

# **2014 IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning**

**(ADPRL 2014)**

**Orlando, Florida, USA  
9-12 December 2014**



**IEEE Catalog Number: CFP14ADP-POD  
ISBN: 978-1-4799-4551-1**

# TABLE OF CONTENTS

IEEE SSCI 2014 General Committee ..... vii

IEEE ADPRL 2014 Committee ..... viii

Keynote Talk: ADPRL'14 ..... xi

Wednesday, December 10

9:20AM-10:00AM

ADPRL'14 Keynote

**Approximate Dynamic Programming Methods: A Unified Framework**

Dimitri P. Bertsekas

10:20AM-12:00PM

**ADPRL'14 Reinforcement Learning 1: Representation and Function Approximation**

Chair: Olivier Pietquin and Joschka Boedecker

10:20AM	<b><i>Approximate Real-Time Optimal Control Based on Sparse Gaussian Process Models</i></b> .....	<b>1</b>
	Joschka Boedecker, Jost Tobias Springenberg, Jan Wuelving and Martin Riedmiller	
10:40AM	<b><i>Subspace Identification for Predictive State Representation by Nuclear Norm Minimization</i></b> .....	<b>9</b>
	Hadrien Glaude, Olivier Pietquin and Cyrille Enderli	
11:00AM	<b><i>Active Learning for Classification: An Optimistic Approach</i></b> .....	<b>17</b>
	Timothe Collet and Olivier Pietquin	
11:20AM	<b><i>Accelerated Gradient Temporal Difference Learning Algorithms</i></b> .....	<b>25</b>
	Dominik Meyer, Remy Degenne, Ahmed Omrane and Hao Shen	
11:40AM	<b><i>Convergent Reinforcement Learning Control with Neural Networks and Continuous Action Search</i></b> .....	<b>33</b>
	Minwoo Lee and Charles Anderson	

1:30PM-3:10PM

**ADPRL'14 Optimal Control 1: Fundamentals and Techniques**

Chair: Eugene Feinberg and Theodorou Evangelos

1:30PM	<b><i>Convergence of Value Iterations for Total-Cost MDPs and POMDPs with General State and Action Sets</i></b> .....	<b>41</b>
	Eugene Feinberg, Pavlo Kasyanov and Michael Zgurovsky	
1:50PM	<b><i>Theoretical Analysis of a Reinforcement Learning based Switching Scheme</i></b> .....	<b>49</b>
	Ali Heydari	
2:10PM	<b><i>An analysis of optimistic, best-first search for minimax sequential decision making</i></b> .....	<b>55</b>
	Lucian Busoniu, Remi Munos and Elod Pall	
2:30PM	<b><i>Nonparametric Infinite Horizon Kullback-Leibler Stochastic Control</i></b> .....	<b>63</b>
	Yunpeng Pan and Evangelos Theodorou	
2:50PM	<b><i>Information-Theoretic Stochastic Optimal Control via Incremental Sampling-based Algorithms</i></b> .....	<b>71</b>
	Oktay Arslan, Evangelos Theodorou and Panagiotis Tsiotras	

### 3:30PM-5:10PM

#### Special Session: ADPRL'14 Reinforcement Learning and Optimization in Stochastic Multi-objective Environments

Chair: Madalina Drugan and Yann-Michael De Hauwere

3:30PM	<i>Policy Gradient Approaches for Multi-Objective Sequential Decision Making: A Comparison.....</i>	79
	Simone Parisi, Matteo Pirota, Nicola Smacchia, Luca Bascetta and Marcello Restelli	
3:50PM	<i>Annealing-Pareto Multi-Objective Multi-Armed Bandit Algorithm.....</i>	87
	Saba Yahyaa, Madalina Drugan and Bernard Manderick	
4:10PM	<i>Pareto Upper Confidence Bounds algorithms: an empirical study.....</i>	95
	Madalina Drugan, Ann Nowe and Bernard Manderick	
4:30PM	<i>Multi-Objective Reinforcement Learning for AUV Thruster Failure Recovery .....</i>	103
	Seyed Reza Ahmadzadeh, Petar Kormushev and Darwin G. Caldwell	
4:50PM	<i>Model-Based Multi-Objective Reinforcement Learning .....</i>	111
	Marco Wiering, Maikel Withagen and Madalina Drugan	

### Thursday, December 11

#### 9:20AM-10:00AM

#### Special Lecture: ADPRL'14 Talk: Cognitive Control in Cognitive Dynamic Systems: A New Way of Thinking Inspired by The Brain, Speaker: Simon Haykin

9:20AM	<i>Cognitive Control in Cognitive Dynamic Systems: A New Way of Thinking Inspired by The Brain.....</i>	117
	Simon Haykin, Ashkan Amiri and Mehdi Fatemi	

#### 10:20AM-12:00PM

#### Special Session: ADPRL'14 Approximate Dynamic Programming for Energy and Sustainability

Chair: Boris Defourny

10:20AM	<i>Using Approximate Dynamic Programming for Estimating the Revenues of a Hydrogen-based High-Capacity Storage Device .....</i>	124
	Vincent Francois-Lavet, Raphael Fonteneau and Damien Ernst	
10:40AM	<i>Adaptive Aggregated Predictions for Renewable Energy Systems .....</i>	132
	Balazs Csaji, Andras Kovacs and Jozsef Vancza	
11:00AM	<i>A Comparison of Approximate Dynamic Programming Techniques on Benchmark Energy Storage Problems: Does Anything Work? .....</i>	140
	Daniel Jiang, Thuy Pham, Warren Powell, Daniel Salas and Warren Scott	
11:20AM	<i>Near-Optimality Bounds for Greedy Periodic Policies with Application to Grid-Level Storage.....</i>	148
	Yuhai Hu and Boris Defourny	

#### 1:30PM-3:10PM

#### Special Session: ADPRL'14 Learning Control and Optimization based on Adaptive Dynamic Programming

Chair: Dongbin Zhao and Derong Liu

1:30PM	<i>Data-Driven Partially Observable Dynamic Processes Using Adaptive Dynamic Programming.....</i>	156
	Xiangnan Zhong, Zhen Ni, Yufei Tang and Haibo He	
1:50PM	<i>Model-free Q-learning over Finite Horizon for Uncertain Linear Continuous-time Systems.....</i>	164
	Hao Xu and Sarangapani Jagannathan	

2:10PM	<i>Optimal Self-Learning Battery Control in Smart Residential Grids by Iterative Q-Learning Algorithm</i> .....	170
	Qinglai Wei, Derong Liu, Guang Shi, Yu Liu and Qiang Guan	
2:30PM	<i>A Data-based Online Reinforcement Learning Algorithm with High-efficient Exploration</i> .....	177
	Zhu Yuanheng and Zhao Dongbin	
2:50PM	<i>Reinforcement Learning-based Optimal Control Considering L Computation Time Delay of Linear Discrete-time Systems</i> .....	183
	Taishi Fujita and Toshimitsu Ushio	

### 3:30PM-5:10PM

#### Special Session: ADPRL'14 Online Learning Control Algorithms Based on ADP for Uncertain Dynamic Systems

Chair: Xin Xu and Yanhong Luo

3:30PM	<i>Pseudo-MDPs and Factored Linear Action Models</i> .....	189
	Hengshuai Yao, Csaba Szepesvari, Bernardo Avila Pires and Xinhua Zhang	
3:50PM	<i>Event-based Optimal Regulator Design for Nonlinear Networked Control Systems</i> .....	198
	Avimanyu Sahoo, Hao Xu and Sarangapani Jagannathan	
4:10PM	<i>Adaptive Fault Identification for a Class of Nonlinear Dynamic Systems</i> .....	206
	Li-Bing Wu, Dan Ye and Xin-Gang Zhao	
4:30PM	<i>Adaptive Dynamic Programming for Discrete-time LQR Optimal Tracking Control Problems with Unknown Dynamics</i> .....	212
	Yang Liu, Yanhong Luo and Huaguang Zhang	
4:50PM	<i>Neural-Network-Based Adaptive Dynamic Surface Control for MIMO Systems with Unknown Hysteresis</i> .....	218
	Lei Liu, Zhanshan Wang and Zhengwei Shen	

### 5:10PM-6:45PM

#### Poster Session: SSCI'14 Poster Session

Chair: Dongbin Zhao and Haibo He

P101	<i>Adaptive dynamic programming-based optimal tracking control for nonlinear systems using general value iteration</i> .....	224
	Xiaofeng Lin, Qiang Ding, Weikai Kong, Chunling Song and Qingbao Huang	
P102	<i>ADP-based Optimal Control for a Class of Nonlinear Discrete-time Systems with Inequality Constraints</i> .....	230
	Yanhong Luo and Geyang Xiao	
P103	<i>Using supervised training signals of observable state dynamics to speed-up and improve reinforcement learning</i> .....	235
	Daniel Elliott and Charles Anderson	
P104	<i>A Two Stage Learning Technique for Dual Learning in the Pursuit-Evasion Differential Game</i> .....	243
	Ahmad Al-Talabi and Howard Schwartz	
P105	<i>Heuristics for Multiagent Reinforcement Learning in Decentralized Decision Problems</i> .....	251
	Martin Allen, David Hahn and Douglas MacFarland	
P106	<i>An Adaptive Dynamic Programming Algorithm to Solve Optimal Control of Uncertain Nonlinear Systems</i> .....	259
	Xiaohong Cui, Yanhong Luo and Huaguang Zhang	

Friday, December 12

9:30AM-10:30AM

**ADPRL'14 Reinforcement Learning 2: Interdisciplinary Connections and Applications**

Chair: Abhijit Gosavi

9:30AM	<i>Closed-Loop Control of Anesthesia and Mean Arterial Pressure Using Reinforcement Learning.....</i>	<b>265</b>
	Regina Padmanabhan, Nader Meskin and Wassim Haddad	
9:50AM	<i>Beyond Exponential Utility Functions: A Variance-Adjusted Approach for Risk-Averse Reinforcement Learning.....</i>	<b>273</b>
	Abhijit Gosavi, Sajal Das and Susan Murray	
10:10AM	<i>Tunable and Generic Problem Instance Generation for Multi-objective Reinforcement Learning.....</i>	<b>281</b>
	Deon Garrett, Jordi Bieger and Kristinn Thorisson	

11:00AM-12:00PM

**ADPRL'14 Optimal Control 2: Adaptive and Differential Dynamic Programming**

Chair: Shubhendu Bhasin and Hao Xu

11:00AM	<i>Continuous-Time Differential Dynamic Programming with Terminal Constraints .....</i>	<b>289</b>
	Wei Sun, Evangelos Theodorou and Panagiotis Tsiotras	
11:20AM	<i>Neural Network-based Adaptive Optimal Consensus Control of Leaderless networked Mobile Robots .....</i>	<b>295</b>
	Haci Mehmet Guzey, Hao Xu and Jagannatan Sarangapani	
11:40AM	<i>On-policy Q-learning for Adaptive Optimal Control .....</i>	<b>301</b>
	Sumit Kumar Jha and Shubhendu Bhasin	

<b>AUTHOR INDEX.....</b>	<b>307</b>
--------------------------	------------