KIOS
Research and Innovation Center of Excellence

Monday 18 Sept 2017, 15:30 - 17:00
and Tuesday 19 Sept 2017, 11:00 - 12:30
Room B108, "A. G. Leventis", University of Cyprus

KIOS Distinguished Lecture Series

Approximate Dynamic Programming

Dimitri P. Bertsekas
McAfee Professor of Engineering, Massachusetts Institute of Technology, USA

LECTURE ABSTRACT

We will consider the Dynamic Programming (DP) algorithm for stochastic sequential decision problems, which arise in a broad variety of applications, such as control / robotics / planning, operations research, economics, artificial intelligence, and others. The algorithm in its exact form, computes the optimal cost-to-go functions and an associated optimal policy, but is very often impractical, because of overwhelming computational requirements. Thus, one often has to settle for a suboptimal control scheme that strikes a reasonable balance between practical implementation and adequate performance. In this lecture series, after a discussion of the exact DP algorithm, we will review several approaches for suboptimal control based on DP ideas. These come under two general categories:

Part A (18 Sep. 2017, 15:30-17:00): Approximation in value space, where we approximate the optimal cost-to-go functions with some other functions, in a scheme based on one-step or multistep look-ahead. There are various approaches here, such as problem approximation, aggregation, rollout, model predictive control, parametric approximation (possibly using neural networks), and others.

Part B (19 Sep. 2017, 11:00-12:30): Approximation in policy space, where we restrict the policy to lie within a given parametric class (such as a neural network, or other architecture) and we select the parameters by using a suitable optimization framework.

There are also mixtures of these two approaches, as exemplified by the recent spectacular successes of programs that, among others, have learned how to play challenging games, such as Go, at or above the level of the best humans. We will describe some of the currently popular approximate DP schemes, focusing mostly on finite horizon problems, and review their range of applications.

The KIOS CoE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 739551 (KIOS CoE) and the Government of the Republic of Cyprus through the Directorate General for European Programmes, Coordination and Development.

BRIEF BIO

Dimitri P. Bertsekas did his undergraduate studies in engineering at the National Technical University of Athens, Greece. He obtained his MS in electrical engineering at the George Washington University, Wash. DC in 1969, and his Ph.D. in system science in 1971 at the Massachusetts Institute of Technology. He has held faculty positions with the Engineering-Economic Systems Dept., Stanford University (1971-1974) and the Electrical Engineering Dept. of the University of Illinois, Urbana (1974-1979). Since 1979 he has been teaching at the Electrical Engineering and Computer Science Department of the Massachusetts Institute of Technology (M.I.T.), where he is currently McAfee Professor of Engineering. He has held editorial positions in several journals. His research at M.I.T. spans several fields, including optimization, control, large-scale computation, and data communication networks, and is closely tied to his teaching and book authoring activities. He has written numerous research papers, and sixteen books and research monographs, several of which are used as textbooks in MIT classes.

Professor Bertsekas was awarded the INFORMS 1997 Prize for Research Excellence in the Interface Between Operations Research and Computer Science for his book "Neuro-Dynamic Programming" (co-authored with John Tsitsiklis), the 2000 Greek National Award for Operations Research, the 2001 ACC John R. Ragazzini Education Award, the 2009 INFORMS Expository Writing Award, the 2014 ACC Richard E. Bellman Control Heritage Award for "contributions to the foundations of deterministic and stochastic optimization-based methods in systems and control," the 2014 Khachiyan Prize for Life-Time Accomplishments in Optimization, and the SIAM/MOS 2015 George B. Dantzig Prize. In 2001, Prof. Bertsekas was elected to the United States National Academy of Engineering for "pioneering contributions to fundamental research, practice and education of optimization/control theory, and especially its application to data communication networks." His recent books are "Introduction to Probability: 2nd Edition" (2008), "Convex Optimization Theory" (2009), "Dynamic Programming and Optimal Control," Vol. I, (2017), and Vol. II: (2S012), "Abstract Dynamic Programming" (2013), and "Convex Optimization Algorithms" (2015), all published by Athena Scientific.