Curriculum Vitae

Richard S. Zemel

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Contact Information

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Academic Background

- **Professor**, University of Toronto, Dept. of Computer Science, 2009-present.
- **Visiting Scholar**, U. of Calif., Berkeley, Dept. of Elec. Eng. & Comp. Sci., 2008-09.
- **Visiting Professor**, Stanford University, Dept. of Computer Science, 2008-09.
- **Associate Professor**, University of Toronto, Dept. of Computer Science, 2001-2009.
- **Visiting Faculty**, Princeton University, Department of Biophysics, Jan-Jun 2004.
- **Adjunct Member**, York University, Center for Vision Research, 2000-present.
- **Assistant Professor**, University of Toronto, Dept. of Computer Science, 2000-2001.
- **Assistant Professor**, University of Arizona, Depts. of Psychology & Computer Science, 1996-2000.
- **Postdoctoral Fellow**, Carnegie Mellon University, Depts. of Psychology & Computer Science, 1994-1996.
- **Postdoctoral Fellow**, Salk Institute, Computational Neurobiology Laboratory, 1992-1994.
- **Doctor of Philosophy**, University of Toronto, Dept. of Computer Science, 1989-1993.
- **Master's of Science**, University of Toronto, Dept. of Computer Science, 1987-1989.
- **Bachelor of Arts**, Harvard University, Dept. of History and Science, 1980-1984.

Grants & Fellowships

- National Sciences and Engineering Research Council (NSERC) Discovery Grant, "Machine learning for image undertanding and user modelling", 2009-2014. Total award: $250,000
- National Sciences and Engineering Research Council (NSERC) Discovery Accelerator Supplement, 2009-2012. Total award: $120,000.
- National Sciences and Engineering Research Council (NSERC) Strategic Partnerships Grant, "New machine learning methods for collaborative filtering, document retrieval and image retrieval", 2008-2010. Co-PI, total award: $194,000.
- Microsoft Research/Live Labs Research Grant, "Digital photo organization", 2007-2009. Total award: $100,000.
- James S. McDonnell Foundation Collaborative Research Program, "Understanding recovery from brain injury: Putting network models to work", 2005-2008. Co-PI, total award: $940,000.
- Communications and Information Technology Ontario (CITO) Partnerships Grant, "Semantic retrieval of image and video data", 2005-2007. Co-PI, total award: $250,000
- National Sciences and Engineering Research Council (NSERC) Discovery Grant, "Learning intermediate representations", 2004 - 2008, $150,000.
- Canada Foundation for Innovation (CFI) New Opportunities Grant, "Machine learning and neural networks laboratory", 2002-2005. Co-PI, total award: $413,000.
- Institute for Robotics and Intelligent Systems (IRIS) Research Grant, "Learning algorithms", 2002-2005. Co-PI, total award: $495,000.
- Canadian Institutes for Health Research (CIHR), New Emerging Teams grant, "Development of an integrative computational neuroscience program to understand human mental function", 2002 - 2007. Co-PI, total award: $968,000.
- National Sciences and Engineering Research Council (NSERC) Individual Research Award, "Population code belief networks", 2000 - 2003, $100,000.
- Bell University Laboratories Research Grant, 2000-2003. $60,000.
- Connaught Startup Grant, 2000-2002. $10,000.
- Young Investigator Award, Office of Naval Research, "Computational models of cortical population codes", 2000 - 2002, $144,000.
- National Institutes of Health (NIH) Program Project Grant, 1997-2002. Co-PI, Total award amount: $1.1M.

Honours, Awards, & Scholarships

- Discovery Accelerator Supplement, National Sciences and Engineering Research Council, 2009-2012.
- Fellow, Canadian Institute for Advanced Research, 2007-2010.
- Dean's Excellence Award, University of Toronto, 2005, 2006, 2007, 2008.
- New Opportunities Award, Canada Foundation for Innovation, 2002-2007.
- Young Investigator Award, Office of Naval Research, 1998-2002.
- Postdoctoral Fellowship, National Science Foundation, 1994-1996 (declined).
- National Sciences and Engineering Research Council Postgraduate Scholarship, 1989-1991.
- Ontario Graduate Scholarship, University of Toronto, 1989-1990.
- U.S. Alumni Fellowship, University of Toronto, 1987-1988.
- B.A. degree *magna cum laude*, Harvard University, 1984.
- John Harvard Scholarship, 1980-1984.
- Richard King Mellon National Merit Scholarship, 1980-1984.
- Presidential Scholar, 1980.

Industrial & Research Experience

- **Microsoft/LiveLabs**, Redmond – Consultant (2006-2008)
- **Medipattern**, Toronto – Consultant (2001-2002)
- **Public Optical, Inc.**, Toronto – Consultant (1991-1992)
- **Carnegie Group Inc.**, Pittsburgh – Project Manager (1986-1987)
- **Carnegie Group Inc.**, Pittsburgh – Senior Engineer (1984-1986)
- **Carnegie Mellon University**, Pittsburgh – Research Assistant (summers, 1982-1984)

Publications

Articles in Refereed Journals

Snoek, J, Hoey, J, Stewart, L, Zemel, RS, & Mihalidis, A. (2009). Automated detection of unusual events on stairs. *Image and Vision Computing Journal*. 27(1): 153-166.

Natarajan, R, Huys, Q, Dayan, P, & Zemel, RS (2008). Encoding and decoding dynamic population codes. *Neural Computation*. 20(9): 2325-2360.

Stewart, L, He, X, & Zemel, RS (2008). Learning flexible features for conditional random fields. *IEEE Transactions: Pattern Analysis and Machine Intelligence*. 30(8): 1415-1426.

Klam, F, Zemel, RS, & Pouget, A (2008). Population coding with motion energy filters: The impact of correlations. *Neural Computation*, 20(1): 146 - 175.

Huys, Q, Zemel, RS, Natarajan, R, & Dayan, P (2007). Fast population coding. *Neural Computation*, 19(2): 460-497.

He, X, Zemel, RS., & Mnih, V. (2006). Topological map learning from outdoor image sequences. *Journal of Field Robotics*, 23(11/12): 1091-1104.

Ross, D & Zemel, RS (2006). Learning parts-based representations of data. *Journal of Machine Learning Research*: 2369-2397.

Welling, M, Zemel, RS, & Hinton, GE (2004). Probabilistic sequential independent components analysis. *Transactions in Neural Networks*, 15:4, pp. 838-849.

Pouget, A, Dayan, P, & Zemel, RS (2003). Computation and inference with population codes. *Annual Reviews of Neuroscience: 26*, pp. 381-410.

Zemel, RS & Mozer, MC (2002). Localist attractor networks. *Neural Computation*, 13:5, pp. 1045-1064.

Zemel, RS, Behrmann, M, Mozer, MC, & Bevalier, D (2002). Experience-dependent perceptual grouping and object-based attention. *Journal of Experimental Psychology: Human Perception and Performance*, 28:1, pp. 202-217.

Zemel, RS & Pillow, J (2000). Encoding multiple orientations in a recurrent network. *Neurocomputing*, 32-33, pp. 609-616. Preliminary version appeared in: *Proceedings of the 1999 Computational Neuroscience Meeting*.

Behrmann, M, Zemel, RS, & Mozer, MC (2000). Occlusion, symmetry, and object-based attention: Reply to Saiki (2000). *Journal of Experimental Psychology: Human Perception and Performance*, 26:4, pp. 1497-1505.

Pouget, A, Dayan, P, & Zemel, RS (2000). Information processing with population codes. *Nature Reviews Neuroscience*, 1, pp. 125-132.

Zemel, RS, Dayan, P, & Pouget, A (1998). Probabilistic interpretation of population codes. *Neural Computation*, 10:2, pp. 403-430.

Zemel, RS & Sejnowski, TJ (1998). A model for encoding multiple object motions and self-motion in area MST of primate visual cortex. *The Journal of Neuroscience*, 18:1, pp. 531-547.

Behrmann, M, Zemel, RS, & Mozer, MC (1998). Object-based attention and occlusion: Evidence from normal subjects and a computational model. *Journal of Experimental Psychology: Human Perception and Performance*, 24:4, pp. 1011-1036.

Gray, M, Pouget, A, Zemel, RS, Nowlan, SJ, & Sejnowski, TJ (1998). Reliable disparity estimation through selective integration. *Visual Neuroscience*, 15, pp. 511-528.

Zemel, RS & Hinton, GE (1995). Developing population codes by minimizing description length. *Neural Computation*, 7:3, pp. 549-564.

Zemel, RS, Williams, CKI, & Mozer, MC (1995). Lending direction to neural networks. *Neural Networks*, 8:4, pp. 503-512.

Dayan, P & Zemel, RS (1995). Competition and multiple cause models. *Neural Computation*, 7:3, pp. 565-579.

Dayan, P, Hinton, GE, Neal, R, & Zemel, RS (1995). The Helmholtz Machine. *Neural Computation*, 7:5, pp. 889-904.

Mozer, MC, Zemel, RS, Behrmann, M, & Williams, CKI (1992). Learning to segment images using dynamic feature binding. *Neural Computation*, 4:5, pp. 647-662.

Refereed Conference Papers

Marlin, B & Zemel, RS (2009). Collaborative prediction and ranking with non-random missing data. In: *RecSys-2009: 3rd ACM Conference on Recommender Systems. Best paper award*.

Volkovs, M & Zemel, RS (2009). BoltzRank: Learning to maximize expected ranking gain. In: *ICML-2009: Proceedings of the 24th International Conference on Machine Learning*. *Best student paper award*.

Natarajan, R, Murray, I, Shams, L, & Zemel, RS (2009). Validating a Bayesian model of conflicting sensory inputs. In: *COSYNE-09: Computational and Systems Neuroscience Conference*

He, X & Zemel, RS (2008). Learning hybrid models for image annotation with partially labeled data. In: *NIPS-2008: Advances in Neural Information Processing Systems*.

Natarajan, R, Murray, I, Shams, L, & Zemel, RS (2008). Comparing model predictions of response bias and variance in cue combination. In: *NIPS-2008: Advances in Neural Information Processing Systems*.

Schmah, T, Hinton, G, & Zemel, RS (2008). Competing RBM density models for classification of fMRI images. In: *NIPS-2008: Advances in Neural Information Processing Systems*.

Ross, D, Tarlow, D, & Zemel, RS (2008). Unsupervised learning of skeletons from motion. In: *ECCV-2008: European Conference on Computer Vision*.

Tarlow, D, Zemel, RS, & Frey, B (2008). Flexible priors for exemplar-based clustering. In: *UAI-2008: 24th Conference on Uncertainty in Artificial Intelligence*.

He, X & Zemel, RS (2008). Latent topic random fields: Learning using a taxonomy of labels. In: *CVPR-2008: IEEE Conference on Computer Vision and Pattern Recognition* , Los Alamitos, CA, IEEE Computer Society.

Meeds, E, Ross, D, Roweis, S. & Zemel, RS (2008). Learning stick-figure models using non-parametric Bayesian priors over trees. In: *CVPR-2008: IEEE Conference on Computer Vision and Pattern Recognition*, Los Alamitos, CA, IEEE Computer Society.

Marlin, B, Zemel, RS, Roweis, S & Slaney, M (2007). Collaborative filtering and the missing at random assumption. In: *UAI-2007: 23rd Conference on Uncertainty in Artificial Intelligence*.

Huys Q, & Zemel, RS, Natarajan, R, & Dayan, P (2007). Gaussian priors for population coding. In: *CNS-07: Computational Neuroscience Conference*.

He, X, Zemel, RS, & Ray, D (2006). Learning and incorporating top-down cues in image segmentation. In: *ECCV-2006: European Conference on Computer Vision*, LNCS 2951, (pp. 338-351).

Snoek, J, Hoey, J, Stewart, L & Zemel, RS. (2006). Automated detection of unusual events on stairs. In: *Canadian Conference on Computer and Robot Vision* (pp. 5-13).

Natarajan, R, Huys, Q, Dayan, P & Zemel, RS (2006). Population codes for dynamic cue combination. In: *COSYNE-06: Computational and Systems Neuroscience Conference*

Ross, D, Osindero, S, & Zemel, RS (2006). Combining discriminative features to infer complex trajectories. In: *ICML-2006: Proceedings of the 21st International Conference on Machine Learning* (pp. 761-769).

Natarajan, R, Huys, Q, Dayan, P & Zemel, RS (2006). Population codes for natural dynamic stimuli. In: *CNS-06: Computational Neuroscience Conference*. [34% acceptance rate].

Marlin, B, Roweis, S, & Zemel, RS (2005). Unsupervised learning with non-ignorable missing data. In: *Proceedings of the Tenth International Workshop on Artificial Intelligence and Statistics*, C. M. Bishop & B. J. Frey (Eds.).

Zemel, RS, Huys, Q, Natarajan, R, & Dayan, P (2004). Probabilistic computation in spiking populations. In: *NIPS-17: Advances in Neural Information Processing Systems 17*. Cambridge, MA, MIT Press. (pp. 1609-1616).

Carreira-Perpinan, M & Zemel, RS (2004). Proximity graphs for clustering and manifold learning. In: *NIPS-17: Advances in Neural Information Processing Systems 17*. Cambridge, MA, MIT Press. (pp. 225-232).

Marlin, B & Zemel, RS (2004). The multiple multiplicative factor model for collaborative filtering. *ICML-2004: Proceedings of the 21st International Conference on Machine Learning*.

He,X, Zemel, RS, & Carreira-Perpinan, M (2004). Multiscale conditional random fields for image labelling. *CVPR-2004: IEEE Conference on Computer Vision and Pattern Recognition*.

Boutilier, C, Zemel, RS, & Marlin, B (2003). Active collaborative filtering. *UAI-2003: 19th Conference on Uncertainty in Artificial Intelligence.*

Welling, M, Zemel, RS, & Hinton, GE (2003). Efficient parametric projection pursuit density estimation. *UAI-2003: 19th Conference on Uncertainty in Artificial Intelligence.*

Ross, DA & Zemel, RS (2002). Multiple-cause vector quantization. *NIPS-15: Advances in Neural Information Processing Systems 15*. Cambridge, MA, MIT Press.

Welling, M, Zemel, RS, & Hinton, GE (2002). Self supervised boosting. *NIPS-15: Advances in Neural Information Processing Systems 15*. Cambridge, MA, MIT Press.

Boutilier, C & Zemel, RS (2002). Online queries for collaborative filtering. *Proceedings of the Ninth International Workshop on Artificial Intelligence and Statistics*, C. M. Bishop & B. J. Frey (Eds.).

Zemel, RS, Hungerford, M, & Mozer, MC. (2002). Experience effects in neural coding. *Proceedings of 2002 Neural Information and Coding Conference*.

Zemel, RS & Pitassi, T. (2001). A gradient-based boosting algorithm for regression problems. *NIPS-13: Advances in Neural Information Processing Systems 13*. (pp. 696-702). T. K. Leen, T. G. Dietterich, & V. Tresp (Eds.). Cambridge, MA, MIT Press.

Cowen, S, Zemel, RS, Kudrimoti, H, Gerrard, J, & McNaughton, B (2000). Spike train segmentation and recognition: Identifying the neural correlate of decisions. *Proceedings of the 2000 Computational Neuroscience Meeting*.

Zemel, RS & Mozer, MC (2000). A generative model for attractor dynamics. *NIPS-12: Advances in Neural Information Processing Systems 12*. (pp. 80-86). S. A. Solla, T. K. Leen & K.-R. Muller (Eds.). Cambridge, MA: MIT Press.

Yang, Z & Zemel, RS (2000). Managing uncertainty in cue combination. *NIPS-12: Advances in Neural Information Processing Systems 12* (pp. 869-875). S. A. Solla, T. K. Leen & K.-R. Muller (Eds.). Cambridge, MA: MIT Press.

Zemel, RS & Dayan, P (1999). Distributional population codes and multiple motion models. *NIPS-11: Advances in Neural Information Processing Systems 11*. (pp. 174-180). Cambridge, MA: MIT Press.

Zemel, RS & Dayan, P (1997). Combining probabilistic population codes. *IJCAI-97: Fifteenth International Joint Conference on Artificial Intelligence* (pp. 1114-1119). Morgan Kaufmann.

Zemel, RS, Dayan, P, & Pouget, A (1997). Probabilistic interpretation of population codes. *NIPS-9: Advances in Neural Information Processing Systems 9* (pp. 676-683). M. C. Mozer, M. I. Jordan, & T. Petsche (Eds.). Cambridge, MA: MIT Press.

Zemel, RS, & Sejnowski, TJ (1995). Grouping components of three-dimensional moving objects in area MST of visual cortex. In G. Tesauro, D. S. Touretzky, & T. K. Leen (Eds.), *NIPS-7: Advances in Neural Information Processing Systems 7* (pp. 165-172). Cambridge, MA: MIT Press.

Zemel, RS, & Hinton, GE (1994). Developing population codes by minimizing description length. In *NIPS-6: Advances in Neural Information Processing Systems 6* (pp. 11–18). J. D. Cowan, G. Tesauro, J. Alspector (Eds.). San Mateo, CA: Morgan Kaufmann.

Hinton, GE, & Zemel, RS (1994). Autoencoders, Minimum Description Length, and Helmholtz free energy. In *NIPS-6: Advances in Neural Information Processing Systems 6* (pp. 3–10). J. D. Cowan, G. Tesauro, J. Alspector (Eds.). San Mateo, CA: Morgan Kaufmann.

Zemel, RS, Williams, CKI, & Mozer, MC (1993). Directional-unit Boltzmann machines. In C. L. Giles, S. J. Hanson, & J. D. Cowan (Eds.), *NIPS-5: Advances in Neural Information Processing Systems 5* (pp. 172-179). San Mateo, CA: Morgan Kaufmann.

Mozer, MC, Zemel, RS & Behrmann, M (1992). Learning to segment images using dynamic feature binding. In J. E. Moody, S. J. Hanson, & R. P. Lippmann (Eds.), *NIPS-4: Advances in Neural Information Processing Systems 4* (pp. 436-443). San Mateo, CA: Morgan Kaufmann.

Mozer, MC, Zemel, RS & Behrmann, M (1992). Discovering and using perceptual grouping principles in visual information processing. *Proceedings of the 14th Annual Conference of the Cognitive Society*. Bloomington, IN: Lawrence Erlbaum.

Zemel, RS & Hinton, GE (1991). Discovering viewpoint-invariant relationships that characterize objects. In R. P. Lippmann, J. E. Moody, & D. S. Touretzky (Eds.), *NIPS-3: Advances in Neural Information Processing Systems 3* (pp. 299-305). San Mateo, CA: Morgan Kaufmann.

Zemel, RS, Mozer, MC, & Hinton, GE (1990). TRAFFIC: Object recognition using hierarchical reference frame transformations. In D. S. Touretzky, (Ed.), *NIPS-2: Advances in Neural Information Processing Systems 2* (pp. 266-273). San Mateo, CA: Morgan Kaufmann.

Book Chapters

Pouget, A & Zemel, RS. (2007). In: K Doya & K Ishii (Eds.), *Bayesian Brain: Probabilistic Approaches to Neural Coding* (pp. 115-130). MIT Press.

Zemel, RS (2003). Cortical belief networks. In: R. Hecht-Neilsen & T. McKenna (Eds.), *Computational Models for Neuroscience* (pp. 267-287). Springer-Verlag.

Zemel, RS & Pillow, J (2002). An information-theoretic objective for population codes. In: R. Rao & B. Olshausen (Eds.) *Statistical Theories of Cortical Function* (pp. 223-242). MIT Press,

Zemel, RS (2002). Minimizing description length and neural networks. In: M. A. Arbib (Ed.), *The Handbook of Brain Theory and Neural Networks, Volume II*. MIT Press.

Becker, S & Zemel, RS (2002). Unsupervised learning with global objective functions. In: M. A. Arbib (Ed.), *The Handbook of Brain Theory and Neural Networks, Volume II*. MIT Press.

Teaching Experience

- Undergraduate Courses
  - Introduction to Artificial Intelligence (Univ. of Toronto)
  - Machine Learning (Univ. of Toronto; new course)
  - Foundations of Artificial Intelligence (Univ. of Arizona; new course)
  - Sensation & Perception (Univ. of Arizona)
- Graduate Courses
  - Computational Neuroscience (Univ. of Toronto; new course)
  - Learning & Vision (Univ. of Toronto; new course)
  - Computation in Neural Networks (Univ. of Toronto; new course)
  - Computational Neuroscience (Univ. of Arizona; new course)
  - Neural Network Models (Univ. of Arizona; new course)
  - Visual Attention (Univ. of Arizona; new course)
- Complex Systems Summer School, Santa Fe Institute
- Invited Tutorial, NIPS-13: Neural Information Processing Conference

Student Supervision

- PhD Student Supervision
  - Maksims Volkovs, Dept. of Computer Science, Univ. of Toronto, PhD Advisor, 2009-present (ongoing).
  - Daniel Tarlow, Dept. of Computer Science, Univ. of Toronto, PhD Advisor, 2008-present (ongoing).
  - Arnold Binas, Dept. of Computer Science, Univ. of Toronto, PhD Advisor, 2007-present (ongoing).
  - Laurent Charlin, Dept. of Computer Science, Univ. of Toronto, PhD Co-Advisor. 2007-present (ongoing).
  - James Martens, Dept. of Computer Science, Univ. of Toronto, PhD Co-Advisor, 2009-present (ongoing).
  - Rama Natarajan, Dept. of Computer Science, Univ. of Toronto, PhD Advisor, *Neural representation, learning and manipulation of uncertainty.* Defended 2009.
  - David Ross, Dept. of Computer Science, Univ. of Toronto, PhD Advisor, *Learning Probabilistic Models for Visual Motion*. Defended 2008.
  - Benjamin Marlin, Dept. of Computer Science, Univ. of Toronto, PhD Advisor, *Missing Data Problems in Machine Learning*. Defended 2008.
  - Xuming He, Dept. of Computer Science, Univ. of Toronto, PhD Advisor, *Learning Structured Models for Image Labeling*. Defended 2007.
- MSc Student Supervision
  - Nikola Karamanov, Dept. of Computer Science, Univ. of Toronto, MSc Advisor. 2009-present (ongoing).
  - James Martens, Dept. of Computer Science, Univ. of Toronto, MSc Co-Advisor. Defended April, 2009.
  - Maksims Volkovs, Dept. of Computer Science, Univ. of Toronto, MSc Advisor. Defended January, 2009.
  - Daniel Tarlow, Dept. of Computer Science, Univ. of Toronto, MSc Advisor. Defended January, 2008.
  - Stephen Fung, Dept. of Computer Science, Univ. of Toronto, MSc Advisor. Defended September, 2007.
  - Liam Stewart, Dept. of Computer Science, Univ. of Toronto, MSc Advisor, defended September, 2005.
  - Benjamin Marlin, Dept. of Computer Science, Univ. of Toronto, MSc Advisor, defended April, 2004.
  - David Ross, Dept. of Computer Science, Univ. of Toronto, MSc Advisor, defended April, 2003.

- David Towers, Dept. of Psychology, Univ. of Arizona, MSc Advisor, defended March, 2002.
- Stephen Cowen, Dept. of Psychology, Univ. of Arizona, MSc Co-Advisor, defended August, 2000.

- Postdoctoral Fellow Supervision
  - Amit Gruber, Dept. of Computer Science, University of Toronto, 2009-present (ongoing).
  - Tanya Schmah, Dept. of Computer Science, University of Toronto, 2007-present (ongoing).
  - Miguel Carreira-Perpinan, Dept. of Computer Science, University of Toronto, 2003-present.
  - Daniel Roobaert, Dept. of Computer Science, University of Toronto, 2001-2002.
  - Zhiyong Yang, Dept. of Psychology, University of Arizona, 1998-2000.

Professional Activities

- Conferences
  - **Workshops Chair**, 2009 Advances in Neural Processing Systems Conference
  - **Program Committee**, 2009 International Conference on Machine Learning
  - **Senior Program** Committee, 2009 International Joint Conference on A Intelligence
  - **Program Committee**, 2008 Computer Vision and Pattern Recognition Conference
  - **Program Committee**, 2008 International Conference on Machine Learning
  - **Program Committee**, 2008 European Conference on Computer Vision
  - **Program Committee**, 2007 Uncertainty in Artificial Intelligence Conference
  - **Co-Organizer**, "Perspectives for Future Directions in Computat Mathematical Neuroscience",
  - pre-conference satellite meeting, Computational Neuroscience Society Conference
  - **Program Committee**, 2007 International Conference on Machine Learning
  - **Program Committee**, 11th IEEE International Conference on Computer Vision
  - **Program Committee**, 2007 Computer Vision and Pattern Recognition Conference
  - **Program Committee**, 2006 International Conference on Machine Learning
  - **Program Committee**, 2005 Uncertainty in Artificial Intelligence Conference
  - **Program Committee**, 2005 International Conference on Machine Learning
  - **Tutorials Chair**, 2004 Neural Information Processing Society Conference
  - **Program Committee**, 2004 Uncertainty in Artificial Intelligence Conference
  - **Program Committee**, 2004 International Conference on Machine Learning
  - **Program Committee**, 2003 Computer Vision & Pattern Recognition Conference
  - **Program Committee**, 2003 Cognitive Science Society Conference

- **Program Committee**, 2002 Neural Information Processing Society Conference, area chair for Vision
- **Program Committee**, 2002 Cognitive Science Society Conference
- **Program Committee**, 2001 Neural Information Processing Society Conference, area chair for Algorithms & Architectures
- **Publicity Chair**, 2001 Neural Information Processing Society Conference
- **Primary organizer**, *CNUCs* (*C*omputational *N*euroscientists in *U*pper *C*anada)
- **Workshop Organizer**, 1999 Neural Information Processing Society Conference
- **Workshop Chair**, 1998 Neural Information Processing Society Conference

- Journals
  - **Action Editor**, *Neural Computation* journal
  - **Action Editor**, *Cognitive Science* journal
  - **Action Editor**, *Encyclopedia of Cognitive Science*, MacMillan Publishers

- Referee
  - Grant proposals: National Science Foundation, National Science and Engineering Research Council, Mathematics of Information Technology and Complex Systems Network: Centers of Excellence, National Institutes of Health
  - Journal papers: *Nature; Science; Machine Learning; International Journal of Computer Vision; Neural Computation; Vision Research; Journal of Experimental Psychology; Cerebral Cortex; Cognitive Science; Graphics and Image Processing: Image Understanding; Neural Networks; IEEE Transactions on Neural Networks; Journal of Neuroscience*
  - Conference papers: International Joint Conference on Artificial Intelligence (IJCAI); National Conference on Artificial Intelligence (AAAI); Neural Information Processing Society (NIPS); International Conference on Computer Vision (ICCV); International Conference on Artificial Neural Networks (ICANN)

- University Service
  - Associate Chair, Graduate Studies, Univ. of Toronto Computer Science Department, 2005-2008.
  - School of Graduate Studies Awards Committee, Univ. of Toronto, 2006-2008.
  - Graduate Affairs Committee, Univ. of Toronto Computer Science Department, 2007-2008.
  - Graduate Admissions Committee, Univ. of Toronto Computer Science Department, 2006-2008.
  - Chair, Graduate Admissions Committee, Univ. of Toronto Computer Science Department, 2004-2006.

- Chair, Graduate Affairs Committee, Univ. of Toronto Computer Science Department, 2004-2007.
- Undergraduate Committee, Univ. of Toronto Computer Science Department, 2001-2003.
- Graduate Committee, Univ. of Toronto Computer Science Department, 2000-2001.
- Graduate Admissions Committee, Univ. of Arizona Psychology Department, Cognition & Neural Systems, 1998-2000.
- Computing Resources Committee, Univ. of Arizona Psychology Department, 1998-2000.