

ZOUBIN GHAHRAMANI

PERSONAL DATA

Address: Gatsby Computational Neuroscience Unit
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Date of Birth: 8 February 1970

ACADEMIC EMPLOYMENT

Lecturer, Sep 1998–present
Gatsby Computational Neuroscience Unit, University College London

Honorary Lecturer, Sep 1998–present
Department of Computer Science and Department of Psychology, University College London

Postdoctoral Fellow, Sep 1995–Sep 1998
Department of Computer Science, University of Toronto

EDUCATION

Ph.D. in Cognitive Neuroscience, 1995. Department of Brain and Cognitive Sciences
Massachusetts Institute of Technology
Dissertation: *Computation and Psychophysics of Sensorimotor Integration*
Advisors: Michael I. Jordan and Tomaso Poggio

B.A. *summa cum laude* in Cognitive Science, 1990
Minor in Mathematics. Phi Beta Kappa
University of Pennsylvania

B.S.Eng. *summa cum laude* in Computer Science and Engineering, 1990
University of Pennsylvania

RESEARCH EMPLOYMENT

Research Assistant, Summer 1991
Siemens Corporate Research, Learning Systems Group, Princeton, NJ, USA

Senior Staff Technologist, Summer 1989, 1990
Bell Communications Research, Artificial Intelligence and Information Science Research Group,
Morristown, NJ, USA

Research Assistant, 1987–1990
University of Pennsylvania, Language, Information, and Computation Lab, Philadelphia, PA, USA

TEACHING EXPERIENCE

PhD Courses:

Unsupervised Learning (University College London, 2000, 2001)
Neural Computation (University College London, 1998)

Tutorials:

Unsupervised Learning (Technical University of Denmark, 2001)
Probabilistic Models for Unsupervised Learning (NIPS Conference, 1999)
Neural Computation (London, 1999)

Invited lecturer at:

Autumn School in Cognitive Neuroscience (Oxford, UK, 2001)
EU Advanced Course in Computational Neuroscience (Trieste, Italy, 2001)
Machine Learning PhD class at Carnegie-Mellon University (USA, 2000)
EU Advanced Course in Computational Neuroscience (Trieste, Italy, 2000)
PhD Course on Computational Motor Control (Aalborg, Denmark, 1999)
Summer School on Adaptive Processing of Temporal Information (Salerno, Italy, 1997)

Teaching Assistant at MIT:

Introduction to Psychology (1991)
Computational Cognitive Science (1992)
Cognitive Neuroscience (1994)

RESEARCH INTERESTS

Machine learning and graphical models
Motor control and multisensory integration
Statistical approaches to unsupervised learning
Computational neuroscience
Computational molecular biology

PROFESSIONAL ACTIVITIES

Editorial Board Member:

Machine Learning (2000-2001, resigned in support of *JMLR*)
Journal of Machine Learning Research (2000-2003)
Neural Computing Surveys (1998-)

Workshop Co-organizer:

Inference and Learning in Graphical Models, NIPS 1997, Breckenridge, CO, USA

Program Committee Member:

Neural Information Processing Systems (Publications Chair), 2001
Uncertainty in Artificial Intelligence, 2001
Workshop on Artificial Intelligence and Statistics, 2001
European Conference on Machine Learning, Instance Selection Workshop, 2001
American Association for Artificial Intelligence, 2000
International Conference on Machine Learning, 1998, 2000
Neural Information Processing Systems (Algorithms and Architectures Area Chair), 1999, 2000
Turkish Symposium on Artificial Intelligence and Neural Networks, 1996

Invited Participant:

Dagstuhl International Research Center for Computer Science, 2001, Wadern, Germany
Dagstuhl International Research Center for Computer Science, 1999, Wadern, Germany
Isaac Newton Institute for Mathematical Sciences, 1997, Cambridge, UK

Visiting Researcher: NTT Computer Science Labs, September, 1999, Kyoto, Japan

Grants Reviewed for: U.S. National Science Foundation (Statistics, Circuits and Signal Processing), Canadian Natural Sciences and Engineering Research Council (Computer Science), U.K. National Endowment for Science, Technology and the Arts, U.K. Engineering and Physical Sciences Research Council (Peer Review College Member). Israel–U.S.A. Binational Science Foundation. Mathematics of Information Technology and Complex Systems (Canada).

Journal Articles Reviewed for: *Exp. Brain Res.*, *IEEE Trans. Pat. Anal. & Machine Intell.*, *IEEE Trans. on Neural Networks*, *IEEE Trans. in Speech & Audio Proc.*, *J. Artif. Intell. Res.*, *J. Exp. Psychol: Human Percept. & Perform.*, *J. Machine Learn. Res.*, *Machine Learning*, *Nature*, *Nature Neuroscience*, *Neural Computation*, *Neural Networks*, *Neurocomputing*, *NeuroImage*, *Psychometrika*, *VLSI Signal Proc. Sys.*

Conference Papers Reviewed for: Annual Conference of the Cognitive Science Society, Neural Information Processing Systems, International Conference on Artificial Neural Networks and International Joint Conference on Artificial Intelligence

AWARDS

Innovation Award for Excellence in Strategic Research. Ontario Information Technology Research Centre (with G. Hinton), 1996

McDonnell-Pew Fellowship, Massachusetts Institute of Technology, 1990–1995

Dean's Scholar Award, University of Pennsylvania, 1988

University Scholar, University of Pennsylvania, 1986

25th Anniversary Scholarship, American School of Madrid, 1986

GRANTS

Gatsby Charitable Foundation: Neural Computation grant to G Hinton (Director), P Dayan, Z Li, and Z Ghahramani (1998-2008). About £10,000,000.

The Wellcome Trust, Modularity of learning in Movement Control, 2000-2003. Research grant to support Alex Korenberg's PhD studentship £ 13,580

EPSRC Life Sciences Interface Network: Processing and representation of speech and complex sounds (one of 20 members, 1999-2002, £ 50,000, headed by Prof. Chris Darwin, Sussex)

EU Marie Curie Training Site, Institute of Movement Neuroscience, 2000-2004 (one of 10 participants, 2000-2003, Euros 240,0000)

UCL Graduate School Equipment Fund, Award, 2000, £ 4300

JOURNAL ARTICLES

- [1] Wolpert, D.M, Ghahramani, Z. and Flanagan, J.R. (2001) Perspectives and Problems in Motor Learning. *Trends in Cognitive Science* **5**(11):487-494.
- [2] Raval, A., Ghahramani, Z. and Wild, D.L.,(accepted) A Bayesian network model for protein fold and remote homologue recognition. Accepted subject to revision *Bioinformatics*.
- [3] Ghahramani, Z. (2000) Building blocks of movement (News & Views). *Nature* **407**:682–683.
- [4] Wolpert, D.M. and Ghahramani, Z. (2000) Computational Principles of Movement Neuroscience. *Nature Neuroscience* **3** **supp**:1212-1217.
- [5] Ueda, N. Nakano, R., Ghahramani, Z. and Hinton, G. E. (2000) Split and Merge EM Algorithm for Improving Gaussian Mixture Density Estimates. *Journal of VLSI Signal Processing Systems* **26**(1-2): 133-140.
- [6] Ghahramani, Z. (2001) An Introduction to Hidden Markov Models and Bayesian Networks. *International Journal of Pattern Recognition and Artificial Intelligence*. **15**(1): 9-42. [Also reprinted in *Hidden Markov Models: Applications to Computer Vision* Bunke, H. and Caelli, T. (eds). World Scientific Publishing.]
- [7] Ueda, N. Nakano, R., Ghahramani, Z. and Hinton, G. E. (2000) SMEM Algorithm for Mixture Models. *Neural Computation*. **12**(9):2109–2128.
- [8] Ghahramani, Z. (2000) Variational Bayesian Learning. *Bulletin of the Italian Artificial Intelligence Association (AI*IA Notizie)*, Special Issue on Graphical Models. **13**(1):13-18.
- [9] Ghahramani, Z. and Hinton, G.E. (2000) Variational Learning for Switching State-space Models. *Neural Computation*, **12**(4):963–996. [Also reprinted in *Graphical Models, Foundations of Neural Computation*. MIT Press (2001).]
- [10] Jordan, M.I., Ghahramani, Z., Jaakkola, T.S., Saul, L.K. (1999) An Introduction to Variational Methods in Graphical Models. *Machine Learning*, **37**:183–233.
- [11] Roweis, S.T. and Ghahramani, Z. (1999) A Unifying Review of Linear Gaussian Models. *Neural Computation*, **11**(2): 305-345.
- [12] Ghahramani, Z. and Jordan, M.I. (1997) Factorial Hidden Markov Models. *Machine Learning*, **29**: 245–273.
- [13] Hinton, G.E. and Ghahramani, Z. (1997) Generative Models for Discovering Sparse Distributed Representations. *Philos. Trans. of the Royal Society of London* **B**, **352**: 1177–1190.
- [14] Ghahramani, Z. and Wolpert, D.M. (1997) Modular Decomposition in Visuomotor Learning. *Nature*, **386**:392-395.
- [15] Ghahramani, Z., Wolpert, D.M. and Jordan M.I. (1996) Generalization to Local Remappings of the Visuomotor Coordinate Transformation. *Journal of Neuroscience*, **16**(21):7085-7096.
- [16] Cohn, D.A., Ghahramani, Z. and Jordan, M.I. (1996) Active learning with statistical models. *Journal of Artificial Intelligence Research*, **4**: 129-145.
- [17] Wolpert, D.M., Ghahramani, Z. and Jordan, M.I. (1995) An Internal Model for Sensorimotor Integration. *Science*, **269**: 1880–1882.
- [18] Wolpert, D.M., Ghahramani, Z. and Jordan, M.I. (1995) Are arm trajectories planned in kinematic or dynamic coordinates? An adaptation study. *Experimental Brain Research*, **103**: 460–470.

- [19] Wolpert, D.M., Ghahramani, Z. and Jordan, M.I. (1994) Perceptual distortion contributes to the curvature of human reaching movements. *Experimental Brain Research*, **98**: 153–156.

BOOK CHAPTERS

- [20] Ghahramani, Z. (in press) Information Theory. To appear in *Encyclopedia of Cognitive Science*. Maxmillan Reference Ltd.
- [21] Roweis, S.T. and Ghahramani, Z. (in press) Learning nonlinear dynamical systems using the Expectation-Maximization algorithm. To appear in Haykin, S. (ed.) *Kalman Filtering & Neural Networks*.
- [22] Wolpert, D.M. and Ghahramani, Z. (in press) Motor learning. To appear in *Encyclopedia of Cognitive Science*. Maxmillan Reference Ltd.
- [23] Ghahramani, Z. and Beal, M.J. (2001) Graphical models and variational methods. In Saad, D. and Opper, M. (ed.) *Advanced Mean Field Methods—Theory and Practice*, 161–177. MIT Press.
- [24] Wolpert, D.M. and Ghahramani, Z. (2000) Maps, modules, and internal models in human motor control. In J. Winters and P. Crago (eds.), *Biomechanics and Neural Control of Posture and Movement*, Chapter 23:317-324. Springer-Verlag.
- [25] Sallans, B., Hinton, G.E., and Ghahramani, Z. (1998) A Hierarchical Community of Experts. In Bishop, C.M. (ed.) *Neural Networks for Machine Learning*, 269–284. Springer-Verlag.
- [26] Ghahramani, Z. (1998) Learning Dynamic Bayesian Networks. In C.L. Giles and M. Gori (eds.), *Adaptive Processing of Sequences and Data Structures*. Lecture Notes in Artificial Intelligence, 168–197. Berlin: Springer.
- [27] Hinton, G.E., Sallans, B. and Ghahramani, Z. (1998) A Hierarchical Community of Experts. In M.I. Jordan (ed.), *Learning in Graphical Models*, 479–494. Dordrecht: Kluwer Academic Press.
- [28] Jordan, M.I., Ghahramani, Z., Jaakkola, T.S., Saul, L.K. (1998) An Introduction to Variational Methods in Graphical Models. In M.I. Jordan (ed.), *Learning in Graphical Models*, 105–161. Dordrecht: Kluwer Academic Press.
- [29] Ghahramani, Z., Wolpert, D.M., and Jordan, M.I. (1997) Computational Models of Sensorimotor Integration. In P.G. Morasso and V. Sanguineti (eds.), *Self-Organization, Computational Maps and Motor Control*, 117–147. Amsterdam: North-Holland
- [30] Ghahramani, Z. and Jordan, M.I. (1997) Mixture models for learning from incomplete data. In R. Greiner, T. Petsche and S.J. Hanson (eds.), *Computational Learning Theory and Natural Learning Systems, Vol. IV*, 67–85. Cambridge, MA: MIT Press.
- [31] Cohn, D.A., Ghahramani, Z. and Jordan, M.I. (1997) Active learning with mixture models. In R. Murray-Smith and T.A. Johansen (eds.), *Multiple Model Approaches to Modelling and Control*, 167–183. London: Taylor and Francis Press.

REFEREED CONFERENCE PAPERS

- [32] Beal, M. J., Ghahramani, Z. and Rasmussen, C. E. (2001) The infinite hidden Markov model. To appear in *Advances in Neural Information Processing Systems 14*. Cambridge, MA: MIT Press.
- [33] Rasmussen, C. E. and Ghahramani, Z. (2001) Infinite mixtures of Gaussian process experts. To appear in *Advances in Neural Information Processing Systems 14*. Cambridge, MA: MIT Press.

- [34] Rangel, C., Wild, D.L. Falciani, F., Ghahramani, Z., and Gaiba, A. (2001) Modelling biological responses using gene expression profiling and linear dynamical systems. *International Conference in Systems Biology: The Future of Biology in the 21st Century*. Caltech, CA, USA, Nov 4-7, 2001.
- [35] Ghahramani, Z. and Beal, M.J. (2000) Propagation Algorithms for Variational Bayesian Learning. In T. K. Leen, T. G. Dietterich, and V. Tresp (eds.) *Advances in Neural Information Processing Systems* **13**:507–513. Cambridge, MA: MIT Press.
- [36] Rasmussen, C.E. and Ghahramani, Z. (2001) Occam’s Razor. In T. K. Leen, T. G. Dietterich, and V. Tresp (eds.) *Advances in Neural Information Processing Systems*, **13**:294–300. Cambridge, MA: MIT Press.
- [37] Ueda, N. and Ghahramani, Z. (2000) Optimal Model Inference for Bayesian mixture of Experts. To appear in *IEEE Neural Networks for Signal Processing*. (NNSP 2000) Sydney, Australia.
- [38] Adams, N.J., Storkey, A.J., Ghahramani, Z. and Williams, C.K.I. (2000) MFDTs: Mean Field Dynamic Trees. In *15th International Conference on Pattern Recognition*, Barcelona, Sep 3-8. Vol. 3, pp 151-154.
- [39] Hinton, G.E., Ghahramani, Z. and Teh, Y.W. (2000) Learning to Parse Images. In S.A. Solla, T.K. Leen and K.-R. Müller (eds.) *Advances in Neural Information Processing Systems* **12**:463–469. Cambridge, MA: MIT Press.
- [40] Ghahramani, Z. and Beal, M. (2000) Variational Inference for Bayesian Mixture of Factor Analysers. In S.A. Solla, T.K. Leen and K.-R. Müller (eds.) *Advances in Neural Information Processing Systems* **12**:449–455. Cambridge, MA: MIT Press.
- [41] Ghahramani, Z., Korenberg, A., and Hinton, G.E. (1999) Scaling in a Hierarchical Unsupervised Network. In *ICANN 99: Ninth international conference on Artificial Neural Networks*, 13–18.
- [42] Ueda, N., Nakano, R., Ghahramani, Z. and Hinton, G.E. (1999) Pattern Classification using a Mixture of Factor Analyzers. In *Neural Networks for Signal Processing*, 525–533.
- [43] Ghahramani, Z. and Roweis, S. (1999) Learning nonlinear dynamical systems using an EM algorithm. In M. S. Kearns, S. A. Solla, D. A. Cohn, (eds.) *Advances in Neural Information Processing Systems* **11**:431–437. Cambridge, MA: MIT Press.
- [44] Ueda, N., Nakano, R., Ghahramani, Z. and Hinton, G.E. (1999) SMEM Algorithm for Mixture Models. In M. S. Kearns, S. A. Solla, D. A. Cohn, (eds.) *Advances in Neural Information Processing Systems* **11**:599–605. Cambridge, MA: MIT Press.
- [45] Ueda, N., Nakano, R., Ghahramani, Z. and Hinton, G.E. (1998) Split and Merge EM algorithm for improving Gaussian mixture density estimates. *Neural Networks for Signal Processing*, 274–283.
- [46] Ghahramani, Z. and Hinton, G.E. (1998) Hierarchical non-linear factor analysis and topographic maps. *Advances in Neural Information Processing Systems*. **10**. Cambridge, MA: MIT Press.
- [47] Jordan, M.I., Ghahramani, Z. and Saul L.K. (1997) Hidden Markov decision trees. In M. Mozer, M. Jordan, and T. Petsche (eds.), *Advances in Neural Information Processing Systems*. **9**:501–507. Cambridge, MA: MIT Press.
- [48] Ghahramani, Z. and Jordan, M.I. (1996) Factorial Hidden Markov Models. In D. Touretzky, M. Mozer and M. Hasselmo (eds.), *Advances in Neural Information Processing Systems*. **8**:472–478. Cambridge, MA: MIT Press.
- [49] Ghahramani, Z. (1995) Factorial learning and the EM algorithm. In G. Tesauro, D.S. Touretzky and T.K. Leen (eds.), *Advances in Neural Information Processing Systems*. **7**:617–624. Cambridge, MA: MIT Press.

- [50] Ghahramani, Z., Wolpert, D.M. and Jordan, M.I. (1995) Computational structure of coordinate transformations: A generalization study. In G. Tesauro, D.S. Touretzky and T.K. Leen (eds.), *Advances in Neural Information Processing Systems*. **7**:1125–1132. Cambridge, MA: MIT Press.
- [51] Wolpert, D.M., Ghahramani, Z. and Jordan, M.I. (1995) Forward dynamic models in human motor control: Psychophysical evidence. In G. Tesauro, D.S. Touretzky and T.K. Leen (eds.), *Advances in Neural Information Processing Systems*. **7**:43–50. Cambridge, MA: MIT Press.
- [52] Cohn, D.A., Ghahramani, Z. and Jordan, M.I. (1995) Active learning with statistical models. In G. Tesauro, D.S. Touretzky, and T.K. Leen (eds.), *Advances in Neural Information Processing Systems*. **7**:705–712. Cambridge, MA: MIT Press.
- [53] Ghahramani, Z. (1994) Solving inverse problems using an EM approach to density estimation. In M.C. Mozer, P. Smolensky, D.S. Touretzky, J.L. Elman, & A.S. Weigend (eds.), *Proceedings of the 1993 Connectionist Models Summer School*, 316–323. Hillsdale, NJ: Erlbaum Associates.
- [54] Ghahramani, Z., and Jordan, M.I. (1994) Supervised learning from incomplete data using an EM approach. In J.D. Cowan, G. Tesauro, and J. Alspecter (eds.), *Advances in Neural Information Processing Systems*. **6**:120–127. San Francisco, CA: Morgan Kaufmann Publishers.
- [55] Ghahramani, Z. and Allen, R.B. (1991) Temporal Processing with Connectionist Networks. In *Proceedings of the International Joint Conference on Neural Networks*, 541–546, Seattle, WA.

ABSTRACTS

- [56] Wild, D.L., Raval, A. and Ghahramani, Z. (2000) A Bayesian network model for protein fold and remote homologue recognition. *Eighth International Conference on Intelligent Systems for Molecular Biology (ISMB '00)*. La Jolla, CA, August, 2000.
- [57] Todorov, E and Ghahramani, Z. (2000) Degrees of freedom and hand synergies in manipulation tasks. *Neural Control of Movement*, Key West, FL.
- [58] Vetter, P, Ghahramani, Z, Kawato, M, and Wolpert DM. (2000) Multiple linear controllers for non-linear and nonstationary dynamics. *Neural Control of Movement*, Key West, FL.
- [59] Hamilton, A.F. Jones, K.E. Ghahramani, Z., Lemon, R.N, & Wolpert, D.M. (2000) The coding of movements in primary motor cortex: a TMS study. *ICN-ISC meeting*, Lyons, France.
- [60] Ghahramani, Z. (1999) Time for Bayes: Comments to Amari and Kohonen. *Bulletin of the International Statistical Institute* 52nd Session:115–116. Helsinki, Finland.
- [61] Attias, H. and Ghahramani, Z. (1999) Enhanced Generalization of Supervised Learning by Coupling to Graphical Models. Presented at *The Learning Workshop* in Snowbird, UT.
- [62] Wild, D. and Ghahramani, Z. (1998) A Bayesian Network Approach to Protein Fold Recognition. *Sixth International Conference on Intelligent Systems for Molecular Biology (ISMB '98)*. Montreal, Canada, June, 1998.
- [63] Ghahramani, Z. and Hinton, G.E. (1998) Explaining Images by Integrating over Trees. Presented at the *Machines that Learn Workshop* in Snowbird, UT.
- [64] Ghahramani, Z. and Hinton, G.E. (1997) Switching State-space models. Presented at the *Machines that Learn Workshop* in Snowbird, UT.
- [65] Ghahramani, Z., Wolpert, D.M. and Jordan, M.I. (1995) Computational principles of multisensory integration: Studies of adaptation to novel visuo-auditory remappings. *Society for Neuroscience Abstracts*. **21**(1-3):1181.

SELECTED TECHNICAL REPORTS

- [66] Ghahramani, Z. and Hinton, G.E. (1996) The EM algorithm for mixtures of factor analyzers. Department of Computer Science Technical Report CRG-TR-96-1, University of Toronto.
- [67] Ghahramani, Z. and Hinton, G.E. (1996) Parameter estimation for linear dynamical systems. Department of Computer Science Technical Report CRG-TR-96-2, University of Toronto.
- [68] Rasmussen, C.E., Neal R.M., Hinton, G.E., van Camp, D., Revow, M., Ghahramani, Z., Kustra, R. and Tibshirani, R. (1996) *The Delve Manual*. Department of Computer Science Technical Report. University of Toronto.
- [69] Ghahramani, Z. (1995) *Computation and Psychophysics of Sensorimotor Integration*. Ph.D. Thesis, Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology.
- [70] Ghahramani, Z. (1990) A neural network for learning how to parse Tree Adjoining Grammars. Undergraduate Thesis, Department of Computer Science Engineering and Cognitive Science Program, University of Pennsylvania.

INVITED TALKS (1997–)

- 2001** International Research Center for Computer Science, Schloss Dagstuhl, GERMANY
Microsoft Research, Cambridge UK
Department of Computer Science, University of Essex, UK
School of Cognitive and Computing Sciences, University of Sussex, UK
- 2000** Department of Computer Science, Carnegie Mellon University, USA
Workshop on Real-Time Modeling for Complex Learning Tasks, NIPS Conference, USA
Department of Computer Science, Technical University of Helsinki, FINLAND
Institute for Communicating and Collaborative Systems, University of Edinburgh, UK
Department of Engineering, University of Cambridge, UK
Instituto Superior Tecnico, Lisbon, PORTUGAL
20/20 Speech, Great Malvern, UK
NeuroCOLT Meeting on New Perspectives in the Theory of Neural Nets, Graz, AUSTRIA
Dept. of Experimental Math. and Stat., Vienna Univ. of Econ. and Bus. Admin., AUSTRIA
Neural Control of Movement, Computational Satellite Meeting, Key West, FL, USA
Department of Mathematical Sciences, University of Durham, UK
Institute for Adaptive and Neural Computation, University of Edinburgh, UK
- 1999** Department of Statistical Science, University College London, UK
Workshop on Advanced Mean Field Methods, NIPS Conference, Breckenridge, USA
Department of Experimental Psychology, University of Sussex, UK
ATR Human Information Processing Research Laboratories, Kyoto, JAPAN
NTT Computer Science Laboratory, Kyoto, JAPAN
Neural Networks Session, Meeting of the International Statistical Institute, Helsinki, FINLAND
International Research Center for Computer Science, Schloss Dagstuhl, GERMANY
Department of Mathematical Modelling, Technical University of Denmark, DENMARK
PhD Course on Computational Issues in Motor Control, Aalborg University, DENMARK
- 1998** Workshop on Statistical Theories of Cortical Function, NIPS Conference, Breckenridge, USA
Workshop on Sequential Inference and Learning, NIPS Conference, Breckenridge, USA
Workshop on Learning Relational Data Representations, NIPS Conference, Breckenridge, USA
Neural Systems Group, Imperial College, London, UK
Beckman Institute, University of Illinois, IL, USA
Department of Electrical and Computer Engineering, McMaster University. Hamilton, CANADA
- 1997** Isaac Newton Institute for Mathematical Sciences, Cambridge, UK
Department of Psychology, York University, Toronto, CANADA
Annual Meeting of the Canadian Applied Math Society, Fields Institute, Toronto, CANADA
Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD, USA
Machine Learning and Information Retrieval, AT&T Labs – Research, Murray Hill, NJ, USA
Workshop on Autoencoders/Autoassociators. NIPS Conference. Breckenridge, CO, USA
Workshop on Learning Dynamical Data Structures, NIPS Conference. Breckenridge, CO, USA
Bioinformatics Group, Glaxo-Wellcome Medicines Research. Stevenage, UK