Departments of MSCI & EECE

Approximate Dynamic Programming for Stochastic Optimization and Control

MATH 7512/8521 & EECE 7909/8909 Spring 2016

Instructor: Dr. Robert Kozma, Professor
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Text: Warren B. Powell, Approximate Dynamic Programming, 2nd Ed.
Wiley Series in Probability and Statistics, Wiley, 2011.

Description: Basic concepts and mathematical foundations of nonlinear optimization and control. Exact and approximate optimization of the utility function. Bellman equation, approximate Bellman equation for solving multivariate optimization problems in real time. Partially observable variables, with random noise and tactical objectives varying in time. Optimization in unpredictable and changing environments.
This course is offered in cooperation with EECE.

Topics
Markov decision processes
Bellman equation, value iteration, policy iteration
Approximate dynamic programming, Q learning
Approximate value iteration, post-decision state
Decision trees for multi-stage decisions, multi-agent systems
Modeling dynamic programs, state, action, objective function
Stochastic dynamics, exogenous information
Policies, myopic, lookahead, approximate policy, value, and cost functions
Policy search, stochastic gradients, Bayesian, heuristic
Approximating value function: aggregation, parametric models
Nonparametric approximation of value function: kernel, neural, clustering
Learning value functions: stochastic, linear, least squares, gradient
Optimizing while learning: bootstrap, simulation, linear, nonparametric
Reinforcement learning for approximate dynamic programming (RLADP)
Heuristic Dynamic Programming (HDP)

Prerequisites: Background in calculus and functional analysis, linear algebra MATH 4/6242, or permission of instructor.

Evaluation: Grades are based on homework assignments, class presentations, and/or project. 8000 level students must demonstrate proficiency in all categories.