer's Advanced Computation Division.

3. Biswajit Samanta, Spatial statistical models for the Columbia River Estuary. Dr. Samanta is Assistant Professor of Mining Engineering at IIT, Kharagpur, India.

4. Alan Williams, Stochastic dynamics of spike-timing dependent learning in mormyrid electric fish.

5. Rudolph van der Merwe, Large-scale data assimilation for the Columbia River Estuary. Dr. van der Merwe is with Apple Computer's Advanced Computation Division.

Research Assistants

1. Amy Boyle: Modeling, Algorithms and Experimental Verification of an Electrosensory Virtual Reality, 6/2010-6/2012.

2. Garrett Potter: Stochastic Parametric Receptive Field Estimation and Confidence Bounds. NSF-REU Intern, Summer 2010.

3. Robert Friel: Theory, Computation, and Applications of Master Equation Perturbation Expansions, 6/2010-8/2011.

4. Nathan Herrmann: Mathematica Package for Master Equation Perturbation Expansions. NSF-REU Intern, Summer 2011.

5. David Nielsen: Extended Master Equation Perturbation Expansions, 7/2011-6/2012.

6. Andrew Gao: Experimental Characterization of Electrosensory Stimulus Transducers and Monitoring Hardware, 2/2012–3/2012.

Thesis Reading Committees

Johanna Petersen Austin. *Development and Validation of an Unobtrusive, Continuous Model of Loniliness among Older Adults*, PhD., OHSU, 2015.
Andriy Myronenko. *Non-rigid Image Registration: Regularization, Algorithms and Applications*, PhD., OHSU, 2010.
Yonghong Huang. *Event-related Potentials in Electroencephalography: Characteristics and Single-trial Detection for Rapid Object Search*, PhD., OHSU, 2010.
John Lynch, *Stochastic fault simulation of triple-modular redundant asynchronous pipeline circuits*, PhD., OHSU, 2009.
Frank Adrian, *Exact Ensemble Dynamics for Spike-Timing-Dependent Plasticity*, MS, OHSU, 2008.
Shaojuan Zhu, *Associative Memory as a Bayesian Building Block*, PhD., OHSU, 2008.
Umut Ozertem, *Loacally Defined Principal Curves and Surfaces*, PhD., OGI/OHSU, 2008.
Zhengdong Lu, *Constrained Clustering and Cognitive Decline Detection*, PhD., OGI/OHSU, 2008.
Rafael Fernandez, *Improving Maximum Daily Salinity Regressor Performance in the Columbia River Estuary Project* MS, OGI/OHSU, 2005.
Sergey Frolov, *Enabling Technologies for Fast, Nonlinear Data Assimilation in a Coastal Margin Observatory*, PhD., OGI/OHSU, 2007.
Matt Saffell, *Knowledge Discovery for Time Series*, PhD., OGI/OHSU, 2005.
Nathan Lawrence Willims, *An Examination of Co-evolutionary Learning*, MS, OGI 2004.
Rudolph van der Merwe, *Sigma-Point Kalman Filters for Probabilistic Inference in Dynamic State-Space Models*, PhD., OGI/OHSU, 2004.
Cynthia Archer, *A Framework for Representing Non-Stationary Data with Mixtures of Linear Models*, PhD., OGI/OHSU, 2002.
Bruce Christenson, MS OGI, 2001.
Alex Treman Nelson, *Nonlinear Estimation and Modeling of Noisy Time-Series by Dual Kalman Filtering Methods*, PhD., OGI, 2000.
Steve Rehfuss, *Parallelism in Contextual Processing*, PhD., OGI, 1999
Ravi Krishna Sharma, *Probabilistic Model-based Multisensor Image Fusion*, PhD., OGI, 1999.
Chris van Halewyn, *Smooth, Low-lag Representations of Financial Time Series*, MS, OGI, 1997
Nandakishore Kambhatla, *Local models and Gaussian Mixtures for Statistical Data Processing*, PhD., OGI, 1996.
Genevieve Beth Orr, *Dynamics and Algorithms for Stochastic Search*, PhD., OGI, 1996.
Kay Margarethe Berkling, *Automatic Language Identification with Sequences of Language-Independent Phoneme Clusters*, PhD., OGI, 1996.
Yeshwant Muthusamy, *A Segmental Approach to Automatic Language Identification*, PhD., OGI, 1993.
James Bailey, *A VLSI Interconnect Strategy for Biologically Inspired Artificial Neural Networks*, PhD., OGI, 19922
Hitomi Ohkawa, *Object-oriented Database Support for Scientific Data Management: A System for Experimentation*, PhD., OGI, 1991.
Eric Means, *Designs for a Cortically-Inspired Neurocomputer Architecture*, MS OGI, 1991.
Darin Jackson, *A Decomposition of Backpropagation Artificial Neural Networks for Multicomputers*, MS OGI, 1991.

Lodewyk Frederik Ary Wessel, MS ECE, University of Pretoria, South Africa, 1990.

Talks

Old Dogs, New Tricks: Statistical Models for Personalized Medicine, Invited talk for JST CREST/ PRESTO Meeting with NSF Researchers and JST-NSF International Joint Symposium on Big Data, AI, IoT, Cyber Security for a New Society; Tokyo, Japan; November 28, 2016.
Analytics and Infrastructure for Climate and Environmental Dynamics, Climate Change Analytic Requirements Workshop, U. Alaska, Anchorage, September 3, 2015.
Statistical Models for Personalized Medicine, NIST, July 2, 2015.
Enabling Computational Advances in Environmental Science, Dynamic Data-Driven Environmental Systems Science (DyDESS), Nov. 7, 2014.
Opportunities in Climate Informatics, Climate Informatics, Sept. 25, 2014.
Science, Engineering, and Education for Sustainability, Fourth Annual Workshop on Understanding Climate Change, Boulder, June, 2014.
NSF Smart and Connected Health Program, ICML 2013 Machine Learning in Health Care Workshop, June 20, 2013.
Ensemble Dynamics of Synaptic Plasticity, VTCRI, Roanoke, VA, Feb. 2011.
Machine Learning for Environmental Prediction, Virginia Tech CS, Feb. 2011.
Stochastic Dynamics of Synaptic Plasticity, Reed College, Nov. 2010.
Machine Learning Solutions for a Large-Scale Environmental Observatory, Portland State University, May 2010.
Fast Surrogates for Very High-Dimensional Physical Simulations, Los Alamos National Laboratory, Jan. 2009.
Stochastic Learning — Brains and Machines, Los Alamos National Laboratory, Jan. 2009.
Local Linear Models for Sensor Fusion, NASA/DoD Second Biomorphic Explorers Workshop, Bio-Inspired Engineering of Exploration Systems 2000, Dec. 2000.
Local Probabilistic Image Fusion, Data Fusion – Theory and Applications, NIPS 2000 Workshop, Dec. 2000.
A Perturbation Expansion for Weight Space Probability Densities, On-line Learning in Neural Networks, Newton Institute for Mathematical Sciences, Cambridge University, Cambridge, UK, Nov., 1997.
Ensemble Dynamics of Stochastic Approximation: An Exactly Solvable Model, On-line Learning in Neural Networks, Newton institute for Mathematical Sciences, Cambridge University, Cambridge, UK, Nov., 1997.
A Physicist's View of Stochastic Approximation, Reed College, Feb., 1997.
Asymptotics of Stochastic Search, Dept. of Mathematics, Kings College, London, Oct., 1996.
Towards Faster Machine Learning, Defence Research Agency, Malvern, UK, Dec., 1995.
Dynamics of Online Learning. Neural Information Processing Systems Workshop, December, 1995.
Local Learning, IBM Hursley Science Center, Hursley, UK, Aug., 1995.
Local Models for Dimension Reduction, Classification, and Regression, Aston University, UK, Aug., 1995.
Ensemble Theory for Stochastic Optimization, Oregon Academy of Sciences, Linfield College, Feb. 27 1993.
Weight-Space Densities and Basin Hopping in Stochastic Learning, NEC Research Labora-

tory, Princeton, NJ, June 1992.
Stochastic Optimization, Neural Networks and the Fokker-Planck Equation, Dept. of Physics, University of Wisconsin, Milwaukee, June 1992.
Global Computation by Local Adaptation, Willamette Valley ACM, Portland, Feb. 1991.
Local Learning in Hebbian Nets, Dow Neurological Sciences Institute, Portland, Feb., 1991.
Learning in Linear Feature-Discovery Networks, SPIE Conference on Adaptive Signal Processing, San Diego, July 1991.

Significant Professional Community Service

NSF Program Director, Division of Information and Intelligent Systems, Directorate for Computer and Information Science and Engineering (CISE), National Science Foundation, August 2012 – December 2016.

My assignment at NSF provided opportunities to help shape research directions at the national level, to advise investigators for more effective proposal writing and targeting (through both public outreach activites and individual consultation), to mentor more junior program managers, and to develop new program initiatives. It broadened my scientific and leadership visions, and deepened my understanding of government research funding.

At NSF I managed the core (foundations) program in machine learning (and when first hired, also managed the AI core program). This included collaboratively selecting optimal programs for proposals, managing review, recommending awards, counseling both new and established investigators, outreach at conferences, and cross-program collaboration. The discretion extended to NSF Program Directors along with co-funding opportunities, transfer of proposals from core to cross-disciplinary programs, and new programs enabled me to substantially enhance opportunities for the research community I served.

I spearheaded and drafted, in collaboration with NSF colleagues and with input from the AI community, the NSF Dear Colleague Letter "Self-Monitoring and Self-Assessing Intelligent Systems Research for the CISE/IIS Robust Intelligence Core Program" NSF 15-112. This instrument expressed NSF's interest in funding work to ensure that intelligent systems behave as intended, through self-assessment of performance, self-prediction of limits and of errors, and incorporating ways to insure graceful rather than catastrophic failures.

In addition to my core program, I was active in the CyberSEES (Science, Engineering, and Education for Sustainability) cross-disciplinary program, which funded projects advancing computer science in application to sustainability. I served as the CISE representative on the NSF-wide SEES Integration group. Allied with these efforts, I represented NSF with presentations and as a panel discussant at workshops on climate change modeling (Fourth Workshop on Understanding Climate Change from Data, 6/14), climate informatics (Fourth International Workshop on Climate Informatics, 9/14), and data-driven environmental modeling (DyDESS 2014, 11/14). I served as a CISE representive on the "Food Energy Water Systems working group", which shaped program direction for research on the interactions between food, energy, and water systems.

I represented CISE datamining funding opportunities at the KDD 2014 Workshop "Data Science for Social Good", and the Smart Connected Health program at the KDD 2013 Workshop "Data Mining for Healthcare". I represented NSF and my own perspectives in

a panel discussion at the IEEE ICDM 2015.

The President's BRAIN Initiative, announced in April 2013, provided new challenges and opportunities for computer science in data analysis, data curation, advanced dynamical and statistical modeling, imaging technologies, and synthesis of brain-inspired computational paradigms. I served as lead CISE representative on the NSF-wide BRAIN Initiative working group, whose charter was to establish NSF's directions under the Initiative. I worked on the team that co-authored the first NSF program solicitation associated with the initiative (jointly between CISE; Engineering; Social, Behavioral, and Economic Sciences; and the Education and Human Resource directorates), and was active in the review process for proposals submitted under that solicitation.

I served as the Information and Intelligent Systems division representative for the Algorithms in the Field program, which funded collaborations between computer science algorithmic theorists and applications specialists. I worked with three other program directors in CISE to draft the solicitation, and was active in the review process during the first year of the program.

General Chair, Neural Information Processing Systems 2000 – The yearly NIPS conference integrates biological and engineering research in neural information processing systems. Presentations cover a broad range of topics including cognitive science, neuroscience, theory of learning in biological and synthetic systems, algorithms, hardware, and applications ranging from speech and image signal processing to finance.

Submissions to NIPS are full papers, rather than abstracts, and historically the conference has accepted roughly 20-25% of the submissions, i.e. below the acceptance rate for most journals. Hence the paper quality is consistently high; a point of pride among the organizers and participants.

As General Chair I oversaw the entire conference operation. I worked closely with the program chair, pre-conference tutorials chair, the two post-conference workshop chairs, the publicity chair, and the publications chair.

Our increased attention to publicity and the strength of the scientific and tutorial programs *significantly* enhanced the conference attendance; total registration increased from 448 in 1999 to 623 in 2000, an increase of 39%! This reversed a downward trend several years long. The conference attendance continued to grow in following years. Finally, we established a student paper award, a practice that continues to the present.

Program Chair, Neural Information Processing Systems 1999 – As program chair, I was responsible for the scientific content of the meeting. I recruited a committee of thirteen topical experts who served as program co-chairs, and I oversaw the reviewing and paper selection process. Each of the nearly 500 submissions to the conference (full papers, not merely abstracts) received *at least three reviews*. Soliciting, collecting, and summarizing reviews was a substantial job; we recruited over 200 reviewers who wrote nearly 1500 reviews for the program committee. Finally, I selected the invited speakers who delivered talks covering human visual perception and illusions, sound processing for cochlear implants, neural response spatial patterning, animation of human motion, anomalies in financial time series, and the role of neural firing synchrony in perception.

For the 1999 conference we migrated from paper submissions and reviews to electronic

submissions and web-based reviews. At the time, no commercial system was flexible enough to accommodate the NIPS reviewing process, so we contracted a custom system. I directed the design, development, testing, and deployment of the system (including hiring a software engineer).

Workshops Chair, Neural Information Processing Systems 1994 – The NIPS conference proper is followed by a set of workshops, traditionally at a local ski area, whose scientific content is administered independently from the main conference. As Workshops Chair, I solicited workshop proposals, developed the technical program, and directed local arrangements (including housing, transportation, catering, and skiing). The workshops were attended by a record 395 participants, and concluded with a revenue surplus. Due to this strong growth in attendance, all of the NIPS workshops in subsequent years were run by a team of *two chairs* instead of a single chair.

Other Professional Service

Data Science Executive Advisory Board, Worcester Polytechnic Institute, 2017 –.
NSF grant reviews, 2000 – .
Joint NSF / Japan Science and Technology Agency (JST) workshop on directions in AI and Big Data, November, 2016.
IARPA grant review panel 2015.
NSF Outreach - Program information talk for Dynamic Data-Driven Environmental Sytems Science (DyDESS), November 2014.
NSF Outreach - Program information talk and panel discussant for Climate Informatics, September 2014.
NSF Outreach - Funding panel discussant for KDD Workshop "Data Science for Social Good", August 2014.
NSF Outreach - Program information talk for the Fourth Annual Workshop on Understanding Climnate Change, Boulder, CO, June 2014.
NSF Outreach - ICML 2013 Panel Moderator for Workshop on Machine Learning in Health Care.
DARPA grant review panel 2013.
IJCNN Session Moderator, 2011.
NIPS Foundation Board of Directors, 2000-present.
Organizing Committee NASA/DoD Second Biomorphic Explorers Workshop, BEES 2000.
General Chair, Neural Information Processing Systems (NIPS 14) 2000.
Program Chair, Neural Information Processing Systems (NIPS 13) 1999.
Proceedings Editor, *Advances in Neural Information Processing Systems 7* (NIPS 8), The MIT Press, 1995.
Workshops Chair, Neural Information Processing Systems (NIPS 8) 1994 conference.
Theory Program Co-chair, Neural Information Processing Systems (NIPS 7) 1993 conference.
Action Editor, *Neural Computation*.
Associate Editor, *IEEE Transactions on Neural Networks*.
Ad hoc referee for journals (Science, Optical Engineering, etc.), conferences, grant agencies, and faculty promotion cases.

Institutional Service

At Georgetown University I direct the MS Data Analytics program. This new, interdisciplinary program cross-trains students in statistical modeling and computer science. As director I oversee all aspects of the program including student admissions, curriculum development and scheduling, part-time and full-time faculty hiring, and industry and government partnering. In the two years I have directed the program we have *tripled* the incoming class size from 16 in fall 2015 to 50 in fall 2017. The program is one of the largest STEM MS programs at Georgetown. I have joined with Georgetown's McCourt School of Public Policy to define the Data Science in Public Policy MS program, which will matriculate its first class in fall 2018. We are developing plans for a Business Analytics MS program in collaboration with Georgetown's McDonough School of Business.

Before joining Georgetown University, I had a long, active record of institutional service at OGI and OHSU. I serve on an ad hoc promotion evaluation committee for the Division of Environmental and Biomedical Systems at OHSU. I chaired the Neuroengineering Faculty Search Committee for the Dept. of Biomedical Engineering at OHSU in 2011–2012. I was CSEE representative on the Faculty Evaluation and Promotion Committee from 2005 until the School of Engineering closed in 2008. I served on the Gordon Moore Chair search committee 2004-2005. I helped design the project breadth and selection process for the Intel BAIC award to OHSU, working with the proposal team for a year preceding the award. I served continuously on the Educational Policy Committee from 1997 until the School of Engineering closed in 2008, and previously from 1991-1993. I have obtained funding for and organized two OCATE-sponsored distinguished lecture series on learning systems, one in 1990, and one in 2004. I have worked on numerous departmental and institutional ad hoc committees including co-authoring a major CSE curriculum revision in 1992, and organizing the 1995 CSE Department Advisory Committee Meeting. I organized the 1997-1998 Kentrox-sponsored "Perspectives in Technology" speaker series (which included talks from Daniel Weld, Jim Gray, Bill Wulf, David Tennenhouse, and Feng-Suning Hsu — one of the co-winners of the Fredkin Prize for his work on IBM's Deep Blue computer chess system). I led the construction of a set of 1998 guidelines to insure PhD thesis quality and reduce risk in our post-candidacy students. I led the effort to smoothly join the Electrical Engineering signal processing curriculum to CS curriculum when the ECE department was closed. I actively contributed to two OGI applied math committees, one in 1990, and one 2003. I served on the OGI Faculty Senate 1991-1993 and again 1995-1998.

Honors and Professional Memberships

Tau Beta Pi, Sigma Pi Sigma, Phi Kappa Phi
Plimpton-Lawton prize in Physics, Worcester Polytechnic Institute.
Research Fellowship, University of Wisconsin, Milwaukee, 1981–82.
OGI CSE Outstanding Teaching Award, CSE-OGI, 1998.
OHSU Outstanding Collaboration nomination, 2002.
Outstanding Achievement Award, OGI School of Science and Engineering, OHSU, 2006.
OHSU Award for Collaborative Achievement, OGI School of Science and Engineering, 2007.
OHSU Technology Innovation Award.

Member of American Physical Society and the IEEE.