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Recent Advances in Learning Automata

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To my lovely wife, my beloved dad, my merciful mom, and my dear sisters for their love and supports

Alireza

To my late mother, Dr. H. Afsar Lajevardi. I will never forget her kindness and support. To my brother, Dr. Mohammad Ali Saghiri and my father for their support during difficult days of my life

Ali Mohammad

To my family

S. Mehdi

To my love, my life, my soulmate, my ONE and only, Najmeh

Mehdi

Preface

This book is written for computer engineers, scientists, and students studying/working in reinforcement learning and artificial intelligence domains. The book collects recent advances in learning automaton theory as well as its applications in different computer science problems and domains. The book, in detail, describes the distributed learning automata and the cellular learning automata models for solving a variety of complex problems in wireless sensor networks, complex social networks, cognitive peer-to-peer networks, and adaptive Petri nets. Validation of the given learning automata-based methodologies is provided through extensive computer simulations. In addition, the book presents detailed mathematical and theoretical aspects of recent developments of cellular learning automata in real-world problems. The mathematical level in all chapters is well-suited within the grasp of the scientists as well as the graduate students from the engineering and computer science streams. The reader is encouraged to have basic understanding of probability, stochastic processes, and related mathematical analyses.

This book consists of six chapters dedicated toward using recent models of learning automata for computer science applications. Chapter 1 provides the necessary background about learning automata theory and distributed learning automata. Chapter 2 gives a brief introduction about recent cellular learning automata models including irregular cellular learning automata and dynamic cellular learning automata models. Chapter 3 introduces recent applications of learning automata for wireless sensor networks. Chapter 4 is devoted to applications of learning automata in cognitive peer-to-peer networks. Chapter 5 discusses about the applications of learning automata for social network analyses when the underlying graph model is assumed to be stochastic. Finally, Chap. 6 provides new models of adaptive Petri nets based on learning automata.

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important scientific work. We hope that readers will share our pleasure to present this book on recent advances in learning automata and will find it useful in their careers.

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Abstract

Learning automaton (LA) as a promising field of artificial intelligence is a self-adaptive decision-making device that interacts with an unknown stochastic environment and progressively is able to find the optimal action even provided with probabilistic wrong hints. LA has made a significant impact in many areas of computer science and engineering problems. In the past decade, a wide range of learning automata theories, models, and paradigms have been published by researchers in vast areas of computer science domain such as resource allocation, pattern recognition, image processing, task scheduling, data mining, computer networks, communication networks, distributed adaptive systems, cognitive networks, vehicular sensor networks, grid computing, cloud computing, adaptive Perti-nets, complex social networks, optimization, and so on. Learning automata are extremely suitable for modeling, learning, controlling, and solving real-world problems, especially when the information is incomplete; that is, when the environment is noisy or has a high degree of uncertainty. This book is intended to collect recent advances in learning automata including research results that address key issues and topics related to learning automata theories, architecture, models, algorithms, and their applications.