Book Review

Multi-Agent Reinforcement Learning: Foundations and Modern Approaches

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Multi-agent reinforcement learning studies how multiple agents interact in a familiar environment. When these agents interact with the environment and one another, can we observe them collaborate, coordinate, compete, or collectively learn to accomplish a particular task?

Comprised of 11 chapters in the book, the authors Stefano V. Albrecht Filippos Christianos and Lukas Schäfer claim that agents learn optimal decision policies by trying actions and receiving rewards to choose actions to maximise the sum of received rewards over time. This book starts with a discussion on fundamentals and concept descriptions supported by figures and illustrations.

Initially, the authors described the Markov decision processes, dynamic programming, and temporal-difference learning. Later, they introduced game models to represent interaction processes in a multi-agent system. They explained a game model and a solution concept to define a learning problem in multi-agent reinforcement learning. Subsequently, they explained how to use reinforcement learning techniques to learn optimal agent policies in a game. Thus, the first part is confined to the foundations of the issues.

The second part reflects a summary of deep learning for readers unfamiliar with the field and explains all foundational concepts required to understand the concepts. Further, they introduced deep RL and explained how to use neural networks to learn value functions and policies for RL algorithms. Then, they discussed different modes of training and execution, which determine the information available to agents during and after learning. The last two chapters concluded the book's discussion by describing practical considerations for the implementation of MARL algorithms and presenting environments which can serve as benchmarks and playgrounds to study these algorithms.

At the end of the discussions, the authors presented a list of survey articles of MARL research in reverse chronological order, dating back to the first survey of the field. Later, the book is supplemented by a comprehensive and exhaustive list of references in the field. These references serve as an excellent referral to the users to further extend their literature search.

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