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Editors

Computational Social Networks

Tools, Perspectives and Applications

Springer

Preface

Computational Social Network (CSN) is a new emerging field that has overlapping regions from Mathematics, Psychology, Computer Sciences, Sociology, and Management. E-mails, blogs, instant messages, social network services, wikis, social bookmarking, and other instances of what is often called social software illustrate ideas from social computing. Social network analysis is the study of relationships among social entities.

Very often, all the necessary information are distributed over a number of websites and servers, which brings several research challenges from a data mining perspective. This book is a collection of chapters authored by world-class experts illustrating the concept of social networks from a computational point of view, with a focus on practical tools, applications, and open avenues for further research. The main topics cover the design and use of various computational tools and software, simulations of social networks, representation and analysis of social networks, use of semantic networks in design, and community-based research issues such as knowledge discovery and visualization. The authors present some of the latest advances of computational social networks and illustrate how organizations can gain competitive advantages by applying the different emergent techniques in the real-world scenarios. Experience reports, survey articles, and intelligence techniques and theories with specific networks technology problems are depicted. We hope that this book will be useful for researchers, scholars, postgraduate students, and developers who are interested in social networks research and related issues. In particular, the book will be a valuable companion and comprehensive reference for both postgraduate and senior undergraduate students who are taking a course in Computational Social Networks. The book contains 18 chapters, which are divided into two Parts and all chapters are self-contained to provide greatest reading flexibility.

Part I comprises of eight chapters (including an introductory chapter) and deals with modeling aspects and various computational tools used for social network analysis.

In Chap. 1, Panda et al. provides an overview of a number of social network related concepts from a computational perspective, such as social network analysis,

different performance measures, social network services, tools, and applications. In addition, the authors also illustrate some of the current main problems facing social networks, how to address such challenges, opportunities, and future directions of research.

Xu in Chap. 2 proposes a hierarchical graphical knowledge representation (HGKR) to integrate layered abstractions into a coherent structure such that behavior forecasting may propagate downward or aggregate upward in a network. The system consists of a hierarchical graphical model, an evolutionary computation module, inference/forecasting, and decision support to forecast behaviors of groups at different hierarchies.

In Chap. 3, Herbiet and Bouvry illustrate novel social structure mining techniques devoted to the operation of dynamic mobile social networks. The authors focus on the impact of the notion of dynamics and time-evolving characteristics of the social structures and provide the complete state of the art. Further, a novel approach based on epidemic propagation for dynamic clustering and discovery of communities are introduced and the framework is illustrated using case studies.

Labatut and Balasque in Chap. 4 present an interesting problem of community detection in social networks. After presenting the state of the art, the authors focus on the methodological tools to analyze the obtained community structure, both in terms of topological features and nodal attributes. Real-world social network examples are used to illustrate the application of the presented tools and interpret the results from a business science perspective.

In Chap. 5, Bersano-Mendez et al. introduce how social networks can be modeled and analyzed using graph theory. This chapter provides an extensive overview to the mathematical modeling of social networks with an overview of the metrics used to characterize them and the models used to artificially mimic the formation of such networks. The authors illustrate various metrics based on distances, degrees, and neighborhoods as well as the use of such metrics to detect change in the network structure.

Yang et al. in Chap. 6 introduce a number of different ways of studying the macroscopic structure of social networks. The authors focus on the bow-tie decomposition method, and a precise formal definition for the decomposition as well as an algorithm is illustrated. The closely related daisy model and a fractal approach are also discussed.

In Chap. 7, Apolonia et al. describe the design, the development, and resulting evaluation of a web-enabled platform Cycle-Sharing in Social Networks (CSSN). The platform leverages a social network to perform discovery of computational resources, thus giving the possibility for any user to submit their own jobs for remote processing. Walls, messages, and comments in Facebook are used as the underlying transport for CSSN protocol messages, achieving full portability with existing social networks. CSSN gives the chance for common users to unleash the untapped computing power hidden in social networks.

Davidsen and Ortiz-Arroyo in Chap. 8 provide an analysis on the robustness of centrality measures using some examples. Further, the authors present a method to predict edges in dynamic social networks. Experimental results indicate that the

robustness of the centrality measures follows a predictable pattern and that the use of temporal statistics could improve the accuracy achieved on edge prediction.

Part II deals with usage of social network tools and conceptual ideas for various applications and consists of ten chapters.

Hall et al. in Chap. 9 introduce the theoretical framework for community action and then discuss some of the revolutionary cognitive technologies that provide tools for implementing the theory, and conclude by presenting some preliminary observations from ongoing case studies where the technology has been recently implemented.

In Chap. 10, Kundu deals with the problem of dynamic Web prediction which is typically done using Markov model. Prediction requires complicated methodologies for selection of a particular hyperlink from the pool of hyperlinks of a current Web page. The author proposes a Web prediction method, which is based on real-time characteristics of users. Minimization of the total number of hyperlinks to be selected is the main aim of the proposed approach for accomplishing superior precision in dynamic prediction mode.

Khodaparast and Kavianfar in Chap. 11 illustrate how to make a reliable public cooperative network of wireless users to exchange intra-city data traffic information without using service providers. The proposed architecture includes a routing algorithm, a forwarding incentive mechanism, a security system, and a resiliency scheme.

In Chap. 12, Huang et al. focus on applications of social networks in peer-to-peer networks using *network coding* and *Named Data Networking,* which is a brand-new framework for future communications.

Pal et al. in Chap. 13 illustrate how digital devices can contribute to a social network used by people. The authors describe the need for such devices to detect user activity and allow other users to interact using that information, thereby creating an immersion of the real and virtual worlds.

In Chap. 14, Luo presents the background of ubiquitous environment, social networks, and media sharing. The author illustrates why and how social network-based media sharing is destined to be indispensable in the ubiquitous environment. Several applications are used as case studies and some future directions are also provided.

Geierhos and Ebrahim in Chap. 15 describe a novel technical service dealing with the integration of social networking channels into existing business processes. By doing so, business process management systems, which are already used to e-mail communication, can benefit of social media and also allow companies to follow general trends in customer opinions on the Internet.

In Chap. 16, Cipresso et al. analyze how to consider real emotions in complex networks by understanding subjects' behaviors in specific situations, such as social network sites navigation and to use these information in modeling complex phenomena. The authors propose a framework comprising of networked agents representing subjects and relationships.

Jones et al. in Chap. 17 develop a social learning environment prototype in a university environment by exploiting the communication and collaborative qualities

of social networks. Learners become active participants in the learning process and they could access public Internet content to practice independent information-search and information-discernment skills, which they can share with others, and the virtual learning environment is benefited.

In Chap. 18, Falahi et al. connects social networks with recommender systems clearly illustrating the immediate synergies arising from bringing the two communities together. According to the authors, multiple potentially beneficial mutual synergies still remain to be explored and they provide the state of the art and future opportunities.

We are very much grateful to the authors of this book and to the reviewers for their tremendous service by critically reviewing the chapters. Most of the authors of chapters included in this book also served as referees for chapters written by other authors. Thanks go to all those who provided constructive and comprehensive reviews. The Editors would like to thank Wayne Wheeler and Simon Rees of Springer-Verlag, London, for the editorial assistance and excellent cooperative collaboration to produce this important scientific work. We hope that the reader will share our excitement to present this book on social networks and will find it useful.

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