Studies in Computational Intelligence 820

Alireza Rezvanian
Behnaz Moradabadi
Mina Ghavipour
Mohammad Mehdi Daliri Khomami
Mohammad Reza Meybodi

# Learning Automata Approach for Social Networks

Springer

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Janusz Kacprzyk, Polish Academy of Sciences, Warsaw, Poland
e-mail: kacprzyk@ibspan.waw.pl

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Alireza Rezvanian
School of Computer Science
Institute for Research in Fundamental Sciences (IPM)
Tehran, Iran

and

Computer Engineering and Information Technology Department
Amirkabir University of Technology (Tehran Polytechnic)
Tehran, Iran

Mina Ghavipour
Computer Engineering and Information Technology Department
Amirkabir University of Technology (Tehran Polytechnic)
Tehran, Iran

Mohammad Reza Meybodi
Computer Engineering and Information Technology Department
Amirkabir University of Technology (Tehran Polytechnic)
Tehran, Iran

Behnaz Moradabadi
Computer Engineering and Information Technology Department
Amirkabir University of Technology (Tehran Polytechnic)
Tehran, Iran

Mohammad Mehdi Daliri Khomami
Computer Engineering and Information Technology Department
Amirkabir University of Technology (Tehran Polytechnic)
Tehran, Iran

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*To*
*my lovely wife, Razieh*
*my beloved and merciful parents,*
*Mohammad Reza and Nahid*
*my dear sisters, Saba and Sepinoud*
*for their love and support*
Alireza Rezvanian

*To the memory of my father, Mohsen*
Behnaz Moradabadi

*To my family*
Mina Ghavipour

*To my family*
Mohammad Mehdi Daliri Khomami

# Preface

This book is written for computer engineers, social scientists, and students studying/working on social networks, artificial intelligence, machine learning, reinforcement learning, and learning automata. The book collects recent developments in learning automaton theory in social network analysis applications. The book in detail describes those learning automata models that applied for solving different problems of social network analysis including graph problems, network sampling, community detection, link prediction, trust management, recommender systems, and influence maximization. In each chapter of the book, validation of the learning automata-based methods is presented through theoretical or simulations aspects. The new model of cellular learning automata called wavefront cellular learning automata for social network analysis is also introduced in this book. It is shown that due to the distributed characteristics of wavefront cellular learning automata, this model successfully applied in link prediction and network sampling. The level of mathematical analysis is well suited within the grasp of the scientists as well as the graduate students from the computer engineering and social science domains. The readers are encouraged to have basic understanding of social network analysis, reinforcement learning, learning automata, and related topics.

This book consists of nine chapters dedicated toward using recent models of learning automata for social network applications. Chapter 1 provides the necessary background about learning automata theory, distributed learning automata, and several models of learning algorithms. Chapter 2 gives a brief introduction about a recent cellular learning automata model named wavefront cellular learning automata. Chapter 3 analyzes the research study for learning approach on social network as bibliometric aspect. Chapter 4 is devoted to applications of learning automata in network sampling algorithms. Chapter 5 discusses the learning automata algorithms for community detections. In Chap. 6 link prediction methods using learning automata models are provided. Chapter 7 introduces recent developments in learning automaton theory in social trust management. Recent social recommender systems based on learning automata techniques are reported in Chap. 8. Finally, Chap. 9 provides new methods of influence maximization based on learning automata for information diffusion.

The authors would like to thank Dr. Thomas Ditzinger, Springer, Executive Editor, Interdisciplinary and Applied Sciences and Engineering, Mr. Ravi Vengadachalam, Project Coordinator and Books Production of Springer-Verlag, Heidelberg, for the editorial assistance and Sindhu Sundararajan, Scientific Publishing Services for excellent cooperative collaboration to produce this important scientific work. We hope that readers will share our pleasure to present this book on learning automata approach for social networks and will find it useful in their research.

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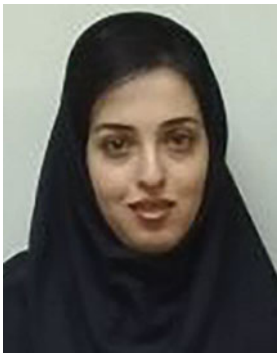
Alireza Rezvanian
Behnaz Moradabadi
Mina Ghavipour
Mohammad Mehdi Daliri Khomami
Mohammad Reza Meybodi

# Contents

# About the Authors

**Alireza Rezvanian** received the B.Sc. degree from Bu-Ali Sina University of Hamedan, Iran, in 2007, the M.Sc. degree in Computer Engineering with honors from Islamic Azad University of Qazvin, Iran, in 2010, and the Ph.D. degree in Computer Engineering at the Computer Engineering and Information Technology Department from Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran, in 2016. Currently, he works as a researcher in the School of Computer Science from Institute for Research in Fundamental Sciences (IPM), Tehran, Iran. He has authored or co-authored more than 70 research publications in reputable peer-reviewed journals and conferences including IEEE, Elsevier, Springer, Wiley, and Taylor & Francis. He has been guest editor of special issue on new applications of learning automata-based techniques in real-world environments for *Journal of Computational Science* (Elsevier). He is an associate editor of the *Human-centric Computing and Information Sciences* (Springer). His research activities include soft computing, evolutionary algorithms, complex networks, social network analysis, data mining, data science, machine learning, and learning automata.



**Behnaz Moradabadi** received the B.S. from Tabriz University in 2009, Tabriz, Iran, and M.Sc. degree in Computer Engineering from Sharif University of Technology in 2011, Tehran, Iran. She also received the Ph.D. degree in Computer Engineering at the Computer Engineering and Information Technology Department from Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran, in 2018. Her current research interests include social networks, learning systems, soft computing, and information retrieval.

**Mina Ghavipour** received her B.Sc. degree in Computer Engineering, in 2008. She also received the M.Sc. and Ph.D. degrees from the Department of Computer Engineering and Information Technology at Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran, respectively, in 2012 and 2018, under supervision of Prof. Mohammad Reza Meybodi. Her research interests lie in the areas of social network analysis and mining, network sampling, recommender systems, social trust, machine learning, and reinforcement learning.

**Mohammad Mehdi Daliri Khomami** received the M.S. degree Computer Engineering from Department of electrical and computer engineering at Qazvin Islamic Azad University. He is currently pursuing Ph.D. degree in Computer Engineering at the Computer Engineering and Information Technology Department, Amirkabir University of Technology (Tehran Polytechnic), Teharan, Iran. His research interests include learning automata, social network analysis, and optimization with application to problems from graph theory.

**Mohammad Reza Meybodi** received the B.S. and M.S. degrees in Economics from the Shahid Beheshti University in Iran, in 1973 and 1977, respectively. He also received the M.S. and Ph.D. degrees from the Oklahoma University, USA, in 1980 and 1983, respectively, in Computer Science. Currently, he is a Full Professor in Computer Engineering Department, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran. Prior to current position, he worked from 1983 to 1985 as an Assistant Professor at the Western Michigan University and from 1985 to 1991 as an Associate Professor at the Ohio University, USA. His current research interests include learning systems, cloud computing, soft computing, and social networks.

# Abstract

Online social networks such as *Facebook*, *Twitter*, *Instagram*, and *LinkedIn* have provided an appropriate platform for people to interact with each other and disseminate different types of information. Thus, analyzing these networks is increasingly important for discovering behavior patterns of interactions among individuals and evolution of the networks over time, as well as developing algorithms required for meaningful analysis. Due to uncertain, dynamic and time-varying nature of social interactions in online social networks, especially in activity and interaction networks, some properties of networks such as network centralities, trust values, diffusion probabilities and user influences change dynamicity over time. Therefore, it would be difficult to capture the structural and dynamical properties of the network. To deal with this problem, several studies based on learning systems have been presented in the literature to reflect dynamical behavior of social network issues in time. In recent years, learning automaton (LA) as a promising intelligent technique has presented potential solutions for many real network problems and has the advantage of being able to work in unknown, uncertain, complex and dynamic environments.

This book is aimed to survey recent developments in problems of social networks addressed by learning automata theories, which are related to network measures, network sampling, stochastic networks, stochastic graphs, community detection, link prediction, trust management, recommender system, influence maximization and their applications.