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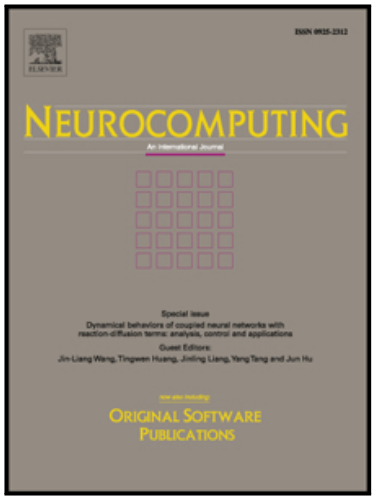

Iterative adaptive dynamic programming methods with neural network implementation for multi-player zero-sum games

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Iterative adaptive dynamic programming methods with neural network implementation for multi-player zero-sum games

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Abstract

This paper presents novel iterative learning methods along with the neural network implementation for multi-player zero-sum games. Solving zero-sum games depends on the solutions of Hamilton-Jacobi-Isaacs equations, which are nonlinear partial differential equations. These solutions are generally difficult or even impossible to be obtained analytically. To overcome this difficulty, iterative adaptive dynamic programming algorithms are utilized. In the related research works, three-network architecture, i.e., critic-actor-disturbance structure, is used to approximate the value function, control policies and disturbance policies. Different from the previous works, this paper employs single-network architecture, i.e., critic-only structure, to implement the proposed algorithms, which reduces the computation burden and the complexity of design procedure. Finally, two simulation examples are provided to illustrate the effectiveness of our proposed methods.

Keywords: Adaptive dynamic programming; Approximate dynamic programming; Zero-sum games; Neural networks.

1. Introduction

Nowadays, the structures of control systems have become more and more complex, and most real industrial systems are controlled by more than one

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