



Constrained Markov Decision Processes

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Constrained Markov Decision Processes:

Constrained Markov Decision Processes Eitan Altman, 1999-03-30 This book provides a unified approach for the study of constrained Markov decision processes with a finite state space and unbounded costs Unlike the single controller case considered in many other books the author considers a single controller with several objectives such as minimizing delays and loss probabilities and maximization of throughputs It is desirable to design a controller that minimizes one cost objective subject to inequality constraints on other cost objectives This framework describes dynamic decision problems arising frequently in many engineering fields A thorough overview of these applications is presented in the introduction The book is then divided into three sections that build upon each other The first part explains the theory for the finite state space The author characterizes the set of achievable expected occupation measures as well as performance vectors and identifies simple classes of policies among which optimal policies exist This allows the reduction of the original dynamic into a linear program A Lagrangian approach is then used to derive the dual linear program using dynamic programming techniques In the second part these results are extended to the infinite state space and action spaces The author provides two frameworks the case where costs are bounded below and the contracting framework The third part builds upon the results of the first two parts and examines asymptotical results of the convergence of both the value and the policies in the time horizon and in the discount factor Finally several state truncation algorithms that enable the approximation of the solution of the original control problem via finite linear programs are given *Constrained Markov Decision Processes* E. Altman, 1995

Constrained Markov Decision Processes as Multi-objective Problems L. C. Thomas, 1982 CONSTRAINED MARKOV DECISION PROCESSES WITH QUEUEING APPLICATIONS. Keith W. Ross, 1985 neither on the past history nor the present state of the line lengths **Sensitivity of Constrained Markov Decision Processes** Eitan Altman, Adam

Shwartz, Tekhniyon, Makhon tekhnologi le-Yisra'el. Fakultah le-handasat hashmal, 1990 Robustness of Policies in Constrained Markov Decision Processes Alexander Zadorojniy, Adam Shwartz, Tekhniyon, Makhon tekhnologi le-Yisra'el. Fakultah le-handasat hashmal. Merkaz le-tekhnoogyot tikshoret u-meda, 2005 **Asymptotic Properties of Constrained Markov Decision Processes** E. Altman, Institut national de recherche en informatique et en automatique (France), 1992

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Constrained Markov Decision Processes : a Gradient Approach Vázquez-Abad, F. J. (Felisa J.), Krishnamurthy, Vikram, Groupe d'études et de recherche en analyse des décisions (Montréal, Québec), 2003 *Wireless Communications* Prathima Agrawal, Matthew D. Andrews, Philip J. Fleming, G. George Yin, Lisa Zhang, 2010-05-05 This volume contains papers based on invited talks given at the 2005 IMA Summer Workshop on Wireless Communications held at the Institute for Mathematics and Its Applications University of Minnesota June 22 July 1 2005 It presents some of the highlights of the

workshop and collects papers covering a broad spectrum of important and pressing issues in wireless communications

Finite Approximations in Discrete-Time Stochastic Control Naci Saldi,Tamás Linder,Serdar Yüksel,2018-05-11 In a unified form this monograph presents fundamental results on the approximation of centralized and decentralized stochastic control problems with uncountable state measurement and action spaces It demonstrates how quantization provides a system independent and constructive method for the reduction of a system with Borel spaces to one with finite state measurement and action spaces In addition to this constructive view the book considers both the information transmission approach for discretization of actions and the computational approach for discretization of states and actions Part I of the text discusses Markov decision processes and their finite state or finite action approximations while Part II builds from there to finite approximations in decentralized stochastic control problems This volume is perfect for researchers and graduate students interested in stochastic controls With the tools presented readers will be able to establish the convergence of approximation models to original models and the methods are general enough that researchers can build corresponding approximation results typically with no additional assumptions *Estimation and Optimal Control for Constrained Markov Chains* D. J.

Ma,A. M. Makowski,A. Shwartz,1986 **Reliable Non-Parametric Techniques for Energy System Operation and Control** Hongcai Zhang,Yonghua Song,Ge Chen,Peipei Yu,2025-07-01 Reliable Non Parametric Techniques for Energy System Operation and Control Fundamentals and Applications of Constraint Learning and Safe Reinforcement Learning Methods a new Volume in the Advances in Intelligent Energy Systems is a comprehensive guide to modern smart methods in energy system operation and control This book covers fundamental concepts and applications in both deterministic and uncertain environments It addresses the challenge of accuracy in imbalanced datasets and the limitations of measurements The book delves into advanced topics such as safe reinforcement learning for energy system control including training efficient intrinsic motivated reinforcement learning and physical layer based control and more Other chapters cover barrier function based control and CVaR based control for systems without hard operation constraints Designed for graduate students researchers and engineers this book stands out for its practical approach to advanced methods in energy system control enabling sustainable developments in real world conditions Bridges the gap between theory and practice providing essential insights for graduate students researchers and engineers Includes visual elements data and code and case studies for easy understanding and implementation Provides the latest release in the Advances in Intelligent Energy Systems series bringing together the latest innovations in smart sustainable energy *Optimal Control of Random Sequences in Problems with Constraints* A.B. Piunovskiy,2012-12-06 Controlled stochastic processes with discrete time form a very interesting and meaningful field of research which attracts widespread attention At the same time these processes are used for solving of many applied problems in the queueing theory in mathematical economics in the theory of controlled technical systems etc In this connection methods of the theory of controlled processes constitute the every day instrument of many specialists

working in the areas mentioned The present book is devoted to the rather new area that is to the optimal control theory with functional constraints This theory is close to the theory of multicriteria optimization The compromise between the mathematical rigor and the big number of meaningful examples makes the book attractive for professional mathematicians and for specialists who apply mathematical methods in different specific problems Besides the book contains setting of many new interesting problems for further investigation The book can form the basis of special courses in the theory of controlled stochastic processes for students and post graduates specializing in the applied mathematics and in the control theory of complex systems The grounding of graduating students of mathematical department is sufficient for the perfect understanding of all the material The book contains the extensive Appendix where the necessary knowledge in Borel spaces and in convex analysis is collected All the meaningful examples can be also understood by readers who are not deeply grounded in mathematics

Proceedings of InCoME-V & CEPE Net-2020 Dong Zhen,Dong Wang,Tianyang Wang,Hongjun Wang,Baoshan Huang,Jyoti K. Sinha,Andrew David Ball,2021-05-15 This volume gathers the latest advances innovations and applications in the field of condition monitoring plant maintenance and reliability as presented by leading international researchers and engineers at the 5th International Conference on Maintenance Engineering and the 2020 Annual Conference of the Centre for Efficiency and Performance Engineering Network InCoME V CEPE Net 2020 held in Zhuhai China on October 23-25 2020 Topics include vibro acoustics monitoring condition based maintenance sensing and instrumentation machine health monitoring maintenance auditing and organization non destructive testing reliability asset management condition monitoring life cycle cost optimisation prognostics and health management maintenance performance measurement manufacturing process monitoring and robot based monitoring and diagnostics The contributions which were selected through a rigorous international peer review process share exciting ideas that will spur novel research directions and foster new multidisciplinary collaborations

Markov Decision Processes with Policy Constraints John Nafteh,Stanford University. Engineering-Economic Systems Department. Decision Analysis Program,1976 This work is concerned with Markov Decision Processes with policy constraints The selection of an optimum stationary policy for such processes in the absence of policy constraints is a problem which has received a great deal of attention and has been satisfactorily solved Relatively little attention has been given to the case when policy constraints are present or to the formulation of such constraints Optimum policy sensitivity analysis is also a subject in which little has been achieved Towards those ends this work makes three major contributions First policy constraints are formulated and categorized Secondly a computationally efficient iterative algorithm is developed for selecting the optimum policy for completely ergodic infinite time horizon Markov Decision Processes with policy constraints for both the risk indifferent and risk sensitive cases Finally the sensitivity of optimum policies to the policy constraints is analyzed by using the algorithm to compute the value of removing a constraint or a group of constraints Author

Advances in Dynamic Games and Applications Jerzy A.

Filar,Vladimir Gaitsgory,Koichi Mizukami,2012-12-06 Modern game theory has evolved enormously since its inception in the 1920s in the works of Borel and von Neumann and since publication in the 1940s of the seminal treatise Theory of Games and Economic Behavior by von Neumann and Morgenstern The branch of game theory known as dynamic games is to a significant extent descended from the pioneering work on differential games done by Isaacs in the 1950s and 1960s Since those early decades game theory has branched out in many directions spanning such diverse disciplines as mathematics economics electrical and electronics engineering operations research computer science theoretical ecology environmental science and even political science The papers in this volume reflect both the maturity and the vitality of modern day game theory in general and of dynamic games in particular The maturity can be seen from the sophistication of the theorems proofs methods and numerical algorithms contained in these articles The vitality is manifested by the range of new ideas new applications the number of young researchers among the authors and the expanding worldwide coverage of research centers and institutes where the contributions originated

Robot Planning with Constrained Markov Decision Processes

,2017 Robotic technologies have advanced significantly that improved capabilities of robots Such robots operate in complicated environments and are exposed to multiple resources of uncertainties The uncertainties causes robots actions to be non deterministic Robot planning in non deterministic environments is a challenging problem that has been extensively discussed in the literature In this dissertation we tackle this class of problems and are more particularly interested in finding an optimal solution while the robot faces several constraints To do so we leverage Constrained Markov Decision Processes CMDPs which are extensions to Markov Decision Processes MDPs by supporting multiple costs and constraints Despite all the capabilities of CMDPs they are not very popular in robot planning One of our goals in this work is to show that CMDPs can also be used in robot planning In the first part of this dissertation we focus on optimizing CMDPs to solve large problems in a timely manner Therefore we propose a hierarchical approach that significantly reduces the computational time of solving a CMDP instance while preserving the existence of a valid solution In other words the Hierarchical CMDP HCMDP guarantees to find a valid solution for a specific problem if the non hierarchical CMDP is able to find one Although the experimental evaluation shows that the HCMDP and the non hierarchical CMDP generate comparable results we do not provide any guarantees in terms of optimality In the second part we aim for more complicated constraints represented as tasks Tasks are usually specified by Linear Temporal Logic LTL properties and determine a desired temporal sequence of states to be visited by the robot For instance an autonomous forklift may be tasked to go to a pick up station load an object drive toward a delivery point and drop it off As seen the order of states is critical Thus we propose a planner that finds a plan to satisfy multiple tasks with given probabilities while having various constraints on its cost functions The proposed solver utilizes the theory of LTL properties to define tasks and the theory of CMDPs to find an optimal solution We also present a special form of product operation between LTL properties and CMDPs that is repeatable This repeatability lets us apply the

product operation several times to take all of the tasks into account The proposed approach is extensively tested in Matlab robot simulation and on a real robot This solver runs the product operation many times which results in increasing number of states Therefore it is crucial to reduce the number of states in order to have a faster solver In part three of this thesis we aim for optimizing the solver in part two We propose two improvements The first improvement considers the order of product operations Although the product operation is commutative and the order of operations does not influence the final result it affects the computational time Thus we present an algorithm to find the best order of operations The second improvement runs a pruning algorithm to reduce the number of states by removing the states that play little or no role in the final product As opposing to the first improvement it may change the final solution However we analyze different cases that may appear and show the effects

Markov Decision Processes Martin L. Puterman, 2005-03-03 The Wiley Interscience Paperback Series consists of selected books that have been made more accessible to consumers in an effort to increase global appeal and general circulation With these new unabridged softcover volumes Wiley hopes to extend the lives of these works by making them available to future generations of statisticians mathematicians and scientists This text is unique in bringing together so many results hitherto found only in part in other texts and papers The text is fairly self contained inclusive of some basic mathematical results needed and provides a rich diet of examples applications and exercises The bibliographical material at the end of each chapter is excellent not only from a historical perspective but because it is valuable for researchers in acquiring a good perspective of the MDP research potential Zentralblatt fur Mathematik it is of great value to advanced level students researchers and professional practitioners of this field to have now a complete volume with more than 600 pages devoted to this topic Markov Decision Processes Discrete Stochastic Dynamic Programming represents an up to date unified and rigorous treatment of theoretical and computational aspects of discrete time Markov decision processes Journal of the American Statistical Association **SIAM Journal on Control and Optimization** Society for Industrial and Applied Mathematics, 2004

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Constrained Markov Decision Processes Introduction

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