Curriculum Vitae

Milos Hauskrecht
Department of Computer Science
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August 8, 2018

Education

PhD in Computer Science, **Massachusetts Institute of Technology**
August 1997, Cambridge, MA, advisor: Prof. Peter Szolovits

MSc in Electrical Engineering (with distinction), **Slovak Technical University**
May 1988, Bratislava, Czechoslovakia

Professional appointments

2015 - present: Professor
Department of Computer Science, University of Pittsburgh, PA

2007 - 2015: Associate Professor
Department of Computer Science, University of Pittsburgh, PA

2001 - 2007: Assistant Professor
Department of Computer Science, University of Pittsburgh, PA

2000 - 2001: Assistant Professor
Computer and Information Sciences Department, Temple University, Philadelphia, PA

1997 - 2000: Postdoctoral research associate
Computer Science Department, Brown University, Providence, RI

1991 - 1997: Research assistant
MIT Laboratory for Computer Science, MIT, Cambridge, MA

1990 - 1991: Research associate
Medical Bionics Research Institute, Bratislava, Slovakia

1988 - 1990: Research assistant
Medical Bionics Research Institute, Bratislava, Slovakia.

Other Current Affiliations

2001 - Present: core faculty
Intelligent Systems Program, University of Pittsburgh, PA

2003 - Present: member
University of Pittsburgh Cancer Institute, Pittsburgh, PA

2005 - Present: affiliated member
Department of Computational Biology, University of Pittsburgh School of Medicine, Pittsburgh, PA

2006 - Present: secondary appointment
Department of Biomedical Informatics, University of Pittsburgh School of Medicine

2006 - Present: core faculty
Biomedical Informatics Training Program, University of Pittsburgh School of Medicine, Pittsburgh, PA

Research interests

Artificial intelligence (AI):

- Machine learning and data mining

- Time-series modeling and analysis

- Planning, and optimization in the presence of uncertainty

Biomedical applications:

- Clinical (EHR) data analysis

- Adverse event prediction

- Clinical monitoring and alerting, patient safety

- Real-time clinical systems

Research funding

Active funding:

- **NIH.** 2R01GM088224. Real-time detection of deviations in clinical care in ICU data stream. (PIs: Hauskrecht, Clermont, Cooper), August 2014 - May 2019, $2,255,702. The goal of the project is to develop evidence-based, rather than knowledge-based, solutions to detect anomalous patient management in acutely ill patients. Our approach works by identifying patient-management patterns that are unusual with respect to patterns associated with comparable patients and by raising a patient-specific alert

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when such a patient is prospectively encountered. Our main conjecture is that these outliers indicate medical errors or clinically useful reminders often enough to warrant its deployment in clinical settings. A real-time system for learning and applying alerting models for a wide variety of patient management decisions will be built and evaluated by physicians in the critical care environment.

- **NIH.** R01LM011966-01. Improving Clinical Decision Support Reliability Using Anomaly Detection Methods. (PI: Adam Wright, Partners healthcare, Boston, MA), **role:** co-investigator, PI - University of Pittsburgh subcontract; Sept, 2014 - Sept, 2019, UPitt subcontract: $275,000
  Clinical decision support (CDS) systems provide clinical team members with and patient-specific information and knowledge with the goal to enhance the quality and safety of healthcare. While the mounting evidence suggests that CDS, when used effectively, can improve health care quality, safety, and effectiveness of care, CDS systems may still fail, and such failures frequently go undetected. The objective of this work is to devise and test new anomaly detection methodologies that can promptly or pro-actively identify anomalies in the operation of the CDS system and report them in order to assure the intended CDS functions.

- **NIH.** 1R01LM012095. Development and Evaluation of a Learning Electronic Medical Record System (PI: Visweswaran), **role**: co-investigator, 09/15/2015 – 06/30/2019. $1,769,088.
  The goal of this project to develop and evaluate a learning electronic medical records system that draws a physician's attention to the right data, at the right time. It learns how to do so by monitoring the electronic medical record (EMR) usage patterns during many past clinical encounters. From these patterns it learns a statistical model of which EMR data to highlight in a given clinical context.

Past funding:

- **NSF.** IIS 0911032. Discovering Complex Anomalous Patterns. (PI: Artur Dubrawsky, CMU), **role:** co-investigator September 2009 - August 2014, (UPitt subcontract)
  The objective of this project is to develop, implement, and evaluate a general and widely applicable framework for detecting potentially complex and important statistical patterns in large databases.

- **NIH.** 1R01LM010019. Using medical records repositories to improve the alert system design. (PI: Hauskrecht), September 30 2009 - September 2013, $1,137,679.
  We propose to develop a framework that is able to assess the performance of an alerting system off-line, before it is deployed. Our off-line evaluation relies on the expert-based assessment of alerts on retrospective patient cases, where clues and outcomes in the data relevant for the assessment are used to leverage expert input and decrease expert effort. To further aid the process of tuning and optimizing the alerting system, we propose to convert the alerting problem to a special prediction learning problem, where past patients examples with expert-defined alerting labels provide the data to train and test the model. Methods from statistical machine learning will be investigated and developed for this purpose.

- **NIH.** 1R01GM088224. Detecting deviations in clinical care in ICU data streams. (PIs: Hauskrecht and Clermont), September 2009 - June 2013, $1,521,570.
  The goal of this project is to develop advanced computational, rather than expert-based, solutions to detect anomalous clinical decision making in acutely ill patients.

The approach works by identifying patient-management patterns that are unusual with respect to patterns associated with comparable patients and by raising a patient-specific alert when such a patient is prospectively encountered. The project aims to demonstrate the feasibility, and potential for clinician acceptance of the approach on retrospective electronic health record data in HIDENIC database.

- **NSF.** IIS 1243409. ICML 2012 workshop on Machine Learning for Clinical Data Analysis. (PI: Hauskrecht), June 15, 2012 - June 15, 2013, $18,000.
  Clinical and health-care applications have been and continue to be the source of inspiration for many areas of artificial intelligence research. Many advances in various sub-specialties of AI have been inspired by challenges posed by medical problems. The purpose of this workshop is to bring together machine learning and informatics researchers interested in problems and applications of machine learning in the clinical domain, with the goal of exchanging ideas and perspectives, identifying research bottlenecks and medical applications, bridging the gap between the theory of machine learning, natural language processing, and the needs of the healthcare community, and, in general, raising awareness of potential healthcare applications in the machine learning community.

- **NIH.** R21LM009102. Evidence-based anomaly detection in clinical databases. (PI: Hauskrecht), April 2007-April 2009, $358,846.
  We propose to develop and evaluate a new data-driven approach for detecting unusual clinical patterns (anomalies) that is complementary to knowledge-based approaches. The new approach is based on comparing clinical actions, such as medications given and labs ordered, taken for the current patient to those actions taken for similar patients in the recent past, as recorded in a clinical database. The approach builds upon recent advances in machine learning and Bayesian network modeling to identify unusual patterns. The advantages of the new computational technique are that it works with minimal prior knowledge, and it may detect anomalies for which no rules have yet been written. We evaluate the approach in a laboratory setting using retrospective data for the cohort of surgical cardiac patients.

- **NCI.** P50 CA090440-06. SPORE in Lung Cancer. (PI: Jill Siegfried) **role:** co-investigator, July 2006–April 2011, $8.5mil.
  The University of Pittsburgh Cancer Institute (UPCI) Specialized Program of Research Excellence (SPORE) in Lung Cancer funded by NCI includes three lung cancer projects and four cores. Dr Hauskrecht works primarily in the "Serum Proteomic Biomarkers for Lung Cancer Detection and Prognosis" project. The work will focus on the analysis of MALDI-TOF MS proteomic profiles and design of computational methods for discovery of potential lung cancer markers in one-shot and longitudinal studies.

- **NSF.** ANI-0325353. Secure CITI: A Secure Information Technology Infrastructure for Disaster Management. (PI: Daniel Mosse), **role:** co-investigator, September 2003-August 2009, $2.8mil.
  The Secure and robust Critical Information Technology Infrastructure project aims to provide infrastructure and computational support to Emergency Managers (EMs) who are responsible for decision-making and management of resources before, during, and after emergencies or disasters. The system relies on a network of sensors that gather data from the field, the algorithms that monitor, detect and predict emergency/disaster situations, and adaptive information-routing schemes that disseminate the data among the appropriate emergency agencies and units.

- **DoD.** USAMRAA Prime Award W81XWH-05-2-0066 Telemedicine and Advanced Technology Research Center (TATRC). Proteomics and Bioinformatics Core Facilities. (PI: M. Becich). **role:** co-investigator, July 2005 - August 2008, $7.6mil.
  The objective of the project is to foster new understanding of cancer and other diseases through proteomics the study of the shape, function and expression of proteins. The primary focus of the project is on new high-throughput technologies that are used to analyze protein expression in patient samples at a high rate of speed and standardized operating procedures to achieve this. Dr. Hauskrecht participates in the development of new computational algorithms for preprocessing, biomarker analysis and disease detection for high-throughput mass-spectrometry and other proteomic datasources and their optimization.

- **NSF.** CMS 0416754. SGER. Modeling Fragility of Sociotechnical Systems: A Transportation Study. (co-PIs: L. Comfort, M. Hauskrecht, J.S. Lin). February 2004-June 2005, $60K.
  The goal of this research is to develop: (1) models of complex socio-technical systems that are vulnerable to failure and (2) tools for the computational analysis of such systems. These models and tools will be used to develop decision support for practicing emergency managers, and will enable them to increase the efficiency and effectiveness of emergency operations under conditions of uncertainty and rapid change.

- **CDRF.** University of Pittsburgh. Latent variable models of stochastic networks. (PI: Hauskrecht), June 2003-July 2004, $9,900.
  The project aims to investigate and develop: (1) A class of stochastic latent variable models capable of representing complex stochastic behavior of large network systems and their dependency structure. (2) Algorithms for learning of these models from observational data. (3) Algorithms for probabilistic inferences upon such models that can be queried by external reliability analysis modules. A scale-up potential of the methods is demonstrated on synthetic networks with hundreds of stochastic components.

Teaching experience

CS Department, University of Pittsburgh   Pittsburgh, PA

- CS 441 Discrete Mathematics for Computer Science

- CS 1571 Introduction to Artificial Intelligence

- CS 1675 Introduction to Machine Learning

- CS 2710 Foundations of Artificial Intelligence

- CS 2740 Knowledge Representation

- CS 2750 Machine Learning

- CS 3710 Probabilistic Graphical Models. Offered as Advanced Topics in Artificial Intelligence.

- CS 3750 Advanced Topics in Machine Learning

CIS Department, Temple University   Philadelphia, PA

- CIS 673, Design and analysis of algorithms, Fall 2000.

- CIS 595, Machine Learning, Spring 2001.

CS Department, Brown University   Providence, RI

- Guest lecturer, CS243, Topics in Machine Learning (Spring 1999, Spring 1998).

Department of EECS, MIT   Cambridge,MA

- Graduate teaching assistant, 6.824, Artificial Intelligence, (Fall 1993, Fall 1994).

Student advising

Past PhD students (primary advisor):

- Will Bridewell (co-advised with Prof. Bruce Buchanan). Science as an Anomaly-Driven Enterprise: A Computational Approach to Generating Acceptable Theory Revisions in the Face of Anomalous Data. Dissertation defended in 2004, currently a research scientist at Stanford University, CA

- Branislav Kveton. Planning in hybrid structured stochastic domains, September 2006, currently a principal research scientist at Google Research, CA.

- Tomas Singliar. Machine learning solutions for transportation networks, December 2008, currently a senior research scientist at Microsoft Research, WA

- Richard Pelikan. Analytical techniques for the improvement of mass spectrometry protein profiling, April 2011, currently a researcher at Oklahoma Medical Research Foundation, OK

- Michal Valko. Adaptive Graph-based Algorithms for Conditional Outlier Detection and Semi-supervised Learning, August 2011, currently a senior research scientist at INRIA, Lille, France.

- Iyad Batal. Mining predictive patterns and the extension to multivariate temporal data, October 2012, currently a software engineer at Microsoft, Inc, CA

- Saeed Amizadeh. Nonparametric graph-based methods for large scale problems, August 2013, currently a research scientist at Microsoft Research, WA.

- Quang Nguyen. Efficient learning with soft-label information and multiple annotators, March 2014, currently a Senior Data Scientist at Intuit, Inc, CA

- Eric Heim. Efficiently and Effectively Learning Models From Human Feedback, December 2015, Air Force Research Laboratory, NY.

- Zitao Liu. Time-series modeling of irregularly sampled multivariate clinical data, July 2016, Pinterest Research Lab, CA.

- Charmgil Hong. Multivariate Data Modeling and Its Applications to Conditional Outlier Detection, September 2017, currently a posdoctoral researcher at the University of Pittsburgh, PA

Current PhD students (primary advisor):

- Siqi Liu. Project: Outlier detection in time series.

- Patrick Luo. Project: Group active learning.

- Salim Malakouti. Project: Learning classification models for classes and their categories.

- Yanbing Xue. Project: Cost efficient learning with auxilairy class level feedback.

- . Jeongmin Lee. Project: Event time series prediction.

Postdoctoral researchers (primary advisor):

- Hamed Valizadegan, PhD, September 2010-July 2013, currently at NASA Research;

- Lei Wu, PhD, July 2011- July 2012, currently at GE Research;

- Iyad Batal, PhD, November 2012-August 2013, currently at GE Research.

- Charmgil Hong, PhD, October 2017 - December 2019.

MSc students (primary advisor):

- Elizabeth Clause, May 2005, MS project: Using a dynamic programming time-warping algorithm to align proteomic sequences.

- Aaron Cois, May 2006, MS thesis: Shells and Spheres: A Novel Framework for Variable Scale Statistical Image Analysis.

- Eric Heim, December 2010, MS project: Improving Classification Using Regularized Logistic Regression on High Dimensional, Few Sample Data.

- Gregory Nilsen, December 2004, MS project: Analysis of Link Structures on the World Wide Web through SVM Classification.

- Richard Pelikan, May 2005, MS project: Development of feature selection techniques for high throughput proteomic profiling.

- Adi Nemlekar, August 2007. MS Project: Identifying unique elements in musical composition.

- Jose Nunez-Varela, May 2006, MS project: Development of a High Level Language Based on Rules for the RoboCup Soccer Simulator.

Dissertation committee memberships:

- Denver Dash, Intelligent Systems Program (ISP), 2003

- Tsai Ching Lu, ISP, 2004

- Yasir Khalifa, Computer Science (CS) Department, 2004

- Will Bridewell, CS, 2004 (co-advisor with Dr. Buchanan)

- Vahan Grigorian, Department of Mathematics, 2004.

- Changhe Yuan, ISP, May 2006
- Andrew Post, Department of Biomedical Informatics (DBMI), October 2006
- Mark Fenner, CS, September 2007
- Shyam Visweswaram, ISP, December 2007
- Xia Jiang, DBMI, Fall 2008
- Yanna Shen, ISP, Spring 2009
- Ali Alanjawi, CS, Spring 2009
- Jialan Que, ISP, Spring 2012
- Cem Akkaya, ISP, Spring 2013
- Peter Sutovsky, School of Information Science (SIS), Summer 2013
- Adedul Hague, CS, Spring 2014
- Yingze Wang, CS, Spring 2014
- Yuriy Sverchkov, ISP, Summer 2014
- Huichao Xu, CS, Fall 2014
- Ian Wong, DBMI/ISP, Summer 2016
- Mahdi Pakdaman, ISP, Fall 2016
- Youngung Cho, CS, Fall 2016
- Xiang Xiao, CS, Fall 2016
- Xiangmin Fan, CS, Spring 2017
- Xiang Xiao, CS, Fall 2016
- Phuong N. Pham, CS, Fall 2017
- Nils E. Murrugarra Llerena, proposed in Spring 2018
- Vineet Raghu, proposed in Spring 2018

Honors, Awards

Homer R. Warner award for recognition of outstanding contributions to the field of Biomedical Informatics. Awarded during the American Medical Informatics Association conference in November 2010.

National Library of Medicine (NLM) fellowship, 1995-1997

Slovak Technical University Chancellor's Prize Award, 1988

Faculty Dean's Award for an excellent MS diploma thesis, 1988

Professional activities

Chair:

- Area Chair for the National Conference on Artificial Intelligence (AAAI): 2010, 2012.
- Workshop Program Chair, National Conference on Artificial Intelligence (AAAI): 2004.
- Co-chair: ICML workshop on Machine Learning for Health Care Applications, Helsinki, Finland, July 2008.
- Co-chair: ICML workshop on Machine learning for Clinical Data Analysis, Edinburgh, Scotland, June 2012.

Advisory/Editorial Boards:

- Artificial Intelligence in Medicine conference
- Machine Learning for Healthcare Conference
- Artificial Intelligence in Medicine journal

Conference program committees:

- National Conference on Artificial Intelligence (AAAI): 1999, 2000, 2002, 2004, 2005, 2007, 2008, 2010, 2011, 2012, 2013 (SPC), 2015 (SPC), 2016 (SPC), 2017 (SPC), 2018 (SPC).
- International Joint Conference on Artificial Intelligence: 2018 (SPC).
- Machine Learning for Healthcare Conference: 2017 (SPC), 2018 (SPC).
- International Conference on Uncertainty in Artificial Intelligence: 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2009, 2010, 2011.
- International Conference on Machine Learning: 2015.
- ACM International conference on Knowledge Discovery and Data Mining (KDD): 2011.
- International Conference on Artificial Intelligence in Medicine: 2013, 2015.
- American Medical Informatics Association Annual Symposium: 2015 (SPC)

Workshop program committees:

- ICML workshop on Machine Learning for Health Care Applications, Helsinki, Finland, July 2008.
- ICML workshop on Machine learning for Clinical Data Analysis, Edinburgh, Scotland, June 2012.
- ICML workshop on Role of Machine Learning in Transforming Healthcare, Atlanta, June 2013.
- NIPS workshop on Machine Learning with Clinical Data, Lake Tahoe, December 2013.

Organizer:

- Reinforcement Learning Workshop (RLW-97), Brown University, Fall 1997
- ICML workshop on Machine Learning for Health Care Applications, Helsinki, Finland, July 2008.

- ICML workshop on Machine learning for Clinical Data Analysis, Edinburgh, Scotland, June 2012.

Referee for conferences:

- National Conference on Artificial Intelligence (AAAI): 1999, 2000, 2002, 2004, 2005, 2007, 2008,2010, 2011, 2012, 2013, 2015, 2016, 2017, 2018
- International Joint Conference on Artificial Intelligence (IJCAI): 1999, 2001, 2003, 2005, 2009, 2018
- International Conference on Uncertainty in Artificial Intelligence (UAI), 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2009, 2010, 2011
- American Medical Informatics Associations (AMIA) conference: 2011, 2012, 2013, 2014, 2015.
- Artificial Intelligence in Medicine (AIME) conference: 2013, 2015, 2017.
- Neural and Information Processing Systems (NIPS): 1998, 2000, 2009, 2010, 2015
- International Conference on Machine Learning (ICML), 1998, 2012, 2015
- Medinfo: 2010, 2013.
- ACM International Conference on Knowledge Discovery and Data Mining (KDD), 2011.
- International Conference on Planning and Scheduling (ICAPS), 2008.
- Artificial Intelligence and Statistics (AISTAT), 2007
- Europian Conference on Artificial Intelligence (ECAI), 1998

Referee for journals:

- Artificial Intelligence journal
- Journal of Artificial Intelligence Research
- Machine Learning Journal,
- Journal of Machine Learning Research
- Journal of American Medical Informatics Association (JAMIA)
- Journal of Biomedical Informatics (JBI)
- Artificial Intelligence in Medicine (AIM) Journal
- IEEE Trans. on Man, Systems and Cybernetics
- Applied Bioinformatics
- Cancer Informatics
- IEEE Transactions on Information Technology in Biomedicine

University service

Computer Science Department committees:

- Undergraduate advising committee (2001, 2002, 2008)
- Undergraduate program committe (2003, 2004)
- Teaching evaluations committee (2004, 2005,2009, 2010,2011, 2012, 2013, 2016)

- Graduate admissions committee (2006, 2013, 2016, 2017, 2018)
- Graduate Program Executive Committee (2007, 2013, 2014, 2015, 2017, 2018)

Intelligent Systems Program (ISP):

- Graduate admissions committee (various years from 2002 till 2016)

Publications

Journal articles

Siqi Liu, Adam Wright, and Milos Hauskrecht, Change-Point Detection Method for Clinical Decision Support System Rule Monitoring, *Artificial Intelligence in Medicine Journal*, 2018.

Milos Hauskrecht, I. Batal, C. Hong, Q. Nguyen, G. Cooper, S. Visweswaran, G. Clermont. Outlier-based detection of unusual patient-management actions: An ICU study. *Journal of Biomedical Informatics*, vol. 64, December 2016.

I. Batal, G. Cooper, D. Fradkin, J. Harrison, F. Moerchen, and M. Hauskrecht. An Efficient Pattern Mining Approach for Event Detection in Multivariate Temporal Data. *Knowledge and Information Systems*, 46 (1): 115-150, 2016.

Z. Liu, and M. Hauskrecht. Clinical Time Series Prediction: Towards A Hierarchical Dynamical System Framework. *Journal of Artificial Intelligence in Medicine*, 65(1):5-18, September 2015.

Q. Nguyen, H. Valizadegan, M. Hauskrecht. Learning classification models with soft-label information *Journal of American Medical Informatics Association*, 21:3, pp. 501-508, 2014.

H. Valizadegan, Q. Nguyen, M. Hauskrecht. Learning Classification Models from Multiple Experts. *Journal of Biomedical Informatics*, 46:6, pp. 1125-1135, 2013.

I. Batal, H. Valizadegan, G. Cooper and M. Hauskrecht. A Temporal Pattern Mining Approach for Classifying Electronic Health Record Data. *IEEE Transactions on Intelligent Systems and Technology: Special Issue on Health Informatics*, 4:4, pp. 2013.

M. Hauskrecht, I. Batal, M. Valko, S. Visweswaran, G. Cooper, G. Clermont. Outlier Detection for Patient Monitoring and Alerting. *Journal of Biomedical Informatics*, vol 46, Issue 1, pp. 47-55, 2013 (electronic version August 2012).

TC. Hart, PM. Corby, M. Hauskrecht, OH Ryu, R. Pelikan, M. Valko, MB. Oliveira, GT. Hoehn, and WA. Bretz: Identification of Microbial and Proteomic Biomarkers in Early Childhood Caries, *International Journal of Dentistry*, 2011

Richard Pelikan, Milos Hauskrecht: Efficient Peak-Labeling Algorithms for Whole-Sample Mass Spectrometry Proteomics. *IEEE/ACM Trans on Comput. Biology Bioinformatics*, 7(1): pp. 126-137, 2010.

T. Singliar and M. Hauskrecht. Learning to detect incidents from noisily labeled data. *Machine Learning Journal*, 79:3, pp. 335 - 354, September 2009.

R. Pelikan, W. L. Bigbee, D. Malehorn, and M. Hauskrecht. Intersession Reproducibility of Mass Spectrometry Proteomic Profiles and its Effect on the Accuracy of Multivariate Classification models. *Bioinformatics*, doi: 10.1093/bioinformatics/btm415, 2007

T. Singliar and M. Hauskrecht. Noisy-or Component Analysis and its Application to Link Analysis. *Journal of Machine Learning Research*, vol. 7, pp. 2189-2213, 2006.

B. Kveton, M. Hauskrecht, C. Guestrin. Solving Factored MDPs with Hybrid State and Action Variables. *Journal of Artificial Intelligence Research*, vol. 27, pp. 153–201, 2006.

T. Jahnukainen, D. Malehorn, M. Sun, J. Lyons-Weiler,W. Bigbee, G. Gupta, R.Shapiro, P. Randhawa, R. Pelikan, M. Hauskrecht, A. Vats. Proteomic Analysis of Urine in Kidney Transplant Patients with BK Virus Nephropathy. *Journal of American Society of Nephrology (JASN)*, vol 17, pp. 3248–3256, 2006.

M. Hauskrecht, R. Pelikan, W.L. Bigbee, D. Malehorn, M.T. Lotze, H.J. Zeh, D.C. Whitcomb, and J. Lyons-Weiler. Feature Selection for Classification of SELDI-TOF-MS Proteomic Profiles, *Applied Bioinformatics*, 4:4, pp. 227-246, 2005.

J. Lyons-Weiler, R. Pelikan, H.J. Zeh III, D.C. Whitcomb, D.E. Malehorn, W.L. Bigbee and M. Hauskrecht. Assessing the Statistical Significance of the Achieved Classification Error of Classifiers Constructed Using Serum Peptide Profiles and a Prescription for Random Resampling Repeated Studies for Massive High-Throughput Genomic and Proteomic Studies, *Cancer Informatics*, 1:1, pp. 53-77, 2005.

M. Hauskrecht, L. Ortiz, I. Tsochantaridis, and E. Upfal. Efficient methods for computing trading strategies for multi-market commodity trading. *Applied Artificial Intelligence*, vol. 15, pp. 429-452, 2001.

M. Hauskrecht. Value-function approximations for partially observable Markov decision processes. *Journal of Artificial Intelligence Research*, vol. 13, pp. 33–94, 2000.

M. Hauskrecht, H. Fraser. Planning treatment of ischemic heart disease with partially observable Markov decision processes. *Artificial Intelligence in Medicine*, vol. 18, pp. 221-244, 2000.

Book chapters

M. Hauskrecht, R. Pelikan, M. Valko, J. Lyons-Weiler. Feature selection and dimensionality reduction in genomics and proteomics. In Berrar, Dubitzky, Granzow, eds. *Fundamentals of Data Mining in Genomics and Proteomics*, Springer, pages 149–172, Fall 2006.

R. Pelikan, M. Lotze, J. Lyons-Weiler, D. Malehorn, and M. Hauskrecht. Serum Proteomic Profiling and Analysis. In Lotze MT, Thomson AW, eds. *Measuring Immunity: Basic Biology and Clinical Applications*, Elsevier, London, pages 648-659, 2004.

Refereed conference papers
(if known, acceptance rates are included)

Patrick Luo and M. Hauskrecht. Hierarchical Active Learning with Proportion Feedback on Regions. *European Conference on Machine Learning (ECML)*, Dublin, Ireland, September 2018.

Patrick Luo and M. Hauskrecht. Hierarchical Active Learning with Group Proportion Feedback . *27th International Joint Conference on Artificial Intelligence (IJCAI)*, Stockholm, Sweden, July 2018.
acceptance rate: $710/3470 = 20.5\%$

Zitao Liu, Yan Yan and M. Hauskrecht. A Flexible Forecasting Framework for Hierarchical Time Series with Seasonal Patterns: A Case Study of Web Traffic . *41st International ACM SIGIR Conference on Research and Development in Information Retrieval*, Ann Arbor, MI, July 2018.
acceptance rate: 21%

Yanbing Xue and M. Hauskrecht. Active Learning of Multi-Class Classifiers with Auxiliary Probabilistic Information. *31th International FLAIRS Conference*, Melbourne, FL, May 2018.

Charmgil Hong and M. Hauskrecht. Multivariate Conditional Outlier Detection: Identifying Unusual Input-Output Associations in Data. *31th International FLAIRS Conference*, Melbourne, FL, May 2018.

Zitao Liu, and M. Hauskrecht. A Personalized Predictive Framework for Multivariate Clinical Time Series via Adaptive Model Selection. *26th ACM International Conference on Information and Knowledge Management (CIKM)*, November 2017.
acceptance rate: 171/820=20.9%

Siqi Liu, Dean Sittig, Adam Wright, and M. Hauskrecht. Change-Point Detection for Monitoring Clinical Decision Support Systems with a Multi-Process Dynamic Linear Model. *IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, Kansas City, MO, November 2017.

Siqi Liu, Adam Wright, and M. Hauskrecht. Change-point Detection Method for Clinical Decision Support Rule Monitoring.*16th International Conference on Artificial Intelligence in Medicine*, Vienna, Austria, June 2017.

Zhipeng Luo, and M. Hauskrecht. Group-based Active Learning of Classification Models. *FLAIRS 30*, FL, May 2017.

Siqi Liu, Adam Wright, and M. Hauskrecht. Online Conditional Outlier Detection for Nonstationary Time-series.*FLAIRS 30*, FL, May 2017.

Yanbing Xue, and M. Hauskrecht. Efficient Learning of Classification Models from Soft-label Information by Binning and Ranking. *FLAIRS 30*, FL, May 2017 (best student paper award).

Yanbing Xue, and M. Hauskrecht. Active learning of classification models with Likert-scale feedback. *SIAM Data Mining Conference (SDM)*, Houston, TX, April 2017.
acceptance rate: 26%

Yanbing Xue and Milos Hauskrecht. Learning of Classification Models from Noisy Soft-Labels. *European Artificial Intelligence Conference (ECAI)*, Hague, Netherland, 2016.

Zitao Liu and Milos Hauskrecht. Learning Linear Dynamical Systems from Multivariate Time Series: A Matrix Factorization Based Framework. *SIAM International Conference on Data Mining (SDM)*, Miami, FL, 2016.
acceptance rate: 96/370 = 26%

Zitao Liu and Milos Hauskrecht. Learning Adaptive Forecasting Models from Irregularly Sampled Multivariate Clinical Data. *The 30th AAAI Conference on Artificial Intelligence(AAAI)*, Phoenix, AZ, 2016.
acceptance rate: 549/2132 = 25.8%

Zitao Liu, Yan Yan, Jian Yang, and Milos Hauskrecht. Missing Value Estimation for Hierarchical Time Series: A Study of Hierarchical Web Traffic. *IEEE International Conference on*

Data Mining(ICDM), Atlantic City, NJ, 2015.
acceptance rate: 18.1%

Eric Heim, and Milos Hauskrecht. Sparse Multidimensional Patient Modeling using Auxiliary Confidence Labels. *Proceedings of the 2015 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, Washington DC, 2015.

C. Hong, I. Batal, and M. Hauskrecht. A Generalized Mixture Framework for Multi-label Classification. *SIAM Data Mining Conference (SDM-15)*, Vancouver, Canada, April 2015.
acceptance rate: 72/491= 14.7%

E. Heim, M. Berger, L.M. Seversky, and M. Hauskrecht. Efficient Online Relative Comparison Kernel Learning. *SIAM Data Mining Conference (SDM-15)*, Vancouver, Canada, April 2015.
acceptance rate: 72/491= 14.7%

M. Pakdaman Naeini, G. Cooper, and M. Hauskrecht. Binary classifier calibration using a Bayesian non-parametric approach. *SIAM Data Mining Conference (SDM-15)*, Vancouver, Canada, April 2015.
acceptance rate: 36/491 = 7.3%

Z. Liu, and M. Hauskrecht. A Regularized Linear Dynamical System Framework for Multivariate Time Series Analysis. *The 29th AAAI Conference on Artificial intelligence (AAAI 2015)*, Austin, TX, 2015.
acceptance rate=531/1991=26.6%

M. Pakdaman Naeini, G. Cooper, and M. Hauskrecht. Obtaining well-calibrated probabilities using Bayesian binning. *The 29th AAAI Conference on Artificial intelligence (AAAI 2015)*, Austin, TX, 2015.
acceptance rate: 238/1991=12%

C. Hong, I. Batal, and M. Hauskrecht. A Mixture of Trees Framework for Multi-Label Classification. *ACM International Conference on Information and Knowledge Management (CIKM)*, Shanghai, China, 2014.
acceptance rate: 175/838 = 21%

E. Heim, H. Valizadegan, and M. Hauskrecht. Relative Comparison Kernel Learning with Auxiliary Kernels. *Europian Machine Learning Conference (ECML)*, Nancy, France, 2014.
acceptance rate: 115/483=23.8%

M. Pakdaman Naeini, I. Batal, Z. Liu, C. Hong, and M. Hauskrecht. An Optimization-based Framework to Learn Conditional Random Fields for Multi-label Classification *SIAM Data Mining Conference*, Philadelphia, PA, April 2014.
acceptance rate: 120/389 = 29%

I. Batal, C. Hong, and M. Hauskrecht. An Efficient Probabilistic Framework for Multi-Dimensional Classification. *ACM International Conference on Information and Knowledge Management (CIKM)*, San Francisco, CA, November 2013.
acceptance rate: 12.5%

A. Amizadeh, B. Thiesson, M. Hauskrecht. The Bregman Variational Dual-Tree Framework. *The 29th International Conference on Uncertainty in Artificial Intelligence (UAI)*, Seattle, WA, July 2013.
acceptance rate: 73/233=31%

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acceptance rate: 89/348 = 25.5%

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acceptance rate : 62/299 = 20.7%

I. Batal, G. Cooper, and M. Hauskrecht. A Bayesian Scoring Technique for Mining Predictive and Non-Spurious Rules. *The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases*, Bristol, UK, September 2012.
acceptance rate: 105/443=23%

S. Amizadeh, B. Tiesson, M. Hauskrecht. Variational Dual-Tree Framework for Large-Scale Transition Matrix Approximation. *Proceedings of the 28th International Conference on Uncertainty in Artificial Intelligence*, Catalina Island, CA, August 2012.
acceptance rate: 96/304 = 31%

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acceptance rate: 133/755=17.6%

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acceptance rate: 134/400= 33%

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acceptance rate (oral): 53/363= 15%

Y. Sverchkov, S. Visweswaran, G. Clermont, M. Hauskrecht, G. Cooper. A Multivariate Probabilistic Method for Comparing Two Clinical Datasets. *ACM SIGHIT International Health Informatics Symposium (IHI)*, Miami, FL, January 2012.
acceptance rate: 19 %

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acceptance rate (oral presentation): 18%

Q. Nguyen, H. Valizadegan, M. Hauskrecht. Learning classification with auxiliary probabilistic information. *International Conference on Data Mining (ICDM)*, Vancouver, December 2011.
acceptance rate (oral presentation): 18%

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acceptance rate (oral presentation): $227/1325 = 17\%$

I. Batal and M. Hauskrecht. Constructing Classification Features using Minimal Predictive Patterns. *ACM Conference on Information and Knowledge Management (CIKM)*, Toronto, Canada, 2010.
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acceptance rate: 16%

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acceptance rate: 264/982=26.9%.

S. Wang, and M. Hauskrecht. Effective Query Expansion with the Resistance Based Term Similarity Metric, *Proceedings of the 33rd Annual International ACM SIGIR Conference*, July 2010.
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acceptance rate: 46%

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acceptance rate: 54 / 592 = 9.1%.

T. Singliar and M. Hauskrecht. Modeling Highway Traffic Volumes. In *Proceedings of the Eighteen Europian Conference on Machine Learning (ECML)*, 2007.
acceptance rate: 118/592= 20%.

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B. Kveton and M. Hauskrecht. Solving Factored MDPs with Exponential-Family Transition Models. In *Proceedings of the 16th International Conference on Planning and Scheduling (ICAPS)*, pages 114–120, UK, June 2006.
acceptance rate: 33 / 99 = 33%

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L.K. Comfort, M. Hauskrecht, J.S. Lin. Dynamic Networks: Modeling Change in Environments Exposed to Risk. *Annual Research Conference of the Association of Public Policy and Management*, Atlanta, Georgia, October 2004.

C. Guestrin, M. Hauskrecht, B. Kveton. Solving Factored MDPs with Continuous and Discrete Variables. In *Proceedings of the 20th Conference on Uncertainty in Artificial Intelligence*, pages 235-242, 2004.
acceptance rate: 75 / 253 = 30%

V. Grigorian, D. Chiarulli, M. Hauskrecht. Subject Filtering for Passive Biometric Monitoring. In the *Proceedings of the International Federation of Classification Societies Conference (IFCS04)*, pages 485–494, June 2004.

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acceptance rate: 198 / 717 = 28%

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M. Hauskrecht, L. Ortiz, I. Tsochantaridis, E. Upfal. Computing global strategies for multimarket commodity trading. In *Proceedings of the Fifth International al Conference on Artificial Intelligence Planning and Scheduling*, pages 159–166, 2000.
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M. Hauskrecht, H. Fraser. Modeling treatment of ischemic heart disease with partially observable Markov decision processes. In *Proceedings of American Medical Informatics Association annual symposium on Computer Applications in Health Care*, pages 538-542, 1998.

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Providence, RI, pp. 734-739, 1997.

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M. Hauskrecht. Evaluation and optimization of management plans in stochastic domains with imperfect information. In *Proceedings of the 12th International Workshop on Principles of Diagnosis (DX-01)*, pp. 71–78, 2001.

M. Hauskrecht, H. Fraser. Planning medical therapy using partially observable Markov decision processes. In *Proceedings of the 9th International Workshop on Principles of Diagnosis (DX-98)*, Cape Cod, MA, pp. 182-189, 1998.

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