

Marek Petrik

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IBM T.J. Watson Research Center *Email:* mpetrik@us.ibm.com
Yorktown Heights, NY *Web:* <http://cs.umass.edu/~petrik>
- RESEARCH INTERESTS Approximate dynamic programming/reinforcement learning, robust optimization, machine learning, mathematical optimization, operations research.
- 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
- ◇ Marek Petrik and Shlomo Zilberstein, *Robust Approximate Bilinear Programming*, Submitted to Journal of Machine Learning Research, 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 (JAIR), 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.
- CONFERENCE PUBLICATIONS
- ◇ Marek Petrik, *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, *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

- ◇ Marek Petrik, *Distributionally Robust Approach to Approximate Dynamic Programming*, INFORMS 2011
- ◇ Marek Petrik, Dharmashankar Subramanian, *Risk Sensitive Resource Management in Dynamic Settings*, INFORMS 2011
- ◇ Dan Iancu, Marek Petrik, Dharmashankar Subramanian, Pu Huang, *The Price of Dynamic Inconsistency for Distortion Risk Measures*, INFORMS 2011

- ◇ Marek Petrik, *Optimization-based Methods for Approximate Dynamic Programming*, INFORMS 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

- ◇ 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 grants: "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

RESEARCH
PROJECTS

- ◇ **Robust and Risk-sensitive Multistage Optimization**
We study methods that can optimize decision making in dynamic problems in the presence of model errors and risk-averse objectives. These methods combine robust optimization, machine learning, and approximate dynamic programming.
(2010 – present)
- ◇ **Reliable Optimization-based Approximate Dynamic Programming**
We developed a new approach to *reinforcement learning* and *approximate dynamic programming* based on optimization-based analysis. This led to more reliable algorithms with better theoretical properties than existing methods and good empirical performance.
(2006 – present)
- ◇ **Algorithms and formal models for decentralized planning problems.**
We have developed novel algorithms and formal models for decentralized planning problems. We showed a connection between existing multi-agent planning algorithms and mathematical optimization. The resulting algorithms significantly outperformed the state of the art.
(2005 – 2008)
- ◇ **Pickup and delivery problem with time windows.** We developed algorithms for scheduling truck deliveries in an industrial setting. The solution methods were based on dynamic programming, constraint satisfaction, and mathematical optimization.
(2005)
- ◇ Algorithm portfolios. (2004 – 2005)

EMPLOYMENT

- ◇ **Postdoctoral Research Associate at IBM T.J. Watson Research Center**
(August 2010 – Present)
Business Analytics and Mathematical Sciences
- ◇ **Research Assistant**, University of Massachusetts Amherst
(September 2005 – June 2010)
Resource bounded reasoning lab
- ◇ **Teaching Assistant** University of Massachusetts Amherst
(Spring 2008)
Artificial Intelligence class
- ◇ **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.

TEACHING
EXPERIENCE

- ◇ Guest lecture: “Abstraction and Hierarchical Search”, Artificial Intelligence class, Fall 2009
- ◇ Took 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

- ◇ **Program Committee of Conferences**
 - International Joint Conference on Artificial Intelligence (IJCAI) 2011
 - Artificial Intelligence and Statistics 2011
 - Autonomous Agents and Multiagent Systems (AAMAS) 2010
 - Uncertainty in Artificial Intelligence (UAI) 2010 International Joint Conference on Artificial Intelligence (IJCAI) 2009
 - Conference on Artificial Intelligence (AAAI) 2008
- ◇ **Journal Reviewing**
 - Information Processing Letters 2011
 - Journal of Artificial Intelligence Research 2008–2010
 - Journal of Machine Learning Research 2008–2010
 - Journal of Autonomous Agents and Multi-Agent Systems 2007–2009
 - IEEE Transactions on Automatic Control 2009–2010
- ◇ **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
 - Annals of Mathematics and Artificial Intelligence 2006

REFERENCES

- ◇ **Shlomo Zilberstein** Professor of Computer Science
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- ◇ **Ronald Parr** Associate Professor of Computer Science
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 - Duke University *Email:* parr@cs.duke.edu
 - Durham, NC 27708 USA *Web:* <http://cs.duke.edu/~parr>
- ◇ **Sridhar Mahadevan** Associate Professor of Computer Science
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- ◇ **Andrew G. Barto** Professor of Computer Science
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- ◇ **Victor R. Lesser** Professor of Computer Science
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