Michael Bowling

Curriculum Vitae

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RESEARCH INTERESTS	**Machine Learning.** Specifically, learning in games, agent modelling, reinforcement learning, game theory, computer game environments, and mobile robots.

ACADEMIC POSITIONS

Full Professor 2013–Present
Department of Computing Science, University of Alberta

Associate Professor 2008–2013
Department of Computing Science, University of Alberta

Adjunct Assistant Professor 2006–2008
School of Computer Science, University of Waterloo

Assistant Professor 2003–2008
Department of Computing Science, University of Alberta

EDUCATION

Ph.D. in Computer Science, Carnegie Mellon University 2003
Advisor: Professor Manuela Veloso
Award: Co-winner of the School of Computer Science Dissertation Award.

M.Sc., Computer Science Carnegie Mellon University 1999

B.S., Math and Computer Science, Carnegie Mellon University 1996
University Honors

AWARDS AND HONORS

Faculty of Science Research Fellowship 2017–2022

Faculty of Science Research Award 2014

Faculty of Science Innovation in Teaching Award 2014
Co-winner. This award recognizes creative contributions to the development of tools for the innovative presentation of coursework, new curriculum design, and the creation of an improved teaching and learning environment.

Honourable Mention for Alan Blizzard Award 2011
Past head instructor for the CMPUT250 teaching team that won this award. The Alan Blizzard award is a Canadian-wide award for collaborative teaching. Only 4 honourable mentions had been awarded in its first 12 years, in addition to the 14 winners and co-winners.

Department Research Award 2010

Teaching Unit Award 2009
Head instructor for the CMPUT250 teaching team that won the University of Alberta's Teaching Unit Award for "excellence that occurs as a result of the collaboration of instructors".

Second Man-Machine Poker Championship   2008
Led the Computer Poker Research Group in the development of Polaris, which had 3 wins, 2 losses, and 1 draw to become the first computer program to defeat professional poker players in a meaningful competition. Polaris also competed in the First Man-Machine Poker Championship in 2007 resulting in 1 win, 2 losses, and a draw.

AAAI Computer Poker Competition Champion   2006-2015
Led the University of Alberta team that has won a total of 23 of the 39 events over its first 10 years.

AI Video Awards Finalist   2008
Finalist for Best Educational Video.

PE Publishing Award   2007
Awarded the 2005 PE Publishing Award for the *Journal of Systems and Control Engineering* [7]. Co-author.

Best Student Paper Award   2007
At the *2007 IEEE International Symposium on Approximate Dynamic Programming and Reinforcement Learning* [101]. Co-author (with Ph.D. student Tao Wang).

ASTech Award Winner   2006
A principal investigator in the Alberta Ingenuity Centre for Machine Learning, winning the Alberta Science and Technology Foundation award in the category *Outstanding Leadership in Alberta Technology*.

ASTech Finalist   2005
Alberta Science and Technology Foundation finalist in the category *Leaders of Tomorrow*.

CMU School of Computer Science Dissertation Award   2003
Co-winner. Nominated for the ACM Dissertation Award.

RoboCup Robot Soccer Champion Teams
RoboCup Small-Size League (CMU)   1998
American Open Small-Size League (CMU)   2003

IJCAI Excellent Paper   2001
Conference paper [93] invited as a fast-track submission to *Artificial Intelligence*.

Allen Newell Medal for Research Excellence   1998
The Allen Newell Medal for Research Excellence is awarded by the School of Computer Science at Carnegie Mellon. It recognizes an outstanding body of work that epitomizes Allen Newell's research style.

RESEARCH EXPERIENCE   **Cogitai, Inc.,** Los Angeles, CA   May 2016–April 2017
Visiting Researcher. Developing a platform for continual learning systems "that will let everyday things that sense and act get smarter with experience."

Yahoo! Research, Santa Clara, CA   February–June, 2010
Visiting Researcher. Worked on a complete redesign of the anti-spam system in order to

achieve adversarial guarantees. Co-developed a new concept of regret based on locality that can be applied in domains where even off-line decision-making is computationally hard [39].

Kitano Symbiotic Systems Project, Tokyo, Japan   Summer 2000
Visiting Researcher. Worked on the development of a generic urban disaster simulation environment as a testbed for multiagent technologies. Work focused on creating a flexible kit to simplify agent development and a number of presentations promoting the new area of research.

Digital Mapping Laboratory, CMU, Pittsburgh, PA   1994–1997
Undergraduate Researcher. Developed new automatic and semi-automatic techniques for extracting road data from aerial imagery. Work included improving visualization techniques, as well as incorporating photogrammetric data to improve the accuracy of the extracted road network.

PUBLICATIONS   **Journal Articles**

[1] Matej Moravčík, Martin Schmid, Neil Burch, Viliam Lisý, Dustin Morrill, Nolan Bard, Trevor Davis, Kevin Waugh, Michael Johanson, and Michael Bowling. Deepstack: Expert-level artificial intelligence in heads-up no-limit poker. *Science*, March 2017. Published online.

[2] Michael Bowling, Neil Burch, Michael Johanson, and Oskari Tammelin. Heads-up limit hold'em poker is solved. *Science*, 347(6218):145–149, January 2015.

[3] T.L. MacKay, Nolan Bard, Michael Bowling, and D.C. Hodgins. Do pokers players know how good they are? Accuracy of poker skill estimation in online and offline players. *Computers in Human Behavior*, 31:419–424, February 2014.

[4] Arash Afkanpour, Csaba Szepesvári, and Michael Bowling. Alignment based kernel learning with a continuous set of base kernels. *Machine Learning*, 91:305–324, 2013.

[5] Marc G. Bellemare, Yavar Naddaf, Joel Veness, and Michael Bowling. The arcade learning environment: An evaluation platform for general agents. *Journal of Artificial Intelligence Research*, 47:253–279, 2013.

[6] Daniel J. Lizotte, Michael Bowling, and Susan A. Murphy. Linear fitted-Q iteration with multiple reward functions. *Journal of Machine Learning Research*, 13:3253–3295, 2012.

[7] Brett Browning, James Bruce, Michael Bowling, and Manuela Veloso. STP: Skills, tactics and plays for multi-robot control in adversarial environments. *Journal of Systems and Control Engineering*, 219(1):33–52, 2005.

[8] Michael Bowling and Manuela Veloso. Existence of multiagent equilibria with limited agents. *Journal of Artificial Intelligence Research*, 22:353–384, 2004.

[9] Michael Bowling and Manuela Veloso. Multiagent learning using a variable learning rate. *Artificial Intelligence*, 136:215–250, 2002.

[10] Manuela Veloso, Michael Bowling, Sorin Achim, Kwun Han, and Peter Stone. The CMUnited-98 champion small robot team. *Advanced Robotics*, 2000. An earlier

version appeared in *RoboCup-98: Robot Soccer World Cup II, Asada and Kitano (Eds.)*, Springer, 1999, pages 77–92. A shorter version appeared in the *AI Magazine*, 21:29–36.

Refereed Conferences

[11] Kieran Milan, Joel Veness, James Kirkpatrick, Michael Bowling, Anna Koop, and Demis Hassabis. The forget-me-not process. In *Advances in Neural Information Processing Systems 29 (NIPS)*, 2016. To Appear, [Acceptance Rate: 23%].

[12] Zaheen Farraz Ahmad, Robert C. Holte, and Michael Bowling. Action selection for hammer shots in curling. In *Proceedings of the Twenty-Fifth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 561–567, 2016. [Acceptance Rate: 24%].

[13] Timothy Yee, Viliam Lisý, and Michael Bowling. Monte Carlo tree search in continuous action spaces with execution uncertainty. In *Proceedings of the Twenty-Fifth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 690–696, 2016. [Acceptance Rate: 24%].

[14] Yitao Liang, Marlos Machado, Erik Talvitie, and Michael Bowling. State of the art control of atari games using shallow reinforcement learning. In *Proceedings of the Fifteenth International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 485–493, 2016. [Acceptance Rate: 25%].

[15] Viliam Lisy, Trevor Davis, and Michael Bowling. Counterfactual regret minimization in sequential security games. In *Proceedings of the Thirtieth Conference on Artificial Intelligence (AAAI)*, pages 544–550, 2016. [Acceptance Rate: 26%].

[16] Oskari Tammelin, Neil Burch, Michael Johanson, and Michael Bowling. Solving heads-up limit texas hold'em. In *Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 645–652, 2015. [Acceptance Rate: 29%].

[17] Viliam Lisy, Marc Lanctot, and Michael Bowling. Online Monte Carlo counterfactual regret minimization for search in imperfect information games. In *Proceedings of the Fourteenth International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 27–36, 2015. [Acceptance Rate: 25%].

[18] Nolan Bard, Deon Nicholas, Csaba Szepesvari, and Michael Bowling. Decision-theoretic clustering of strategies. In *Proceedings of the Fourteenth International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 17–25, 2015. To Appear, [Acceptance Rate: 25%].

[19] James Neufeld, Michael Bowling, and Dale Schuurmanns. Variance reduction via antithetic Markov chains. In *Proceedings of the Eighteenth International Conference on Artificial Intelligence and Statistics (AISTATS)*, pages 708–716, 2015. [Acceptance Rate: 29%].

[20] Kevin Waugh, Dustin Morrill, J. Andrew Bagnell, and Michael Bowling. Solving games with functional regret estimation. In *Proceedings of the Twenty-Ninth Conference on Artificial Intelligence (AAAI)*, pages 2138–2145, 2015. [Acceptance Rate: 27%].

[21] Martha White, Junfeng Wen, Michael Bowling, and Dale Schuurmans. Optimal estimation of multivariate ARMA models. In *Proceedings of the Twenty-Ninth Conference on Artificial Intelligence (AAAI)*, pages 3080–3086, 2015. [Acceptance Rate: 27%].

[22] Pascal Poupart, Aarti Malhotra, Pei Pei, Kee-Eung Kim, Bongseok Goh, and Michael Bowling. Approximate linear programming for constrained partially observable Markov decision processes. In *Proceedings of the Twenty-Ninth Conference on Artificial Intelligence (AAAI)*, pages 3080–3086, 2015. [Acceptance Rate: 27%].

[23] Sriram Srinivasan, Erik Talvitie, and Michael Bowling. Improving exploration in UCT using local manifolds. In *Proceedings of the Twenty-Ninth Conference on Artificial Intelligence (AAAI)*, pages 3386–3392, 2015. [Acceptance Rate: 27%].

[24] Ujjwal Das Gupta, Erik Talvitie, and Michael Bowling. Policy tree: Adaptive representation for policy gradient. In *Proceedings of the Twenty-Ninth Conference on Artificial Intelligence (AAAI)*, pages 2547–2553, 2015. [Acceptance Rate: 27%].

[25] Trevor Davis, Neil Burch, and Michael Bowling. Using response functions to measure strategy strength. In *Proceedings of the Twenty-Eighth Conference on Artificial Intelligence (AAAI)*, pages 630–636, 2014. [Acceptance Rate: 28%].

[26] Neil Burch, Michael Johanson, and Michael Bowling. Solving imperfect information games using decomposition. In *Proceedings of the Twenty-Eighth Conference on Artificial Intelligence (AAAI)*, pages 602–608, 2014. [Acceptance Rate: 28%].

[27] Nolan Bard, Michael Johanson, and Michael Bowling. Asymmetric abstractions for adversarial settings. In *Proceedings of the Thirteenth International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 501–508, 2014. [Acceptance Rate: 24%].

[28] Parisa Mazrooei, Chris Archibald, and Michael Bowling. Automating collusion detection in sequential games. In *Proceedings of the Twenty-Seventh Conference on Artificial Intelligence (AAAI)*, pages 675–682, 2013. [Acceptance Rate: 29%].

[29] Chris Rayner, Nathan Sturtevant, and Michael Bowling. Subset selection of search heuristics. In *Proceedings of the Twenty-Third International Joint Conference on Artificial Intelligence (IJCAI)*, pages 637–643, 2013. [Acceptance Rate: 28%].

[30] Marc Bellemare, Joel Veness, and Michael Bowling. Bayesian learning of recursively factored environments. In *Proceedings of the Thirtieth International Conference on Machine Learning (ICML)*, pages 1211–1219, 2013. [Acceptance Rate: 24%].

[31] Arash Afkanpour, András György, Csaba Szepesvári, and Michael Bowling. A randomized mirror descent algorithm for large scale multiple kernel learning. In *Proceedings of the Thirtieth International Conference on Machine Learning (ICML)*, pages 374–382, 2013. [Acceptance Rate: 24%].

[32] Joel Veness, Martha White, Michael Bowling, and András György. Partition tree weighting. In *Proceedings of the Data Compression Conference (DCC)*, pages 321–330, 2013.

[33] Michael Johanson, Neil Burch, Richard Valenzano, and Michael Bowling. Eval-

uating state-space abstractions in extensive-form games. In *Proceedings of the Twelfth International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 271–278, 2013. [Acceptance Rate: 23%].

[34] Nolan Bard, Michael Johanson, Neil Burch, and Michael Bowling. Online implicit agent modelling. In *Proceedings of the Twelfth International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 255–262, 2013. [Acceptance Rate: 23%].

[35] Joshua Davidson, Christopher Archibald, and Michael Bowling. Baseline: Practical control variates for agent evaluation in zero-sum domains. In *Proceedings of the Twelfth International Conference on Autonomous Agents and Multi-Agent Systems (AA-MAS)*, pages 1005–1012, 2013. [Acceptance Rate: 23%].

[36] Katherine Chen and Michael Bowling. Tractable objectives for robust policy optimization. In *Advances in Neural Information Processing Systems 25 (NIPS)*, pages 2078–2086, 2012. [Acceptance Rate: 25%].

[37] Marc G. Bellemare, Joel Veness, and Michael Bowling. Sketch-based linear value function approximation. In *Advances in Neural Information Processing Systems 25 (NIPS)*, pages 2222–2230, 2012. [Acceptance Rate: 25%].

[38] Marc Lanctot, Richard Gibson, Neil Burch, and Michael Bowling. No-regret learning in extensive-form games with imperfect recall. In *Proceedings of the Twenty-Ninth International Conference on Machine Learning (ICML)*, pages 65–72, 2012. [Acceptance Rate: 27%].

[39] Michael Bowling and Martin Zinkevich. On local regret. In *Proceedings of the Twenty-Ninth International Conference on Machine Learning (ICML)*, pages 1631–1638, 2012. [Acceptance Rate: 27%].

[40] Michael Johanson, Nolan Bard, Neil Burch, and Michael Bowling. Finding optimal abstract strategies in extensive form games. In *Proceedings of the Twenty-Sixth Conference on Artificial Intelligence (AAAI)*, pages 1371–1379, 2012. [Acceptance Rate: 26%].

[41] Marc G. Bellemare, Joel Veness, and Michael Bowling. Investigating contingency awareness using Atari 2600 games. In *Proceedings of the Twenty-Sixth Conference on Artificial Intelligence (AAAI)*, pages 864–871, 2012. [Acceptance Rate: 26%].

[42] Richard Gibson, Marc Lanctot, Neil Burch, Duane Szafron, and Michael Bowling. Generalized sampling and variance in counterfactual regret minimization. In *Proceedings of the Twenty-Sixth Conference on Artificial Intelligence (AAAI)*, pages 1355–1361, 2012. A longer version is available as a University of Alberta Technical Report, TR12-02., [Acceptance Rate: 26%].

[43] Joel Veness, Kee Siong Ng, Marcus Hutter, and Michael Bowling. Context tree switching. In *Proceedings of the Data Compression Conference (DCC)*, pages 327–336, 2012.

[44] Michael Johanson, Nolan Bard, Marc Lanctot, Richard Gibson, and Michael Bowling. Efficient Nash equilibrium approximation through Monte Carlo counterfactual regret minimization. In *Proceedings of the Eleventh International Conference on*

Autonomous Agents and Multi-Agent Systems (AAMAS), pages 837–844, 2012. [Acceptance Rate: 20%].

[45] Joel Veness, Marc Lanctot, and Michael Bowling. Variance reduction in Monte Carlo tree search. In *Advances in Neural Information Processing Systems 24 (NIPS)*, pages 1836–1844, 2011. [Acceptance Rate: 22%].

[46] Chris Rayner, Michael Bowling, and Nathan Sturtevant. Euclidean heuristic optimization. In *Proceedings of the Twenty-Fifth Conference on Artificial Intelligence (AAAI)*, pages 81–86, 2011. [Acceptance Rate: 25%].

[47] Michael Johanson, Michael Bowling, Kevin Waugh, and Martin Zinkevich. Accelerating best response calculation in large extensive games. In *Proceedings of the Twenty-Second International Joint Conference on Artificial Intelligence (IJCAI)*, pages 258–265, 2011. [Acceptance Rate: 30%].

[48] Daniel J. Lizotte, Michael Bowling, and Susan A. Murphy. Efficient reinforcement learning with multiple reward functions for randomized controlled trial analysis. In *Proceedings of the Twenty-Seventh International Conference on Machine Learning (ICML)*, pages 695–702, 2010. [Acceptance Rate: 26%].

[49] Marc Lanctot, Kevin Waugh, Martin Zinkevich, and Michael Bowling. Monte Carlo sampling for regret minimization in extensive games. In *Advances in Neural Information Processing Systems 22 (NIPS)*, pages 1078–1086, 2009. A longer version is available as a University of Alberta Technical Report, TR09-15. An earlier version appeared in the *COLT Workshop on On-Line Learning with Limited Feedback* (2009), [Acceptance Rate: 24%].

[50] Kevin Waugh, Nolan Bard, and Michael Bowling. Strategy grafting in extensive games. In *Advances in Neural Information Processing Systems 22 (NIPS)*, pages 2026–2034, 2009. [Acceptance Rate: 24%].

[51] Martha White and Michael Bowling. Learning a value analysis tool for agent evaluation. In *Proceedings of the Twenty-First International Joint Conference on Artificial Intelligence (IJCAI)*, pages 1976–1981, 2009. [Acceptance Rate: 26%].

[52] David Schnizlein, Michael Bowling, and Duane Szafron. Probabilistic state translation in extensive games with large action sets. In *Proceedings of the Twenty-First International Joint Conference on Artificial Intelligence (IJCAI)*, pages 276–284, 2009. [Acceptance Rate: 26%].

[53] Kevin Waugh, Dave Schnizlein, Michael Bowling, and Duane Szafron. Abstraction pathologies in extensive games. In *Proceedings of the Eighth International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 781–788, 2009. [Acceptance Rate: 22%].

[54] Michael Johanson and Michael Bowling. Data biased robust counter strategies. In *Proceedings of the Twelfth International Conference on Artificial Intelligence and Statistics (AISTATS)*, pages 264–271, 2009. [Acceptance Rate: 30%].

[55] Maria Cutumisu, Duane Szafron, Michael Bowling, and Richard S. Sutton. Agent learning using action-dependent learning rates in computer role-playing games. In *Proceedings of the Fourth Conference on Artificial Intelligence and Interactive Digital*

Entertainment (AIIDE), 2008.

[56] Richard Sutton, Csaba Szepesvari, Alborz Geramifard, and Michael Bowling. Dyna-style planning with linear function approximation and prioritized sweeping. In *Proceedings of the Twenty-Fourth Conference on Uncertainty in Artificial Intelligence (UAI)*, pages 528–536, 2008. [Acceptance Rate: 28%].

[57] Umar Syed, Robert Schapire, and Michael Bowling. Apprenticeship learning using linear programming. In *Proceedings of the Twenty-Fifth International Conference on Machine Learning (ICML)*, pages 1032–1039, 2008. [Acceptance Rate: 27%].

[58] Michael Bowling, Michael Johanson, Neil Burch, and Duane Szafron. Strategy evaluation in extensive games with importance sampling. In *Proceedings of the Twenty-Fifth International Conference on Machine Learning (ICML)*, pages 72–79, 2008. [Acceptance Rate: 27%].

[59] Michael Bowling, Alborz Geramifard, and David Wingate. Sigma point policy iteration. In *Proceedings of the Seventh International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 379–386, 2008. [Acceptance Rate: 22%].

[60] James Neufeld, Jason Roberts, Stephen Walsh, Michael Sokolsky, Adam Milstein, and Michael Bowling. Autonomous geocaching: Navigation and goal finding in outdoor domains. In *Proceedings of the Seventh International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 47–54, 2008. [Acceptance Rate: 22%].

[61] Nathan Sturtevant, H. James Hoover, Jonathan Schaeffer, Sean Gouglas, Michael Bowling, Finnegan Southey, Matthew Bouchard, and Ghassan Zabaneh. Multidisciplinary students and instructors: A second-year games course. In *Proceedings of the Thirty-Ninth ACM Technical Symposium on Computer Science Education (SIGCSE)*, pages 383–387, 2008. [Acceptance Rate: 31%].

[62] Tao Wang, Daniel Lizotte, Michael Bowling, and Dale Schuurmans. Stable dual dynamic programming. In *Advances in Neural Information Processing Systems 20 (NIPS)*, pages 713–720, 2008. [Acceptance Rate: 22%].

[63] Martin Zinkevich, Michael Johanson, Michael Bowling, and Carmelo Piccione. Regret minimization in games with incomplete information. In *Advances in Neural Information Processing Systems 20 (NIPS)*, pages 905–912, 2008. [Acceptance Rate: 22%].

[64] Michael Johanson, Martin Zinkevich, and Michael Bowling. Computing robust counter-strategies. In *Advances in Neural Information Processing Systems 20 (NIPS)*, pages 1128–1135, 2008. A longer version is available as a University of Alberta Technical Report, TR07-15, [Acceptance Rate: 22%].

[65] Martin Zinkevich, Michael Bowling, and Neil Burch. A new algorithm for generating equilibria in massive zero-sum games. In *Proceedings of the Twenty-Second Conference on Artificial Intelligence (AAAI)*, pages 788–793, 2007. [Acceptance Rate: 27%].

[66] Nolan Bard and Michael Bowling. Particle filtering for dynamic agent modelling in simplified poker. In *Proceedings of the Twenty-Second Conference on Artificial In-*

telligence (AAAI), pages 515–521, 2007. [Acceptance Rate: 27%].

[67] Daniel Lizotte, Tao Wang, Michael Bowling, and Dale Schuurmans. Automatic gait optimization with gaussian process regression. In *Proceedings of the Twentieth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 944–949, 2007. [Acceptance Rate: 35%].

[68] Alborz Geramifard, Michael Bowling, Martin Zinkevich, and Richard S. Sutton. iLSTD: Eligibility traces and convergence analysis. In *Advances in Neural Information Processing Systems 19 (NIPS)*, pages 441–448, 2007. [Acceptance Rate: 24%].

[69] Martin Zinkevich, Michael Bowling, Nolan Bard, Morgan Kan, and Darse Billings. Optimal unbiased estimators for evaluating agent performance. In *Proceedings of the Twenty-First National Conference on Artificial Intelligence (AAAI)*, pages 573–578, 2006. [Acceptance Rate: 30%].

[70] Armita Kaboli, Michael Bowling, and Petr Musilek. Bayesian calibration for Monte Carlo localization. In *Proceedings of the Twenty-First National Conference on Artificial Intelligence (AAAI)*, pages 964–969, 2006. [Acceptance Rate: 30%].

[71] Achim Rettinger, Martin Zinkevich, and Michael Bowling. Boosting expert ensembles for rapid concept recall. In *Proceedings of the Twenty-First National Conference on Artificial Intelligence (AAAI)*, pages 464–469, 2006. [Acceptance Rate: 30%].

[72] Alborz Geramifard, Michael Bowling, and Richard S. Sutton. Incremental least-squares temporal difference learning. In *Proceedings of the Twenty-First National Conference on Artificial Intelligence (AAAI)*, pages 356–361, 2006. [Acceptance Rate: 30%].

[73] Tao Wang, Pascal Poupart, Michael Bowling, and Dale Schuurmans. Compact, convex upper bound iteration for approximate POMDP planning. In *Proceedings of the Twenty-First National Conference on Artificial Intelligence (AAAI)*, pages 1245–1251, 2006. [Acceptance Rate: 30%].

[74] Nathan Sturtevant, Martin Zinkevich, and Michael Bowling. ProbMaxn: Opponent modeling in n-player games. In *Proceedings of the Twenty-First National Conference on Artificial Intelligence (AAAI)*, pages 1057–1063, 2006. [Acceptance Rate: 30%].

[75] Michael Bowling, Dana Wilkinson, and Ali Ghodsi. Subjective mapping. In *New Scientific and Technical Advances in Research (NECTAR) of the Proceedings of the Twenty-First National Conference on Artificial Intelligence (AAAI)*, pages 1569–1572, 2006. [Acceptance Rate: 57%].

[76] Michael Bowling, Peter McCracken, Michael James, James Neufeld, and Dana Wilkinson. Learning predictive state representations using non-blind policies. In *Proceedings of the Twenty-Third International Conference on Machine Learning (ICML)*, pages 129–136, 2006. [Acceptance Rate: 20%].

[77] Nathan Sturtevant and Michael Bowling. Robust game play against unknown opponents. In *Proceedings of the Fifth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 713–719, 2006. [Acceptance Rate: 23%].

[78] Peter McCracken and Michael Bowling. Online discovery and learning of predictive state representations. In *Advances in Neural Information Processing Systems 18 (NIPS)*, pages 875–882, 2006. [Acceptance Rate: 27%].

[79] Michael Bowling, Dana Wilkinson, Ali Ghodsi, and Adam Milstein. Subjective localization with action respecting embedding. In *Proceedings of the International Symposium of Robotics Research (ISRR)*, 2005. [Acceptance Rate: 30%].

[80] Finnegan Southey, Michael Bowling, Bryce Larson, Carmelo Piccione, Neil Burch, Darse Billings, and Chris Rayner. Bayes' bluff: Opponent modelling in poker. In *Proceedings of the Twenty-First Conference on Uncertainty in Artificial Intelligence (UAI)*, pages 550–558, 2005. [Acceptance Rate: 34%].

[81] Tao Wang, Daniel Lizotte, Michael Bowling, and Dale Schuurmans. Bayesian sparse sampling for on-line reward optimization. In *Proceedings of the Twenty-Second International Conference on Machine Learning (ICML)*, pages 961–968, 2005. [Acceptance Rate: 27%].

[82] Michael Bowling, Ali Ghodsi, and Dana Wilkinson. Action respecting embedding. In *Proceedings of the Twenty-Second International Conference on Machine Learning (ICML)*, pages 65–72, 2005. [Acceptance Rate: 27%].

[83] Michael Bowling and Peter McCracken. Coordination and adaptation in impromptu teams. In *Proceedings of the Twentieth National Conference on Artificial Intelligence (AAAI)*, pages 53–58, 2005. [Acceptance Rate: 18%].

[84] Dana Wilkinson, Michael Bowling, and Ali Ghodsi. Learning subjective representations for planning. In *Proceedings of the Nineteenth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 889–894, 2005. [Acceptance Rate: 18%].

[85] Michael Bowling. Convergence and no-regret in multiagent learning. In *Advances in Neural Information Processing Systems 17 (NIPS)*, pages 209–216, 2005. [Acceptance Rate: 25%].

[86] Darse Billings, Aaron Davidson, Terence Schauenberg, Neil Burch, Michael Bowling, Robert Holte, Jonathan Schaeffer, and Duane Szafron. Game tree search with adaptation in stochastic imperfect information games. In *Computers and Games (CG)*, 2004. [Acceptance Rate: 58%].

[87] Michael Bowling, Brett Browning, and Manuela Veloso. Plays as effective multiagent plans enabling opponent-adaptive play selection. In *Proceedings of the Fourteenth International Conference on Automated Planning and Scheduling (ICAPS)*, pages 376–383, 2004. [Acceptance Rate: 31%].

[88] Michael Bowling and Manuela Veloso. Simultaneous adversarial multi-robot learning. In *Proceedings of the Eighteenth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 699–704, August 2003. [Acceptance Rate: 21%].

[89] James Bruce, Michael Bowling, Brett Browning, and Manuela Veloso. Multi-robot team response to a multi-robot opponent team. In *Proceedings of the 2003 IEEE International Conference on Robotics and Automation (ICRA)*, pages 2281–2286, 2003. An earlier version appeared in the *IROS Workshop on Collaborative Robotics* (2002).

[90] Gal A. Kaminka and Michael Bowling. Towards robust teams with many agents. In *Proceedings of the First International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 729–736, July 2002. [Acceptance Rate: 26%].

[91] Brett Browning, Michael Bowling, and Manuela Veloso. Improbability filtering for rejecting false positives. In *Proceedings of the 2002 IEEE International Conference on Robotics and Automation (ICRA)*, pages 3038–3043, May 2002. [Acceptance Rate: 59%].

[92] Rune Jensen, Manuela Veloso, and Michael Bowling. OBDD-based optimistic and strong cyclic adversarial planning. In *Proceedings of the Sixth European Conference on Planning (ECP)*, pages 265–276, September 2001. [Acceptance Rate: 50%].

[93] Michael Bowling and Manuela Veloso. Rational and convergent learning in stochastic games. In *Proceedings of the Seventeenth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 1021–1026, August 2001. [Acceptance Rate: 24%].

[94] Michael Bowling and Manuela Veloso. Convergence of gradient dynamics with a variable learning rate. In *Proceedings of the Eighteenth International Conference on Machine Learning (ICML)*, pages 27–34, June 2001. [Acceptance Rate: 34%].

[95] Michael Bowling. Convergence problems of general-sum multiagent reinforcement learning. In *Proceedings of the Seventeenth International Conference on Machine Learning (ICML)*, pages 89–94, June 2000.

[96] Michael Bowling and Manuela Veloso. Bounding the suboptimality of reusing subproblems. In *Proceedings of the Sixteenth International Joint Conference on Artificial Intelligence (IJCAI)*, pages 1340–1345, August 1999. An earlier version appeared in the *Proceedings of the NIPS Workshop on Abstraction in Reinforcement Learning* (1998), [Acceptance Rate: 26%].

[97] Manuela Veloso, Michael Bowling, Sorin Achim, Kwun Han, and Peter Stone. CMUnited-98: a team of robotic soccer agents. In *Proceedings of the Eleventh Innovative Applications of Artificial Intelligence (IAAI)*, pages 891–896, 1999.

Additional Refereed Workshops, Symposia, and Letters

[98] Martin Zinkevich, Michael Bowling, and Michael Wunder. The lemonade stand game competition: Solving unsolvable games. *ACM SIGecom Exchanges*, 10(1):35–38, 2011.

[99] Kevin Waugh, Martin Zinkevich, Michael Johanson, Morgan Kan, David Schnizlein, and Michael Bowling. A practical use of imperfect recall. In *Proceedings of the Eighth Symposium on Abstraction, Reformulation and Approximation (SARA)*, pages 175–182, 2009. [Acceptance Rate: 62%].

[100] Michael Biggs, Ali Ghodsi, Dana Wilkinson, and Michael Bowling. Scalable action respecting embedding. In *Proceedings of the Tenth International Symposium on Artificial Intelligence and Mathematics (ISAIM)*, 2008.

[101] Tao Wang, Michael Bowling, and Dale Schuurmans. Dual representations for dynamic programming and reinforcement learning. In *Proceedings of the 2007 IEEE*

International Symposium on Approximate Dynamic Programming and Reinforcement Learning, pages 44–51, April 2007. [Acceptance Rate: 75%].

[102] Peter McCracken and Michael Bowling. Safe strategies for agent modelling in games. In *AAAI Fall Symposium on Artificial Multi-agent Learning*, October 2004.

[103] Michael Bowling, Brett Browning, Allen Chang, and Manuela Veloso. Plays as team plans for cooperation and adaptation. In *IJCAI Workshop on Issues in Designing Physical Agents for Dynamic Real-Time Environments: World Modelling, Planning, Learning, and Communicating*, August 2003.

[104] Michael Bowling and Manuela Veloso. Scalable learning in stochastic games. In *AAAI Workshop on Game Theoretic and Decision Theoretic Agents*, July 2002.

[105] Michael Bowling, Rune Jensen, and Manuela Veloso. A formalization of equilibria for multiagent planning. In *AAAI Workshop on Planning with and for Multiagent Systems*, July 2002.

[106] Michael Bowling and Manuela Veloso. Motion control in dynamic multi-robot environments. In *Proceedings of the 1999 IEEE International Symposium on Computational Intelligence in Robotics and Automation (CIRA)*, pages 168–173, November 1999.

[107] Manuela Veloso, Peter Stone, and Michael Bowling. Anticipation as a key for collaboration in a team of agents: A case study in robotic soccer. In *Proceedings of SPIE Sensor Fusion and Decentralized Control in Robotic Systems II*, volume 3839, September 1999.

[108] Michael Bowling and Manuela Veloso. Reusing learned policies between similar problems. In *Proceedings of the AI*IA-98 Workshop on New Trends in Robotics*, October 1998.

[109] Michael Bowling, Peter Stone, and Manuela Veloso. Predictive memory for an inaccessible environment. In *Working Notes of the IROS-96 Workshop on RoboCup*, November 1996.

Unrefereed Book Chapters, Technical Reports, and Theses

[110] Michael Bowling, Rune Jensen, and Manuela Veloso. Multiagent planning in the presence of multiple goals. In Rene Jorna, Wout van Wezel, and Alex Meystel, editors, *Planning in Intelligent Systems: Aspects, Motivations, and Methods*, Intelligent Series, pages 345–371. Wiley, 2005.

[111] Michael Bowling. *Multiagent Learning in the Presence of Agents with Limitations*. PhD thesis, Computer Science Department, Carnegie Mellon University, Pittsburgh, PA, May 2003. Available as technical report CMU-CS-03-118.

[112] Michael Bowling and Manuela Veloso. An analysis of stochastic game theory for multiagent reinforcement learning. Technical report CMU-CS-00-165, Computer Science Department, Carnegie Mellon University, 2000.

[113] Michael Bowling. Robocup rescue: Agent development kit, version 0.4, 2000. Manual.

[114] Jr. David M. McKeown, Michael Bowling, G. Edward Bulwinkle, Steven Douglas Cochran, Stephen J. Ford, Wilson A. Harvey, Dirk Kalp, Chris McGlone, Jeff McMahill, Michael F. Polis, Jefferey A. Shufelt, and Daniel Yocum. Research in image understanding and automated cartography: 1995-1996. In *Proceedings of the DARPA Image Understanding Workshop*, pages 779–812, 1997.

ACADEMIC
SERVICE

Journal Associate Editor
Journal of Machine Learning Research 2015–2017

Journal Associate Editor
Journal of Artificial Intelligence Research 2009–2015

Journal Editorial Board
Machine Learning 2006–Present

Senior Program Committee Member
International Conference on Machine Learning (ICML) 2006,2008,2012
International Joint Conference on Artificial Intelligence (IJCAI) 2009,2011
Conference on Artificial Intelligence (AAAI) 2007,2013,2014,2016
Conference on Autonomous Agents and Multiagent Systems (AAMAS) 2006,2014
Neural Information Processing Systems (NIPS) 2008,2009,2014
Artificial Intelligence and Statistics (AISTATS) 2010

Program Committee Member
Conference on Artificial Intelligence (AAAI) 2004–2006,2008,2010,2015
Neural Information Processing Systems (NIPS) 2006,2007,2011–2013
International Conference on Machine Learning (ICML) 2002–2005,2007,2008
International Joint Conference on Artificial Intelligence (IJCAI) 2005–2007
International Conference on Autonomous Agents and 2002,2004,2008,2012
    Multiagent Systems (AAMAS)
ACM Electronic Commerce (EC) 2012
Multi-disciplinary Conference on Reinforcement Learning and Decision Making (RLDM) 2013,2014
Conference on AI and Interactive Digital Entertainment (AIIDE) 2010–2012
Robotics: Science and Systems (RSS) 2006,2007
International Conference on Artificial Intelligence and Statistics (AISTATS) 2008,2009
Symposium on Abstraction, Reformulation and Approximation (SARA) 2009
International Symposium on Artificial Intelligence and Mathematics (ISAIM) 2008
Canadian Conference on Artificial Intelligence (AI) 2004
RoboCup Symposium 2000,2001–2003

AI Index Steering Committee 2016
One-Hundred Year Study on Artificial Intelligence (AI-100), Stanford University

Doctoral Consortium Mentor 2011–2012
For the AAAI Doctoral Consortium.

Steering Committee 2009–Present
Annual Computer Poker Competition.

Special Issue Guest Co-Editor 2006
For *Machine Learning* on "Machine Learning and Games". Co-editors with Johannes Fuernkranz, Thore Graepel, and Ron Musick.

Co-Chair of the AI Video Awards 2009
At the 2009 International Joint Conference on Artificial Intelligence (IJCAI).

Intelligent Systems Demonstrations Co-Chair 2008
For the AAAI Conference on Artificial Intelligence.

Volunteer Chair 2006
For the International Conference on Machine Learning (ICML).

Chair of the Educational Track of the AI Video Awards 2008
As part of the AAAI Conference on Artificial Intelligence.

Exhibitions Co-Chair 2005
For the International Conference on Intelligent Robots and Systems (IROS). Co-chaired with Bruce Digney.

Workshop Organization
AAAI Workshop on Applied Adversarial Reasoning and Risk Modelling 2011
NIPS Workshop on "Learning and Planning from Batch Time Series Data" 2010
AAAI Workshop on "Multiagent Learning" 2005
AAAI Fall Symposium on "Artificial Multi-Agent Learning" 2005
CG Workshop on "Agents in Computer Games" (Co-chaired with Regis Vincent) 2002

RoboCup Organization 2000-2004
Chair of the RoboCup small-size league technical committee for 2004, which is responsible for competition rules and guiding the league's research agenda. Chair of the small-size league competition for the RoboCup American Open in 2002 (co-chair), 2003, and 2004. I am also a member of the organizing committee for the RoboCup special interest group on multiagent learning started in 2001. I was head referee for the RoboCup small-size league in 2000 and 2001.

UNIVERSITY SERVICE

University Service
Member representative on Compute Canada 2014–2016
Co-Director of the Game Development Certificate 2012–Present
TLAT Sub-Committee on eTextbooks 2012

Faculty of Science Service
Faculty of Science Awards Selection Committee 2014-2016
Faculty of Science representative on Faculty of Arts Council 2013–2016
Faculty Evaluation Committee 2010–2011

Departmental Service
Graduate Program Committee 2014–Present
Faculty Recruiting Committee 2015-2016
Undergraduate Curriculum Committee 2011–2013
Faculty Recruiting Committee 2010
Undergraduate Program Committee 2008–2009

Computing Infrastructure Committee	2007–2008
Graduate Committee	2005–2006
Distinguished Lecture Co-Organizer	2006–2007

RESEARCH
GRANTS

IBM Faculty Award 2016
$51,500. "Deep and Decomposable Game Theoretic Learning Algorithms".

Alberta Innovates Research Centre 2014-2017
$2,000,000 per year (on average). "Alberta Innovates Centre for Machine Learning (AICML)". Joint with R. Goebel, R. Greiner, R. Holte, D. Schuurmans, R. Sutton, C. Szepesvari, Y. Yasui, O. Zaiane. Third round of funding for AICML.

Alberta Gaming Research Institute Grant 2012–2013
$10,000 total. "Tools for the Analysis of Multi-Player Poker Games". Joint with C. Archibald.

NSERC Discovery Grant 2012–2017
$42,000 per year. "Human-Scale Game Theory in Imperfect Information Settings".

Kule Institute for Advanced Study 2011–2012
$14,720 total. "Creating a Gaming Community Platform Driven by Students in Real World Classrooms". Joint with S. Gouglas, G. Rockwell, P. Boechler, M. Carbonaro.

Alberta Gaming Research Institute Grant 2009–2010
$10,000 total. "Calling Their Bluff: Investigating the Accuracy of Skill Assessment Among Poker Players". Joint with T. L. MacKay, D. Hodgins.

Alberta Innovates Research Centre 2009–2014
$2,000,000 per year (on average). "Alberta Innovates Centre for Machine Learning (AICML)". Joint with R. Goebel, R. Greiner, R. Holte, R. Mitchell, D. Schuurmans, R. Sutton, C. Szepesvari, Y. Yasui, O. Zaiane. Second round of funding for AICML.

Alberta Health Services 2009–2011
$1,000,000 total. "Ingenuity Research Grant". Joint with R. Goebel, R. Greiner, R. Holte, R. Mitchell, D. Schuurmans, R. Sutton, C. Szepesvari, Y. Yasui, O. Zaiane.

NSERC Discovery Grant 2007–2012
$28,000 per year. "Data-Driven Statistical Agent Modelling".

Alberta Ingenuity New Faculty Grant 2006–2008
$100,000 per year. "Subjective Models for Autonomous Robots".

NSERC Strategic Project 2005–2007
$195,000 per year. "Intelligent Agents for Interactive Entertainment". Joint with J. Schaeffer, M. Buro, M. Mueller, D. Schuurmans, and D. Szafron.

Alberta Ingenuity Research Centre 2003–2008
$1,800,000 per year (on average). "Alberta Ingenuity Centre for Machine Learning (AICML)". Joint with R. Greiner, R. Goebel, R. Holte, J. Schaeffer, D. Schuurmans, R. Sutton, C. Szepesvari. The centre was started in 2002. I joined in 2003.

NSERC Discovery Grant   2004–2007
$26,034 per year. "Learning in Impromptu Multiagent Systems".

University of Alberta Startup Funds   2003
$80,000.

SUPERVISION   **Post-Doctoral Fellows**

Y. Engel (3/2005–8/2007).

M. Zinkevich (9/2005–8/2007).

J. Veness (1/2011–10/2012).

C. Archibald (9/2011–9/2013).

K. Waugh (9/2015-8/2016).

V. Lisy (8/2015–2/2017).

Ph.D. Students

T. Wang (10/2003–8/2007; with D. Schuurmans). Thesis title: "New Representations and Approximations for Sequential Decision Making under Uncertainty".

D. Wilkinson (4/2006–11/2007; with D. Schuurmans). Thesis title: "Subjective Mapping".

M. Lanctot (9/2008–11/2012). Thesis title: "Monte Carlo Sampling and Regret Minimization for Equilibrium Computation and Decision-Making in Large Extensive Form Games".

A. Afkanpour (3/2007–3/2013; with C. Szpesvári). Thesis title: "Multiple Kernel Learning with Many Kernels".

M. Gendron-Bellemare (4/2011–8/2012). Thesis title: "Fast, Scalable Algorithms for Reinforcement Learning in High Dimensional Domains".

C. Rayner (9/2008–11/2014). Thesis title: "Optimization for Heuristic Search".

M. White (12/2009–12/2014). Thesis title: "Regularized Factor Models"

N. Bard (3/2008–3/2016). Thesis title: "Online Agent Modelling in Human-Scale Problems".

M. Johanson (9/2008–1/2016). Thesis title: "Robust Strategies and Counter-Strategies: From Superhuman to Optimal Play".

J. Neufeld (4/2008–3/2016). Thesis title: "Adaptive Monte Carlo Integration".

K. Chen (9/2009–9/2015). Withdrew to cofound Alieo Games.

N. Burch (9/2011–Present).

A. Koop (4/2012–Present).

M. Machado (9/2013–Present).

T. Davis (6/2015–Present).

D. Morrill (2/2016–Present).

M.Sc. Students

P. McCracken (3/2004–9/2005). Thesis title: "An Online Algorithm for Learning Predictive State Representations".

A. Geramifard (3/2005–12/2006; with R. Sutton). Thesis title: "Incremental Least-Squares Temporal Difference Learning". Massachusetts Institute of Technology (MIT).

A. Kaboli (1/2005–9/2007; with P. Musilek). Thesis title: "Bayesian Calibration for Monte Carlo Localization".

M. Johanson (3/2005–10/2007). Thesis title: " Robust Strategies and Counter-Strategies: Building a Champion Level Computer Poker Player".

N. Bard (3/2005–3/2008). Thesis title: "Using State Estimation for Dynamic Opponent Modelling".

J. Neufeld (3/2006–4/2008). Thesis title: "Autonomous Outdoor Navigation and Goal Finding".

K. Waugh (3/2008–7/2009; with D. Schuurmans). Thesis title: "Abstraction in Large Extensive Games".

D. Schnizlein (3/2008–7/2009; with D. Szafron). Thesis title: "State Translation in No-Limit Poker".

M. White (9/2008–12/2009; with D. Schuurmans). Thesis title: "A General Framework for Reducing Variance in Agent Evaluation".

Y. Naddaf (3/2008–3/2010). Thesis title: "Learning to Play Generic Atari 2600 Console Games".

M. Joya (3/2010–6/2012). Thesis title: "Methods for Automatic Heart Sound Identification".

P. Mazrooei (4/2011–9/2012). Thesis title: "Collusion Detection in Sequential Games".

M. Vafadoost (4/2011–8/2013). Thesis title: "Temporal Abstraction in Monte Carlo Tree Search".

J. Davidson (4/2011–1/2014). Thesis title: "The Baseline Approach to Agent Evaluation".

T. Davis (9/2012–6/2015). Thesis title: "Using Response Functions for Strategy Training and Evaluation".

S. Srinivasan (4/2013–11/2014). Thesis title: "State Generalization in UCT".

U. das Gupta (4/2013–11/2014). Thesis title: "Adaptive Representation for Policy Gradient".

D. Morrill (1/2013–2/2016). Thesis title: "Using Regret Estimation to Solve Games Compactly".

T. Yee (4/2014–Present).

R. Post (4/2015–Present).

Undergraduate Summer Researchers
C. Rayner (2005), T. Pittman (2005), J. Ho (2005), M. Lednicky (2006–2008), G. Ward (2012-2013), B. Kuzma (2013-2014), J. Chu (2013), J. Emery (2014).

Visiting Student
A. Rettinger (3/2005–6/2005)

THESIS
EXAMINATION

Ph.D. Examiner: F. Mirzazadeh (11/2016; Alberta, CS) A. White (5/2015; Alberta, CS) S. Ganzfried (4/2015; CMU, CS) R. Zhao (3/2015; Alberta, CS) J. Hawkin (8/2014; Alberta, CS) R. Gibson (12/2013; Alberta, CS) L. Lelis (7/2013; Alberta, CS) D. Chakraborty (8/2013; UTexas-Austin, CS) G. Bartok (6/2012; Alberta, CS) A. m. Farahmand (9/2011; Alberta, CS), J. Long (8/2011; Alberta, CS), D. Lizotte (7/2008; Alberta, CS), A. Milstein (3/2008; Waterloo, CS),

M.Sc. Examiner: Z. Ahmad (1/2016; Alberta, CS) Y. Wu (7/2016; Alberta, CS) A. Edwards (4/2016; Alberta, Rehab) K. Atui (9/2015; Alberta, CS) S. Hernandez (9/2015; Alberta, CS) P. Jin (12/2014; Alberta, CS) M. Bastani (11/2013; Alberta, CS) A. Sanabria (9/2013; Alberta, CS) J. Wen (7/2013; Alberta, CS) A. Karamaoun (6/2013; Alberta, Physics) M. Burden (8/2012; Alberta, HuCo) D. Huntley (10/2011; Alberta, CS), A. Sharifi (9/2010; Alberta, CS), S. Hladky (6/2009; Alberta, CS), D. Rayner (6/2008; Alberta, CS), A. Visatemongkolchai (9/2007; Alberta, CS), P. Pytlak (8/2007; Alberta, ECE), C. Onuczko (5/2007; Alberta, CS), G. Xaio (2/2007; Alberta CS), M. Kan (1/2007; Alberta CS), F. Ahmad (1/2007; Alberta, ECE), E. Rafols (9/2006; Alberta, CS), C. Paduraru (12/2006; Alberta, CS), B. Hoehn (12/2005; Alberta, CS), R. Guanlao (9/2004; Alberta, ECE), S. Verret (5/2004; Alberta, CS)

TEACHING

Undergraduate Courses

INTD350: Game Design Principles and Practice (W2013,F2013,W2015,W2016)

CMPUT274/275: Honors Intro to Computing I/II (F2011–W2014)

CMPUT101: Introduction to Computing (W2011)

CMPUT229: Computer Organization and Architecture I (F2008)

CMPUT250: Computers and Games (F2005–W2009,F2015,W2016)

CMPUT412: Experimental Mobile Robotics (W2005,W2006)

CMPUT204: Algorithms I (W2004,F2004)

Graduate Courses

CMPUT658: Applied Game Theory (F2010)

CMPUT608: Robotics Challenge (F2005,F2007)

CMPUT608: Learning in Multiagent Systems (W2004)

15-889: Multiagent Systems, Theory and Practice (2001)
        Co-taught at CMU with Prof. Manuela Veloso and Dr. Gal Kaminka.

PERSONAL
INFORMATION

Citizenship: United States; Permanent Resident of Canada

Family: Married with three boys.

Hobbies: Board game connoisseur, curling, indoor wall climbing.