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Reinforcement learning in learning automata and cellular learning automata via multiple reinforcement signals

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Highlights

- Reinforcement learning schemes are extended to learn using multiple feedbacks.
- Using separate feedbacks, the proposed models can learn an optimal subset of actions.
- The effectiveness of the proposed models is investigated experimentally.
- Theoretical convergence analysis of some of the presented models is provided.

Abstract

Many scientific and engineering problems are decentralized in nature. Various distributed approaches have been developed for solving these problems, and among them, cellular learning automaton has demonstrated to be an effective model for systems consisting of a large number of interacting components. In the cellular learning automata approach, each such component is modeled by a learning automaton. The learning automaton associated with a component aims to learn the action which best suites with its neighboring components. This objective becomes more challenging when the automaton is required to find the optimal subset of its available actions. The common learning automata algorithms can deal with this problem by considering all combinations of their allowable actions as new action sets. However, this approach is only applicable for small action spaces. The current work extends some

common learning automata algorithms so that they can efficiently learn the optimal subset of their actions through parallel reinforcements. These parallel reinforcements represent the favorability of each action in the performed subset of actions; consequently, the learning automaton would be able to learn the effectiveness of each action individually. By integrating the new LA models in a cellular learning automaton, each component of the system is able to interact with its neighbors simultaneously via multiple actions. In order to investigate the effectiveness of the proposed models, their applicability on a channel assignment problem is investigated experimentally. The achieved results demonstrate the efficiency of the proposed multi-reinforcement learning schemes.

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Keywords

Learning automata; Cellular learning automata; Multi radio channel assignment

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