Semi-Markov Decision Processes and Perfect Information Semi-Markov Stochastic Games

Submitted by- Kushal Guha Bakshi

Index no.- 85/18/Maths./25

Abstract

The thesis entitled "**Semi-Markov Decision Processes and Perfect Information Semi-Markov Stochastic Games**" concentrates on proving the existence of solutions for various finite discounted and undiscounted semi-Markov decision processes and perfect information semi-Markov/ Stochastic games. We also discuss some efficient algorithms to solve such special classes of semi-Markov decision processes and semi-Markov (Stochastic) games. The main results are stated as follows:

The first chapter is introductory in nature. Here we present the required definitions and introduce the notations used in this dissertation. We also present a brief survey on the literature of zero-sum two person matrix games. To introduce stochastic games, we start from the very beginning of Markov decision processes and its different payoff criterion. Finally, we describe semi-Markov decision processes as well as semi-Markov games.

In the second chapter, we study Semi-Markov Decision Processes (SMDPs) With Vector Pay-offs under discounted as well as limiting ratio average payoff (undiscounted) structure and prove the existence of pure stationary/semi-stationary Pareto-optimal strategies. We also discuss efficient algorithms to compute pure stationary and pure semi-stationary Pareto-optimal strategies for both the discounted and undiscounted (limiting ratio average) SMDP models with vector rewards respectively.

In the third chapter, we study Undiscounted Perfect Information Semi-Markov Stochastic Games and prove the existence of the value and a pair of optimal pure semi-stationary strategies for both the players. An algorithm has also been provided in this chapter to solve such stochastic/semi-Markov games. Some numerical examples are added too.

The thesis ends with a chapter on Undiscounted Semi-Markov Decision Processes With Countably Infinite Action Spaces. We establish the existence of a near-optimal pure semi-stationary strategy of the decision maker in such SMDP models. The analysis here is done without putting any bounded condition on the reward structure. However, we allow strategies/policies with finite support only. We also propose an efficient algorithm to compute the value and a near-optimal pure semi-stationary strategy of the decision maker in such a semi-Markov decision process. We further develop an optimality equation of such SMDP model using a recurrence condition.

21/02/2024

Kushal Guha Bakshi
Signature of the candidate

Professor
DEPARTMENT OF MATHEMATICS
Jadavpur University
Kolkata – 700 032, West Bengal
Signature of the supervisor