Marek Petrik

CONTACT

Business Analytics and Mathematical Sciences
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RESEARCH INTERESTS

Machine learning, mathematical optimization, robust and risk-averse optimization, reinforcement learning and approximate dynamic programming, precision agriculture, resource management.

EDUCATION

- **University of Massachusetts Amherst**, Amherst, MA, USA. (2005 – 2010)
  Ph.D. in Computer Science: September 1, 2010, GPA: 4.0/4.0
  Advisor: Shlomo Zilberstein
  Thesis: Optimization-based Approximate Dynamic Programming
  Committee: Shlomo Zilberstein, Andrew Barto, Sridhar Mahadevan, Ana Muriel, Ronald Parr
- **University of Massachusetts Amherst**, Amherst, MA, USA. (2005 – 2008)
  M.Sc. in Computer Science, May 2008, GPA: 4.0/4.0
- **Univerzita Komenskeho**, Bratislava, Slovakia. (2000 – 2005)
  B.Sc. in Computer Science, graduated: June 2005
  Major in *Artificial Intelligence* and *Parallel Algorithms*
  GPA: 3.84/4.0 Graduation thesis: *Learning Parallel Portfolios of Algorithms*

JOURNAL ARTICLES

- Dan Iancu, Marek Petrik, Dharmashankar Subramanian, *Tight approximations of dynamic risk measures*, Mathematics of Operations Research 40(3), 2015.
- Amit Dhurandhar, Marek Petrik, *Efficient and accurate methods for updating generalized linear models with multiple feature additions*, Journal of Machine Learning Research 15:2607–2627, 2014.
- Markus Ettl, Prateek Jain, Ronny Luss, Marek Petrik, Rajesh Ravi, Chitra Venkatramani, *Combining social media and customer behavior analytics for personalized customer engagements*, IBM Journal of Research and Development 58(5/6):7:1-7:12, 2014.
- Marek Petrik and Shlomo Zilberstein, *Robust approximate bilinear programming for value function approximation*, Journal of Machine Learning Research 12:3027–3063, 2011
- Marek Petrik, *Optimization-based Approximate Dynamic Programming*, Ph.D. Dissertation 2010, University of Massachusetts Amherst.
- Marek Petrik and Shlomo Zilberstein, *A bilinear programming approach for multiagent systems*, Journal of Artificial Intelligence Research 35:235–274, 2009.
- Jeff Johns, Marek Petrik, and Sridhar Mahadevan, *Hybrid Least-Squares Algorithms for Approximate Policy Evaluation*, Machine Learning 76(2):243–256 and European Conference on Machine Learning (ECML), 2009.
- Marek Petrik and Shlomo Zilberstein, *Learning parallel portfolios of algorithms*, Annals of Mathematics and Artificial Intelligence, 48(1-2):85–106, 2006.

REFEREED CONFERENCE PUBLICATIONS

- ◇ Bo Liu, Ji Liu, Mohammad Ghavamzadeh, Sridhar Mahadevan, Marek Petrik, *Finite-Sample Analysis of Proximal Gradient TD Algorithms*, Uncertainty in Artificial Intelligence (UAI), 2015, (Best Student Paper Award) (Acceptance rate: 25 %)
- ◇ Marek Petrik, Xiaojian Wu, *Optimal Threshold Control for Energy Arbitrage with Degradable Battery Storage*, Uncertainty in Artificial Intelligence (UAI), 2015, (Acceptance rate: 25 %)
- ◇ Marek Petrik, Dharmashankar Subramanian, *RAAM: The benefits of robustness in approximating aggregated MDPs in reinforcement learning*, Neural Information Processing Systems (NIPS), 2014. (Acceptance rate: spotlight 4.8%)
- ◇ Francisco Barahona, Markus Ettl, Marek Petrik, Peter Rimshnick, *Optimizing deliveries in agile supply chains with demand shocks*, Winter Simulation Conference, 2013.
- ◇ Janusz Marecki, Marek Petrik, Dharmashankar Subramanian, *Solution methods for constrained Markov decision process with continuous probability modulation*, Conference on Uncertainty in Artificial Intelligence (UAI), 2013. (Acceptance rate: 31%)
- ◇ Marek Petrik and Dharmashankar Subramanian, *An approximate solution method for large risk-averse Markov decision processes*, Conference on Uncertainty in Artificial Intelligence (UAI), 2012. (Acceptance rate: 31%)
- ◇ Marek Petrik, *Approximate dynamic programming by minimizing distributionally robust bounds*, International Conference on Machine Learning (ICML), 2012. (Acceptance rate: 27%)
- ◇ Marek Petrik and Shlomo Zilberstein, *Resource management using point-based dynamic programming*, Proceedings of the 25th Conference on Artificial Intelligence (AAAI), 2011. (Acceptance rate 24.8%)
- ◇ Marek Petrik, Gavin Taylor, Ron Parr, and Shlomo Zilberstein, *Feature selection using regularization in approximate linear programs for Markov decision processes*, Proceedings of the International Conference on Machine Learning (ICML) 27, 2010. (Acceptance rate: 26%)
- ◇ Marek Petrik and Shlomo Zilberstein, *Robust value function approximation using bilinear programming*, Proceedings of the Advances in Neural Information Processing Systems (NIPS) 22, 2009. (Acceptance rate — spotlight: 8%)
- ◇ Marek Petrik and Shlomo Zilberstein, *Constraint relaxation in approximate linear programs*, Proceedings of the International Conference on Machine Learning (ICML), 2009. (Acceptance rate 26%)
- ◇ Marek Petrik and Bruno Scherrer, *Biasing approximate dynamic programming with a lower discount factor*, Proceedings of the Advances in Neural Information Processing Systems (NIPS) 21, 2008. (Acceptance rate 27%)
- ◇ Marek Petrik and Shlomo Zilberstein, *Learning heuristic functions through approximate linear programming*, Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS), 2008. (Acceptance rate 34%)
- ◇ Martin Allen, Marek Petrik, and Shlomo Zilberstein, *Interaction structure and dimensionality in decentralized problem solving*, Proceedings of the Conference on Artificial Intelligence (AAAI) (Short Paper), 2008. (Acceptance rate 26%)

- ◇ Marek Petrik and Shlomo Zilberstein, *Anytime coordination using separable bilinear programs*, Proceedings of the Conference on Artificial Intelligence (AAAI), 2007. (Acceptance rate 27%)
- ◇ Marek Petrik *An analysis of Laplacian methods for value function approximation in MDPs*, Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI), 2007 (Acceptance rate 16%)
- ◇ Marek Petrik and Shlomo Zilberstein, *Average-reward decentralized Markov decision processes*, Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI), 2007 (Acceptance rate 16%)

PEER-REVIEWED SYMPOSIA

- ◇ Marek Petrik, Dharmashankar Subramanian, *RAAM: The Benefits of Robustness in Approximating Aggregated MDPs in Reinforcement Learning*, From Bad Models to Good Policies (Sequential Decision Making under Uncertainty), NIPS Workshop, 2014.
- ◇ Marek Petrik, *Distributionally Robust Approach to Approximate Dynamic Programming*, European Workshop on Reinforcement Learning, 2012.
- ◇ Brenda Dietrich, Markus Ettl, Roger D. Lederman, Marek Petrik, *Optimizing the end-to-end value chain through demand shaping and advanced customer analytics*, 11th International Symposium on Process Systems Engineering, 2012.
- ◇ Marek Petrik, *Robust Approximate Optimization for Large Scale Planning Problems*. AAAI Doctoral Consortium, Pasadena, CA, 2009.
- ◇ Marek Petrik and Shlomo Zilberstein, *A Successive approximation algorithm for coordination problems*. In Proceedings of the International Symposium on Artificial Intelligence and Mathematics, Fort Lauderdale, FL, 2008
- ◇ Marek Petrik and Shlomo Zilberstein, *Learning static parallel portfolios of algorithms*. In Proceedings of the International Symposium on Artificial Intelligence and Mathematics, Fort Lauderdale, FL, 2006.
- ◇ Marek Petrik, *Statistically optimal combination of algorithms*. In Proceedings of the International Conference on Current Trends in Theory and Practice of Computer Science (SOFSEM), 2005.

BOOK CHAPTERS

- ◇ Marek Petrik and Shlomo Zilberstein, *Learning Feature-Based Heuristic Functions*. In Y. Hamadi, E. Monfroy, and F. Saubion (Eds.), Autonomous Search, Springer, June, 2011.

INVITED TALKS & PRESENTATIONS

- ◇ Stephen Becker, Marek Petrik, Ban Kawas, Karthikeyan N. Ramamurthy, *Robust Compressed Least Squares Regression*, Out of the Box: Robustness in High Dimension, NIPS Workshop, 2014
- ◇ Marek Petrik, Dharmashankar Subramanian, *Using Robustness in Approximate Dynamic Programming*, INFORMS Annual Meeting, 2014
- ◇ Marek Petrik, *Using Robust Optimization for Solving Large Data-driven Problems*, CS Colloquium, University of Colorado, Boulder, 2014.
- ◇ Marek Petrik, *Using Robustness in Value Function Approximation*, Modeling and Optimization: Theory and Applications (MOPTA), 2014

- ◇ Marek Petrik, *Distributionally Robust Approach to Approximate Dynamic Programming*, OR & OM Seminar, Tepper School of Business, Carnegie Mellon University, 2012
- ◇ Marek Petrik, Dharmashankar Subramanian, *Feature Selection in Linear Dynamical Systems*, INFORMS Annual Meeting, 2012
- ◇ Marek Petrik, *Distributionally Robust Approach to Approximate Dynamic Programming*, INFORMS Annual Meeting, 2011
- ◇ Marek Petrik, Dharmashankar Subramanian, *Risk Sensitive Resource Management in Dynamic Settings*, INFORMS Annual Meeting, 2011
- ◇ Dan Iancu, Marek Petrik, Dharmashankar Subramanian, Pu Huang, *The Price of Dynamic Inconsistency for Distortion Risk Measures*, INFORMS Annual Meeting 2011
- ◇ Marek Petrik, *Optimization-based Methods for Approximate Dynamic Programming*, INFORMS Annual Meeting, 2010.
- ◇ Marek Petrik, *Approximate Dynamic Programming for Resource Management*, IBM T.J. Watson Research Center, 2010
- ◇ Marek Petrik, *Approximate Dynamic Programming for Resource Management*, Robotics Institute, Carnegie-Mellon University, 2010
- ◇ Marek Petrik and Shlomo Zilberstein, *Value Function Approximation for Reservoir Management*, 2nd International Conference on Computational Sustainability, 2010
- ◇ Marek Petrik and Shlomo Zilberstein, *Blood Inventory Management Using Approximate Linear Programming Marek Petrik and Shlomo Zilberstein*. Presented at INFORMS Computing Society Meeting, Charleston, SC, 2009
- ◇ Marek Petrik and Shlomo Zilberstein, *Constraint Relaxation in Approximate Linear Programs*. Dagstuhl Seminar 09181: "Sampling-based Optimization", Dagstuhl, Germany, 2009
- ◇ Marek Petrik, *Aggregation in MDPs: Policy iteration and linear programming*. Presented at New England Student Colloquium on Artificial Intelligence, 2007.
- ◇ Marek Petrik, Shlomo Zilberstein, *Coordination in multi-agent systems*. Presented at MAIA research group in INRIA 2007.
- ◇ Marek Petrik *Basis construction using Krylov method*. Presented at TAM 2006, Bratislava, Slovakia.
- ◇ Marek Petrik, *Knowledge representation for expert systems*. Presented at International Conference for Undergraduate and Graduate Students of Applied Mathematics 2004.

TECHNICAL REPORTS

- ◇ Pu Huang, Dan Iancu, Marek Petrik, Dharmashankar Subramanian, *The Price of Dynamic Inconsistency for Distortion Risk Measures*, arXiv 2011.
- ◇ Marek Petrik and Shlomo Zilberstein, Global Optimization for Value Function Approximation, arXiv 2010.
- ◇ Marek Petrik, Gavin Taylor, Ron Parr, and Shlomo Zilberstein, *Feature selection using regularization in approximate linear programs for Markov decision processes*, arXiv 1005.1860.
- ◇ Marek Petrik and Shlomo Zilberstein, *Robust Value Function Approximation Using Bilinear Programming*. University of Massachusetts Technical Report UM-CS-2009-052, 2009.

◇ Martin Allen, Marek Petrik, and Shlomo Zilberstein, *Interaction Structure and Dimensionality Reduction in Decentralized MDPs*. University of Massachusetts Technical Report UM-CS-2008-11, 2008.

GRANTS

◇ Co-authored a funded AFOSR grant "Adaptive Optimization Techniques for Large-Scale Stochastic Planning", FA9550-08-1-0171

◇ Took a class on writing grant proposals: "The Grant Process: From Solicitation to Award "

AWARDS

◇ Awarded Graduate School Fellowship, University of Massachusetts Amherst, 2008-2009

◇ Passed portfolio (Ph.D. candidacy exam) with distinction, University of Massachusetts Amherst 2008

◇ Received: "Outstanding Synthesis Project" award for "A linear programming approach to bounds and basis construction for Markov decision processes", 2007-2008

◇ 2nd Place in Tetris Domain in Reinforcement Learning Competition 2008 (with Jeff Johns and Colin Barringer)

◇ Invited to Dagstuhl seminar 09181: "Sampling-based Optimization"

◇ Final Round of Microsoft Fellowship 2007/2008

◇ AAAI Doctoral Consortium 2009

EMPLOYMENT

◇ **Research Staff Member**, IBM T.J. Watson Research Center, Yorktown, NY
(December 2011 – present)
Department of Business Analytics and Mathematical Sciences

- Supply chain optimization
- Revenue and demand management
- Dynamic recommender systems
- Portfolio / resource management
- Dynamic optimization for precision agriculture
- Machine learning for environmental monitoring

◇ **Postdoctoral Researcher**, IBM T.J. Watson Research Center, Yorktown, NY
(July 2010 – November 2011)
Department of Business Analytics and Mathematical Sciences

- Supply chain optimization and disaster response
- Revenue and demand management

◇ **Research/Teaching Assistant**, University of Massachusetts Amherst
(September 2005 – June 2010)
Resource bounded reasoning lab

◇ **Researcher and Developer**, Whitestein Technologies
(October 2003 – August 2005)
Optimization of large-scale production and transport processes.

- Research on Multi-agent systems and optimization
- Combinatorial optimization for production planning and vehicle routing
- Constraint programming, Mozart, Prolog, Java

◇ **Programmer**, OneTwoTech (June 2001 – June 2003)
Design, implementation and evaluation of new technologies for a web-application server, using: Advanced .NET Framework, COM+, MS SQL Server, Web Services

◇ **Programmer** SWTeam (July 2000 – July 2001) Implementation of high performance components for client-side data management for multi-dimensional (OLAP) databases using: C++, MS SQL.

PROGRAMMING EXPERIENCE

◇ Python, C/C++, F#, Java, Scala, C#, Matlab, R, SQL, MongoDB, GDAL

TEACHING EXPERIENCE

◇ Guest lecture: "Abstraction and Hierarchical Search", Artificial Intelligence class, Fall 2009

◇ Attended a pedagogy class on: "Scientific Teaching", Spring 2009

◇ Teaching assistant: "Artificial Intelligence", Spring 2008

◇ Organized and taught a study group on: "Linear Programming and Mathematical Optimization", Fall 2007

PROFESSIONAL SERVICE

◇ **Journal Reviewing**

- Mathematics of Operations Research, 2012–2015
- Operations Research, 2013–2015
- Journal of Artificial Intelligence Research 2008–2015
- Journal of Machine Learning Research 2008–2015
- AdHoc Networks Journal 2015
- A Quarterly Journal of Operations Research 2015
- Information Processing Letters 2011
- International Journal of Approximate Reasoning 2011
- Journal of Autonomous Agents and Multi-Agent Systems 2007–2010
- IEEE Transactions on Automatic Control 2009–2010
- Annals of Mathematics and Artificial Intelligence 2006, 2010
- Applied Stochastic Models in Business and Industry 2015

◇ **Program Committee of Conferences**

- International Conference on Machine Learning (ICML), 2011–2015
- Conference on Artificial Intelligence (AAAI) 2008, 2012–2015
- Advances in Neural Information Processing Systems (NIPS), 2011–2015
- Uncertainty in Artificial Intelligence (UAI) 2010, 2013–2015
- Artificial Intelligence and Statistics (AI-STATS), 2011, 2012
- International Symposium on Artificial Intelligence and Mathematics 2011

- International Joint Conference on Artificial Intelligence (IJCAI) 2009, 2011, 2013
- Autonomous Agents and Multiagent Systems (AAMAS) 2010

◇ **Other Organizing**

- Local co-chair of ICML 2016

◇ **Conference Reviewing**

- North–East Student Colloquium on Artificial Intelligence (NESCAI) 2010
- International Conference on Automated Planning and Scheduling (ICAPS) 2007–2009
- National Conference on Artificial Intelligence (AAAI) 2006
- International Symposium on Artificial Intelligence and Mathematics 2006

◇ **Other Reviewing**

- Judge for SIAM Moody's Mega Math Challenge 2014, 2015

REFERENCES

◇ **Shlomo Zilberstein** Professor of Computer Science

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◇ **Ronald Parr** Professor of Computer Science and Department Chair

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Duke University
Durham, NC 27708 USA

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Web: http://cs.duke.edu/~parr

◇ **Csaba Szepesvari** Professor of Computer Science

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Edmonton, Alberta, Canada

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Web: http://www.ualberta.ca/~szepesva/

◇ **Dan A. Iancu** Assistant Professor of Operations, Information and Technology

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Stanford University
Stanford, CA 94305

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