CURRICULUM VITA

Melanie Mitchell

Department of Computer Science
Portland State University
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RESEARCH EXPERIENCE AND INTERESTS

Artificial intelligence, machine learning, biologically inspired computing, cognitive science, and complex systems.

GRADUATE EDUCATION

Ph.D. in Computer Science, 1990, University of Michigan.
    Dissertation advisor: Douglas R. Hofstadter
    Dissertation title: *Copycat: A Computer Model of High-Level Perception and Conceptual Slippage in Analogy-Making.*

PROFESSIONAL EMPLOYMENT

Professor, Portland State University, Department of Computer Science, 9/04–present.

External Professor, Santa Fe Institute, 2000–present.

Professor, 7/04–9/04; Associate Professor, 8/02–7/04, OGI School of Science and Engineering, Oregon Health & Science University, Department of Computer Science and Engineering.

Staff Member, Santa Fe Institute, 10/00–8/02.

Technical Staff Member, Los Alamos National Laboratory, Biophysics Group, 9/99–9/00.

Research Professor and Director of the Adaptive Computation Program, Santa Fe Institute, 6/92–8/99.

Postdoctoral Scholar, University of Michigan, Department of Electrical Engineering and Computer Science, 9/90–6/92.

HONORS AND AWARDS

Winner of Phi Beta Kappa Society 2010 Science Book Award for *Complexity: A Guided Tour*.

Complexity: A Guided Tour named by Amazon.com as #3 of the **10 best science books of 2009**.

Complexity: A Guided Tour longlisted (one of 12) for the **2010 Royal Society Science Book Prize**.

Ulam Memorial Lectureship, Santa Fe Institute, 1997 (Annual honorary lectureship for three public lectures on Complex Systems).

Fellowship, Michigan Society of Fellows, University of Michigan, 1990–1993 (a three-year postdoctoral fellowship at the University of Michigan).

Regents' Fellowship, University of Michigan, 1984–1988 (a four-year fellowship for graduate studies at the University of Michigan).

GRANTS

Visual Situation Recognition: An Integration of Deep Networks and Analogy-Making. M. Mitchell, PI. National Science Foundation, 2014–2017. ($450,000; $10,000 REU Supplement).

Complexity Explorer: A Web-Based System for Complexity Education, M. Mitchell and G. Richardson, Co-PIs. Grant to the Santa Fe Institute from the John Templeton Foundation, 2011-2017 ($377,394 to SFI; $394,666 to PSU).

A Scalable Architecture for Image Interpretation, M. Mitchell and G. Kenyon, Co-PIs. National Science Foundation, 2010–2014. ($500,000).

Workshop: Shared Organizing Principles in the Biological and Computing Sciences, D. McPheeters, PI; M. Mitchell, J. Wise, and R. Greenspan, Co-PIs. National Science Foundation, 2010. ($98,570).

Evolving and Understanding Cellular Arrays, M. Mitchell, PI. MARCO Center for Functional Engineered Nano Architectonics (funded by Microelectronics Advanced Research Corporation), 2006–2009 ($325,000).

Adaptive Image Feature Detection and Image Retrieval with Genetic Algorithms, M. Mitchell, PI. Intel Corporation, 2003–2005 ($102,996).

Perception and Analogy-Making in Complex Adaptive Systems, M. Mitchell, PI. J. S. McDonnell Foundation, 2002–2007 ($377,533).

Complex Systems Summer School, R. Goldstein and M. Mitchell, PIs. Office of Naval Research, 2000–2002 ($294,855).

Computing with Networks of Spiking Neurons, M. Mitchell, PI. Los Alamos National Laboratory (Laboratory Directed Research an Development Grant), 2000 ($150,000).

1999 Complex Systems Summer School, M. Mitchell and L. Nadel, PIs. Department of Energy, 1999–2000 ($50,000).

Evolving Cellular Automata With Genetic Algorithms, J. P. Crutchfield, PI; M. Mitchell, Co-PI. National Science Foundation, 1994–1996 ($297,828).

Evolving Cellular Automata With Genetic Algorithms, M. Mitchell, PI; J. P. Crutchfield, Co-PI. National Science Foundation, 1997–1999 ($224,947).

Rapid Feature Identification using Reconfigurable Computing Technology and Genetic Algorithms, M. Mitchell, Subcontractor. Los Alamos National Laboratory, 1998–1999 ($41,422).

Automatic Programming of Decentralized Parallel Architectures, M. Mitchell, PI. National Science Foundation, CISE Postdoctoral Associate Program, 1997–1999 ($46,200, with an equal amount in matching funds from the Santa Fe Institute, to support a postdoctoral fellow).

Major Research Instrumentation Program: A New Computational Infrastructure at the Santa Fe Institute, E. Jen, PI; J. P. Crutchfield, S. Durlauf, C. Langton, and M. Mitchell, Co-PIs. National Science Foundation, 1997–2000 ($202,377).

Evolving Cellular Automata With Genetic Algorithms, J. Crutchfield and M. Mitchell, PIs. Department of Energy, 1994–1996 ($120,000).

Foundations of Genetic Algorithms, S. Forrest and M. Mitchell, PIs. Alfred P. Sloan Foundation, 1993–1994 ($30,000).

PUBLICATIONS

Books Authored

Mitchell, M. (2009). *Complexity: A Guided Tour*. New York: Oxford University Press.

Mitchell, M. (1996). *An Introduction to Genetic Algorithms*. Cambridge, MA: MIT Press.

Mitchell, M. (1993). *Analogy-Making as Perception: A Computer Model*. Cambridge, MA: MIT Press.

Books Edited

Booker, L., Forrest, S., Mitchell, M., and Riolo, R. L. (2005). *Perspectives on Adaptation in Natural and Artificial Systems*. New York: Oxford University Press.

Belew, R. K. and Mitchell, M. (editors). (1996). *Adaptive Individuals in Evolving Populations: Models and Algorithms*. Reading, MA: Addison-Wesley.

Book Chapters

Ghosh, P., Mitchell, M., Tanyi, J., and Hung, A. (2009). A genetic algorithm-based level-set curve evolution for prostate segmentation on pelvic CT and MRI images. E. Romero and F. Gonzalez (editors), *Biomedical Image Analysis and Machine Learning Technologies: Applications and Techniques*. ICI Global.

Mitchell, M. (2008). Five questions. In C. Gershenson (editor), *Complexity: 5 Questions*. Automatic Press.

Cenek, M. and Mitchell, M. (2007). Evolving cellular automata. In R. A. Meyers (editor), *Encyclopedia of Complexity and Systems Science*. Berlin: Springer-Verlag.

Mitchell, M. (2006). Coevolutionary learning with spatially distributed populations. In G. Y. Yen and D. B. Fogel (editors), *Computational Intelligence: Principles and Practice*. New York: IEEE Computational Intelligence Society.

Crutchfield, J. P., Mitchell, M., and Das, R. (2003). Evolutionary design of collective computation in cellular automata. In J. P. Crutchfield and P. K. Schuster (editors), *Evolutionary Dynamics—Exploring the Interplay of Selection, Neutrality, Accident, and Function*, pp. 361–411. New York: Oxford University Press.

Mitchell, M. and Newman, M. (2002). Complex systems theory and evolution. In M. Pagel (editor), *Encyclopedia of Evolution*. New York: Oxford University Press.

Mitchell, M. (2001). Analogy-making as a complex adaptive system. In L. Segel and I. Cohen (editors), *Design Principles for the Immune System and Other Distributed Autonomous Systems*. New York: Oxford University Press.

Mitchell, M. (1999). Evolutionary computation. In R. Wilson and F. Keil (editors), *The MIT Encyclopedia of the Cognitive Sciences*. Cambridge, MA: MIT Press.

Mitchell, M. (1998). Computation in cellular automata: A selected review. In T. Gramss, S. Bornholdt, M. Gross, M. Mitchell, and T. Pellizzari, *Nonstandard Computation*, pp. 95–140. Weinheim: VCH Verlagsgesellschaft.

Mitchell, M., Crutchfield, J. P., and Das, R. (1998). Evolving cellular automata to perform computations. In T. Bäck, D. Fogel, and Z. Michalewicz (editors), *Handbook of Evolutionary Computation*. Oxford: Oxford University Press.

Mitchell, M. and Forrest, S. (1998). Royal Road functions. In T. Bäck, D. Fogel, and Z. Michalewicz (editors), Handbook of Evolutionary Computation. Oxford: Oxford University Press.

Belew, R. K., Mitchell, M., and Ackley, D. H. (1996). Computation and the natural sciences. In R. K. Belew and M. Mitchell (editors), *Adaptive Individuals in Evolving Populations: Models and Algorithms*. Reading, MA: Addison-Wesley.

Mitchell, M., Crutchfield, J. P., and Hraber, P. T. (1994). Dynamics, computation, and the "edge of chaos": A re-examination. In G. Cowan, D. Pines, and D. Melzner (editors), *Complexity: Metaphors, Models, and Reality*. Reading, MA: Addison-Wesley.

Mitchell, M. (1993). Genetic algorithms. In L. Nadel and D. L. Stein (editors), **1992 Lectures in Complex Systems**. Reading, MA: Addison-Wesley.

Hofstadter, D. R. and Mitchell, M. (1994). The Copycat project: A model of mental fluidity and analogy-making. In K. Holyoak and J. Barnden (editors), *Advances in Connectionist and Neural Computation Theory, Volume 2: Analogical Connections*. Norwood, NJ: Ablex Publishing Corporation. (Adapted as two chapters in D. R. Hofstadter and the Fluid Analogies Research Group, *Fluid Concepts and Creative Analogies: Computer Models of the Fundamental Mechanisms of Thought*. New York: Basic Books, 1995.)

Journal Publications

Forrest, S. and Mitchell, M. (2016). Adaptive computation: An essay in memory of John H. Holland. To appear in *Communications of the ACM*.

Ghosh, P., Mitchell, M., Tanyi, J. A., and Hung, A. Y. (2016). Incorporating priors for medical image segmentation using a genetic algorithm. *Neurocomputing*. 195, 181–194.

Mitchell, M. (2012). Biological computation. *The Computer Journal*, 55, 852–855.

Ghosh, P., Mitchell, M., and Gold, J. (2010). LSGA: Combining level-sets and genetic algorithms for segmentation. *Evolutionary Intelligence*, 3, 1–11.

Mitchell, M. (2006). Complex systems: Network thinking. *Artificial Intelligence*, 170 (18), 1194–1212.

Pagie, L. and Mitchell, M. (2002). A comparison of evolutionary and coevolutionary search. International *Journal of Computational Intelligence and Applications*, 2(1), 53–69.

Mitchell, M. (2001). Life and evolution in computers. *History and Philosophy of the Life Sciences*, 23, 361-383.

Jimenez-Morales, F., Crutchfield, J. P., and Mitchell, M. (2001). Evolving two-dimensional cellular automata to perform density classification: A report on work in progress. *Parallel Computing*, 27 (5), 571–585.

Werfel, J., Mitchell, M., and Crutchfield, J. P. (2000). Resource sharing and coevolution in evolving cellular automata. *IEEE Transactions on Evolutionary Computation*, 4(4), 388–393.

Mitchell, M. and Taylor, C. E. (1999) Evolutionary computation: An overview. *Annual Review of Ecology and Systematics*, 30, 593–616

Mitchell, M. (1999). Can evolution explain how the mind works? A review of the evolutionary psychology debates. *Complexity*, 3 (3), 17–24.

Mitchell, M. (1998). Theories of structure versus theories of change. (Commentary on "The dynamical hypothesis in cognitive science", by T. van Gelder.) *Behavioral and Brain Sciences*, 21, 645-646.

van Nimwegen, E., Crutchfield, J. P., and Mitchell, M. (1999). Statistical dynamics of the Royal Road genetic algorithm. *Theoretical Computer Science*, 229 (1), 41–102.

van Nimwegen, E., Crutchfield, J. P., and Mitchell, M. (1997). Finite populations induce metastability in evolutionary search. *Physics Letters A*, 229 (2), 144-150.

Crutchfield, J. P., and Mitchell, M. (1995). The evolution of emergent computation. *Proceedings of the National Academy of Sciences*, USA, 92 (23): 10742.

Mitchell, M. (1995). Genetic algorithms: An overview. *Complexity*, 1 (1) 31–39.

Mitchell, M., Crutchfield, J. P., and Hraber, P. (1994). Evolving cellular automata to perform computations: Mechanisms and impediments. *Physica D*, 75, 361–391.

Mitchell M., and Forrest, S. (1994). Genetic algorithms and artificial life. *Artificial Life*, 1 (3), 267–289.

Mitchell, M., Hraber, P. T., and Crutchfield, J. P. (1993). Revisiting the edge of chaos: Evolving cellular automata to perform computations. *Complex Systems*, 7, 89–130.

Forrest, S. and Mitchell, M. (1993). What makes a problem hard for a genetic algorithm? Some anomalous results and their explanation. *Machine Learning*, 13, 285-319.

Mitchell, M. and Hofstadter, D. R. (1990). The emergence of understanding in a computer model of concepts and analogy-making. *Physica D*, 42, 322–334.

Seward, F. D. and Mitchell, M. (1981). An X-ray survey of the Small Magellanic Cloud. *Astrophysical Journal*, 243, 736.

Mitchell, M. (1979). Period changes in two W Virginis variables. *Journal of the American Association of Variable Star Observers*, 8 (2).

Conference Proceedings Publications

Thomure, M. D., Mitchell, M., and Kenyon, G. T. (2013). On the role of shape prototypes in hierarchical models of vision. In *Proceedings of the International Joint Conference on Neural Networks (IJCNN)*.

Landecker, W., Thomure, M. D., Bettencourt, L. M. A., Mitchell, M., Kenyon, G. T., and Brumby, S. P. (2013). Interpreting individual classifications of hierarchical networks. In *Proceedings of the 2013 Conference on Computational Intelligence and Data Mining (CIDM 2013)*.

Landecker, W., Thomure, M. D., and Mitchell, M. (2011). Background cues in images classified by hierarchical models. (Abstract.) In *Proceedings of Grand Challenges in Neural Computation II: Neuromimetic Processing and Synthetic Cognition*. Santa Fe, NM.

Thomure, M. D., Landecker, W., and Mitchell, M. (2011). Random prototypes in hierarchical models of vision. (Abstract.) In *Proceedings of Grand Challenges in Neural Computation II: Neuromimetic Processing and Synthetic Cognition*. Santa Fe, NM.

Ghosh, P., Mitchell, M., and Gold, J. (2010). Segmentation of thermographic images of hands using a genetic algorithm. In *Proceedings of SPIE*, Vol. 7538, 75380D (2010).

Marques-Pita, M., Mitchell, M., and Rocha, L. (2008). The role of conceptual structure in designing cellular automata to perform collective computation. In *Proceedings of the Conference on Unconventional Computation*, UC 2008, Springer (Lecture Notes in Computer Science).

Ghosh, P. and Mitchell, M. (2008). Prostate segmentation on pelvic CT images using a genetic algorithm. In *Proceedings of the International Society for Optical Engineering (SPIE), Conference on Medical Imaging*, February, 2008. SPIE Press.

Juengling, R. and Mitchell, M. (2007). Combinatorial shape decomposition. In *Proceedings of the Third International Symposium on Visual Computing (ISVC07)*. Springer (Lecture Notes in Computer Science).

Ghosh, P. and Mitchell, M. (2006). Medical image segmentation with genetic algorithms. In *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO-2006*, pp. 1171–1178.

Mitchell, M., Thomure, M. D., and Williams, N. L. (2006). The role of space in the success of coevolutionary learning. In L. M. Rocha et al. (editors), *Artificial Life X: Proceedings of the Tenth International Conference on the Simulation and Synthesis of Living Systems*, pp. 118–124. Cambridge, MA: MIT Press.

Williams, N. and Mitchell, M. (2005). Investigating the success of spatial coevolutionary learning. In H. G. Beyer et al. (editors), *Proceedings of the 2005 Genetic and Evolutionary Computation Conference, GECCO-2005*. New York: ACM Press, 523–530.

Mitchell, M. (2005). Self-awareness and control in decentralized systems. *In Working Papers of the AAAI 2005 Spring Symposium on Metacognition in Computation*. Menlo Park, CA: AAAI Press.

Jimenez-Morales, F., Mitchell, M., and Crutchfield, J. P. (2002). Evolving one-dimensional cellular automata to perform a non-trivial collective behavior task: One case study. In P. M. A. Sloot, C. J. K. Tan, J. J. Dongarra and A. G. Hoekstra (editors), *Computational Science-ICCS 2002, Part I, Proceedings 2329*, 793-802. Berlin: Springer-Verlag.

Brumby, S. P., Perkins, S. J., Theiler, J., Szymanski, J. J., Bloch, J. J., and Mitchell, M. (1999). Investigation of image feature extraction by a genetic algorithm. In *Proceedings of the International Society for Optical Engineering, Proceedings of SPIE 3812*, 24-31. Bellingham, WA: SPIE Press.

Hordijk, W., Crutchfield, J. P., and Mitchell, M. (1998). Mechanisms of emergent computation in cellular automata. In A. E. Eiben (ed.), *Proceedings of the Fifth International Conference on Parallel Problem Solving From Nature—PPSN V*. New York: Springer.

Jimenez-Morales, F., Crutchfield, J. P., and Mitchell, M. (1998). Evolving two-dimensional cellular automata to perform density classification: A report on work in progress. In S. Bandini, R. Serra, and F. Suggi Liverani (eds.), *Cellular Automata: Research Towards Industry (Proceedings of the Third International Conference on Cellular Automata for Research and Industry)*, 3-14. Springer-Verlag.

Mitchell, M. (1998). A complex-systems perspective on the "computation vs. dynamics" debate in cognitive science. In M. A. Gernsbacher and S. J. Derry (eds.), *Proceedings of the 20th Annual Conference of the Cognitive Science Society—Cogsci98*,710-715.

Mitchell, M., Crutchfield, J. P., and Das, R. (1996). Evolving cellular automata to perform computations: A review of recent work. In *Proceedings of the First International Conference on Evolutionary Computation and its Applications (EvCA '96)*, 42–55. Moscow, Russia: Russian Academy of Sciences.

Hordijk, W., Crutchfield, J. P., and Mitchell, M. (1996). Embedded particle computation in evolved cellular automata. In *Proceedings of the Conference on Physics and Computation—PhysComp96*, Boston, MA.

Das, R., Crutchfield, J. P., Mitchell, M., and Hanson, J. E. (1995). Evolving globally synchronized cellular automata. In L. J. Eshelman (editor), *Proceedings of the Sixth International Conference on Genetic Algorithms*. San Mateo, CA: Morgan Kaufmann.

Das, R., Mitchell, M., and Crutchfield, J. P. (1994).   A genetic algorithm discovers particle-based computation in cellular automata. In Y. Davidor, H.-P. Schwefel, and R. Männer (editors), *Parallel Problem Solving from Nature—PPSN III*. Berlin: Springer-Verlag.

Mitchell, M., Holland, J. H., and Forrest, S. (1994). When will a genetic algorithm outperform hill climbing? In J. D. Cowan, G. Tesauro, and J. Alspector (editors), *Advances in Neural Information Processing Systems 6*, 51-58, San Mateo, CA: Morgan Kaufmann.

Forrest, S. and Mitchell, M. (1993). Relative building-block fitness and the building-block hypothesis. In D. Whitley (editor), *Foundations of Genetic Algorithms 2*, San Mateo, CA: Morgan Kaufmann.

Mitchell, M., Forrest, S., and Holland, J. H. (1992). The royal road for genetic algorithms: Fitness landscapes and GA performance. In F. J. Varela and P. Bourgine (editors), *Proceedings of the First European Conference on Artificial Life*. Cambridge, MA: MIT Press.

Forrest, S. and Mitchell, M. (1991). The performance of genetic algorithms on Walsh polynomials: Some anomalous results and their explanation. In R. Belew and L. Booker (editors), *Proceedings of the Fourth International Conference on Genetic Algorithms*. San Mateo, CA: Morgan Kaufmann.

Mitchell, M. and Hofstadter, D. R. (1990). The right concept at the right time: How concepts emerge as relevant in response to context-dependent pressures. In *Proceedings of the Twelfth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Mitchell, M. and Hofstadter, D. R. (1989). The role of computational temperature in a computer model of concepts and analogy-making. In *Proceedings of the Eleventh Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Hofstadter, D. R. and Mitchell, M. (1988). *Conceptual slippage and analogy-making: A report on the Copycat project*. In Proceedings of the Tenth Annual Conference of the Cognitive Science Society. Hillsdale, NJ: Lawrence Erlbaum Associates.

Hofstadter, D. R. and Mitchell, M. (1988). Concepts, analogies, and creativity. In *Proceedings of the Canadian Society for Computational Studies of Intelligence*. Edmonton: University of Alberta.

 Book Reviews and Popular Press Articles

Mitchell, M. (2014). Adaptive computation: Information, adaptation, and evolution in silico. *Santa Fe Institute Bulletin*, 28(2).

Mitchell, M. (2014). How can the study of complexity transform our understanding of the world? *Big Questions Online* (http://bigquestionsonline.com).

Mitchell, M. (2008). Visual understanding. *Santa Fe Institute Bulletin*, Spring 2008, pp. 50–54.

Mitchell, M. (2003). Review of "Conceptual Coordination: How the Mind Orders Experience in Time" by William J. Clancey. *Contemporary Psychology*, 48 (3).

Mitchell, M. (2002). Review of "A New Kind of Science" by Stephen Wolfram. *Science*, 298, 65–68.

Mitchell, M. (1997). Review of "Figments of Reality" by Ian Stewart and Jack Cohen. *New Scientist*, August 11, 1997.

Mitchell, M. (1998). Review of "Handbook of Genetic Algorithms" by Lawrence Davis. *Artificial Intelligence*, 100 (1-2), 325-330.

Mitchell, M. (1997). Review of "Darwin's Dangerous Idea" by Daniel Dennett. *Complexity*, 2 (1), 32–26.

Mitchell, M. (1995). Review of "Out of Control: The Rise of Neo-Biological Civilization" by Kevin Kelly. *Technology Review*, October, 1995.

Mitchell, M. (1993). Computer models of adaptive complex systems. *New Scientist*, February 13, 1993.

Mitchell, M. (1991). Review of "The Dreams of Reason: The Computer and the Rise of the Sciences of Complexity" by Heinz Pagels. In *Bulletin of the Santa Fe Institute*, 6 (1).

Mitchell, M. (1985). Artificial intelligence and the popular press. *Popular Computing*, January, 1985.

RECENT INVITED LECTURES (2014-2016)
(From over 150 invited lectures since 1990)

"Using analogy to recognize visual situations", Waterloo Institute for Complexity and Innovation, Waterloo, Ontario, Canada. May, 2016

"Using analogy to recognize visual situations". Redwood Center for Theoretical Neuroscience, Berkeley, CA. May, 2016.

"Complexity: A guided tour". Keynote lecture, Oberlin College Oppenheim Symposium on Complex Systems, Oberlin, OH. April, 2016.

"Using analogy to recognize visual situations". Brandeis University IGERT Seminar, Waltham, MA. March, 2016

"The science of complex systems". Innovation Speaker Series, MITRE Corporation, McLean, VA. December, 2015.

"Visual situation recognition", Keynote Lecture, Clojure/West 2015, Portland, OR. April, 2015

"How can the study of complexity transform our understanding of the world?" Northern Arizona University, Flagstaff, AZ. March, 2015.

"Introduction to complexity". Exploring Complexity: Bridging Disciplines Through Complex Systems Science, University of Oregon, Eugene, OR. November, 2014.

"How can the study of complexity transform our understanding of the world?" OMSI Science Pub, Portland, OR, October, 2014.

"Using analogy to discover the meaning of images." Emory Center for Mind, Brain, and Culture, Emory University, Atlanta, GA, April, 2014.

COURSES TAUGHT

Introduction to Complexity (Massive Open Online Course, Santa Fe Institute, 2013-2014, over 17,000 enrolled to date)

Artificial Intelligence (undergraduate and graduate level, University of Michigan, 1991; Portland State University, 2006–present)

Cognitive Science (undergraduate level, University of Michigan, 1991)

Emergent Computation (graduate level, University of New Mexico, 1995)

Evolutionary Computation (undergraduate and graduate level, Oregon Graduate Institute, 2002)

Exploring Complexity in Science and Technology (undergraduate level, Portland State University, 2009–present)

Machine Learning (undergraduate and graduate level, Oregon Graduate Institute and Portland State University, 2003–present)

Advanced Topics in Machine Learning (undergraduate and graduate level, Oregon Graduate Institute and Portland State University, 2005, 2009, 2010)

Machine Learning Seminar (graduate level, Portland State University, 2014–present)

Nonstandard Computation (undergraduate and graduate level, Oregon Graduate Institute and Portland State University, 2004–2005, 2008)

RECENT INVITED CONFERENCE TUTORIALS (2013-2015)
(From over 30 invited conference tutorials since 1990)

"Introduction to Complexity". MITRE Corporation, McClean, VA. December, 2015.

"Introduction to Complexity". Conference on Complex Systems, Arizona State University, Tempe, AZ. September, 2015.

"Introduction to Complexity". Short Course on Complexity in Social Science and Economics, Santa Fe Institute, Santa Fe, NM, August, 2015

"Introduction to Complexity". Short course, Arizona State University, Tempe, AZ, September, 2014.

"Introduction to Complexity". SFI Complex Systems Summer School, Santa Fe, NM, June, 2014.

"Introduction to Networks: Laboratory". Network Science Conference 2014, Berkeley, CA, June, 2014.

"Network Models". Santa Fe Institute Short Course: Exploring Complex Networks, Austin, TX, September, 2013.

"Introduction to Complexity" (three lectures). Santa Fe Institute Complex Systems Summer School, Santa Fe, NM, June 2013.

CONFERENCES, WORKSHOPS, AND SUMMER SCHOOLS ORGANIZED

Organizer, short course on **Exploring Complexity in Science and Technology from a Santa Fe Institute Perspective**. Portland, OR, 2010; Albuquerque, NM, May, 2011; Stanford, CA, Sept. 2012; Austin, TX, Sept. 2013; Santa Fe NM, 2015-2016.

Co-Organizer (with SFI and the Krasnow Institute), short course on **The Science of Complexity: Understanding the Financial Crisis**, Washington, DC, May, 2012.

Co-Organizer (with Jo Ann Wise and Ralph Greenspan), workshop on **Shared Organizing Principles in the Computing and Biological Sciences**. National Science Foundation, Washington, DC. 2010.

Co-Organizer (with Garrett Kenyon, Ilya Nemenman, and Chris Wood), workshop on **Principles of Biological Computation**. Santa Fe Institute, Santa Fe, NM. 2008.

Co-Organizer (with Garrett Kenyon), workshop on **High-Level Perception and Low-Level Vision: Bridging the Semantic Gap**. Santa Fe Institute, Santa Fe, NM. 2007.

Director, **Complex Systems Summer School**, Santa Fe Institute. 1999-2002; 2004–2005 (1999, Co-director with Lynn Stein; 2000, Co-director with Ray Goldstein).

Co-Director (with Imre Kondor), **Central European Complex Systems Summer School**, Central European University, Budapest. 2000.

Co-Organizer (with Lashon Booker, Stephanie Forrest, and Rick Riolo), **Holland Fest** meeting (conference in honor of John Holland's 70th birthday). University of Michigan, Ann Arbor, MI. 1999.

Co-Organizer (with Randall Beer), workshop on **Dynamics, Computation, and Cognition**. Santa Fe Institute. May 12-14, 1996.

Co-Organizer (with Terry Jones and Una-May O'Reilly), workshop on **Biological and Computational Landscapes**, Santa Fe Institute. July 21-23, 1995.

Organizer, working group on **Theoretical Foundations of Genetic Algorithms**, Santa Fe Institute. January 11–13, 1994, May-June, 1994.

Co-Organizer (with Richard Belew), workshop on **Behavioral Plasticity in Evolving Populations: Models and Algorithms**, Santa Fe Institute. July 11–15, 1993.

Organizer, workshop on **Learning and Adaptation in Robots and Situated Agents**, Santa Fe Institute. May 9–13, 1993.

Co-Organizer (with Nils Nilsson), workshop on **Reinforcement Learning in Robotics**, Santa Fe Institute. March 6–11, 1993.

Organizer, workshop on **Computation, Dynamical Systems, and Learning**, Santa Fe Institute. November 16–20, 1992.

POSTDOCS AND STUDENTS SUPERVISED

Postdocs:
Ludo Pagie, Santa Fe Institute, 2000–2002
Manuel Marques-Pita, Portland State University, 2008–2009
Efsun Sarioglu Kayi, Portland State Univeristy, 2015–present

Ph.D. Students
Sheng Lundquist, Ph.D. in progress, Portland State University
Anthony Rhodes, Ph.D. in progress, Portland State University
Jordan Witte, Ph.D. in progress, Portland State University
Max Quinn, Ph.D. in progress, Portland State University.
Will Landecker, Ph.D. 2014, Portland State University
Ralf Jüngling, Ph.D., 2013, Portland State University
Michael Thomure, Ph.D., 2013, Portland State University
Martin Cenek, Ph.D., 2011, Portland State University
Payel Ghosh, Ph.D., 2010, Portland State University
Wim Hordijk, Ph.D., 1999, University of New Mexico/Santa Fe Institute
        (co-advisors James Crutchfield and Stephanie Forrest)
Rajarshi Das, Ph.D., 1996, Colorado State University/Santa Fe Institute
        (co-advisors James Crutchfield and Darrell Whitley)

M.S. Theses
Lewis Coates, M.S. in progress, Portland State University
Kendall Stewart, M.S. 2015, Portland State University

Clint Olson, M.S. 2015, Portland State University
Joanna Solman, M.S., 2014, Portland State University
Mandar Patil, M.S., 2013, Portland State University
George Dittmar, M.S., 2013, Portland State University
Karan Sharma, M.S., 2012, Portland State University
Dan Coates, M.S., 2009, Portland State University
Lanfranco Muzi, M.S., 2009, Portland State University
Davis Stevenson, M.S. 2007, Portland State University
Nathan Williams, M.S., 2004, Oregon Health & Science University

Undergraduate Interns:
Evan Roche, Lewis & Clark College, 2016
Rory Soiffer, University of Washington, 2016
Favian Rahman, Carnegie Mellon University, 2014
Max Boddy, Reed College, 2013
Eben Wood, Portland State University, 2012-2013
Max Orhai, Portland State University, 2012-2013
Jennifer Meneghin, Portland State University, 2006
Michael Thomure, Portland State University, 2004–2005
Jonathan Carlson, Dartmouth College, 2003
Justin Werfel, Princeton University, 1998
Alex Wo, Harvard University, 1997
Elizabeth Ayer, Duke University, 1995
Adam Messinger, Willamette University, 1994

High School Interns:
Robin Tan, Jesuit High School, Portland, OR, 2016
Bryan Lee, Westview High School, Beaverton, OR, 2016
Chandler Watson, Oregon Episcopal School, Portland, OR 2014-2015
Vicki Niu, Lincoln High School, Portland, OR, 2013
Preetha Velu, Jesuit High School, Portland, OR, 2013

PROFESSIONAL SERVICE

Member, Advisory Board, J. S. McDonnell Foundation Postdoctoral Fellowship Program, 2011–present.

Member, Science Board, Santa Fe Institute, 2008–present.

Member of the Science Steering Committee of the Santa Fe Institute (the Institute's main scientific oversight committee), 2000–2001, 2010–2013.

Current member of the Editorial Board of :
     PeerJ Computer Science, 2015–present.
     Artificial Life, 1993–present.
     Genetic Programming and Evolvable Machines, 1999–present.

Evolutionary Intelligence, 2009–present.
International Journal of Natural Computing Research, 2009–present.

Former Editorial Board memberships: *Journal of Machine Learning Research*, 2001–2010 (Action Editor); *Evolutionary Computation* (1995–2006), *Pattern Analysis and Applications*, (1997–1999), *Journal of Artificial Intelligence Research*, (2001–2003).

Member of Advisory Board, National Institute for Mathematical and Biological Synthesis, 2011–2012.

Member of the Editorial Board of the Santa Fe Institute, 1998–2000.

Reviewer and member of proposal evaluation panels, National Science Foundation, 1996, 1999, 2008, 2009, 2011, 2012, 2014.

Consultant for proposal evaluation panel, National Institutes of Health, 2003.

Member of Laboratory Directed Research and Development Review Committee, Computer Science and Software Engineering Category, Los Alamos National Laboratory, 2002.

External reviewer for Los Alamos National Laboratory programs, 1997.

Mentor, Research Experiences for Undergraduates Program, Santa Fe Institute. 1994–1998.

Member, Awards Committee, University of Michigan Rackham Distinguished Dissertation Awards, 1990-1992.

Member of Program Committee for:
2016 Cognitive Science Conference
2008 Artificial Life Conference
2007 European Conference on Artificial Life
2006 Genetic and Evolutionary Computation Conference
2006 Workshop on the Evolution of Complexity, at the 2006 Artificial Life Conference
2006 Artificial Life Conference
2005 Genetic and Evolutionary Computation Conference
2003 Cognitive Science Society Conference
2002 Artificial Life Conference
2000 Genetic and Evolutionary Computation Conference
2000 Artificial Life Conference
1997 American Association for Artificial Intelligence Conference
1997 European Conference on Artificial Life
1996 Foundations of Genetic Algorithms Workshop
1996 AAAI Spring Symposium on Computational Issues in Learning Models of Dynamical Systems
1995 IEEE International Conference on Evolutionary Computation
1995 Neural Information Processing Systems Conference
1995 International Conference on Genetic Algorithms
1995 International Conference on Machine Learning
1995 European Conference on Artificial Life
1994 Foundations of Genetic Algorithms Workshop

1994 Artificial Life Conference
1993 International Conference on Genetic Algorithms
1993 IEEE International Conference on Neural Networks

K–12 EDUCATIONAL ACTIVITIES

Mentor, Apprenticeships in Science and Engineering program, Saturday Academy, Portland, OR, 2013–present.

Team Coordinator, Math Olympiad for Elementary and Middle Schools, Raleigh Park Elementary School, Portland, OR. 2008–2010.

Grand Awards Judge, Intel International Science and Engineering Fair. Portland, OR. 2004.

Mentor, Santa Fe High School "Adventures in Supercomputing" and "Supercomputing Challenge" Programs. 1995–1998.

REFERENCES

Available upon request.