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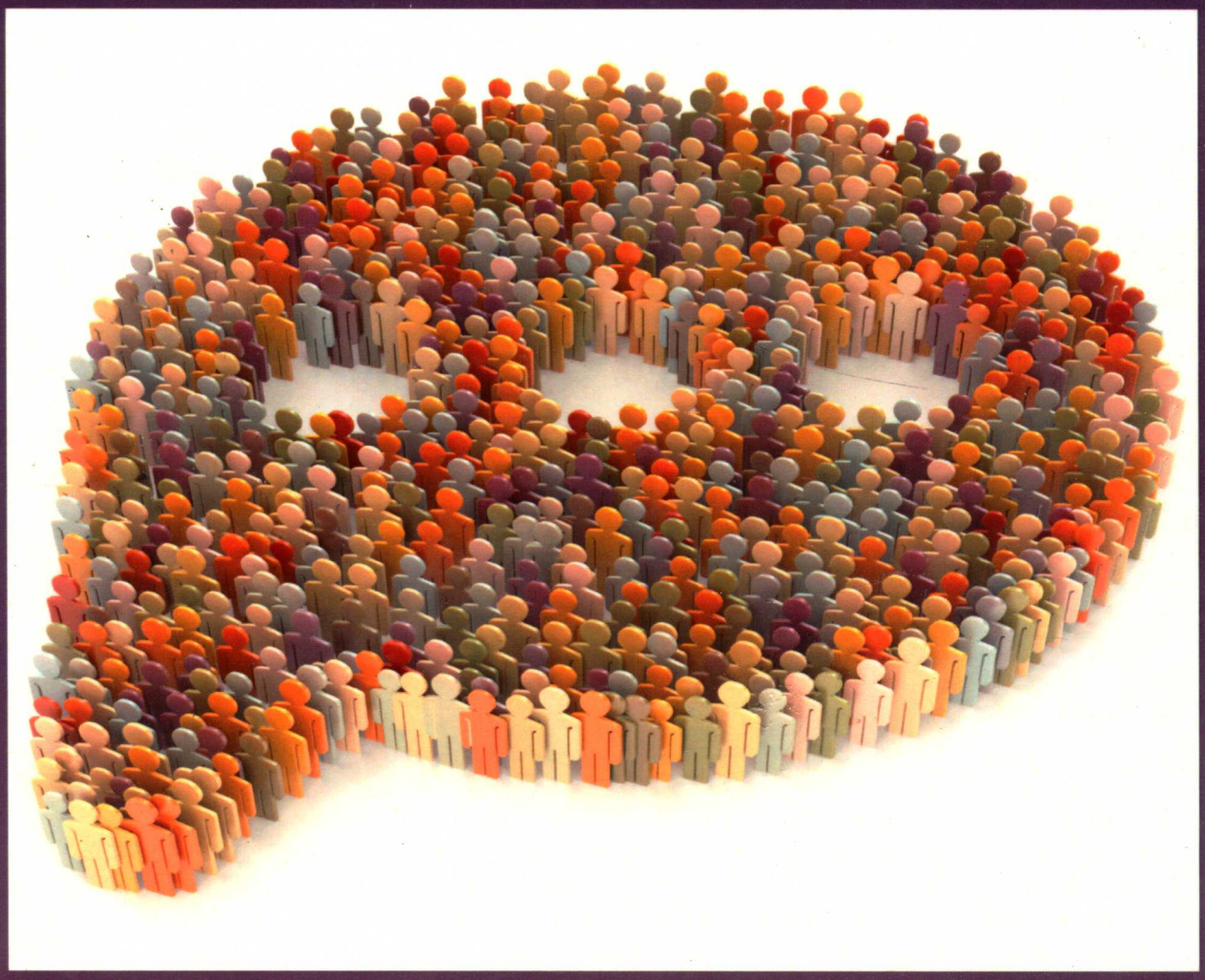
Social Networking and Community Behavior Modeling

Qualitative and Quantitative Measures



Maytham Safar & Khaled A. Mahdi

Social Networking and Community Behavior Modeling:

Qualitative and Quantitative Measures

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Information Science
REFERENCE

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Published in the United States of America by
Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com

Library of Congress Cataloging-in-Publication Data

Social networking and community behavior modeling: qualitative and quantitative measures / Maytham Safar and Khaled A. Mahdi, editors.
p. cm.
Includes bibliographical references and index.
Summary: "This book provides a clear and consolidated view of current social network models, exploring new methods for modeling, characterizing, and constructing social networks"--Provided by publisher.
ISBN 978-1-61350-444-4 (hardcover) -- ISBN 978-1-61350-445-1 (ebook) -- ISBN 978-1-61350-446-8 (print & perpetual access) 1. Social networks. I. Safar, Maytham. II. Mahdi, Khaled A., 1970-
HM741.S6343 2012
302.3--dc23

2011038336

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

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Foreword

Social networks represent aspects of human relationships and behaviors existing and happening around us in the real physical world. In the past decade, they have come along in the cyber digital world with the rapid development of emerging information and communication technology, such as web 2.0, ubiquitous computing, cloud services, and smart phones. Social networking services, including a variety of micro blogging services and so-called social media, have moved into the limelight in the recent years. They have made a lasting influence on an individual's daily life, an enterprise's business process, and even a nation's economic and political system.

Social Networking and Community Behavior Modeling: Qualitative and Quantitative Measures, edited by Professors Maytham Safar and Khaled Mahdi, with an Editorial Advisory Board of famous scholars from different parts of the world, has been published at a very opportune time. The volume encompasses a variety of interdisciplinary topics, which have carefully selected and well discussed from a multidisciplinary perspective. It provides socio-technical views on modeling and developing social networks and online communities, and a comprehensive discussion of the core issues, integrated approaches, and practical visions of its trend in the field.

The book begins with the theoretical issues on the formation of social networks and online communities, transformation from traditional society to virtual world, social construction and network structure, civic engagement and cultural model, and analysis of success factors. It goes further into application issues on knowledge discovery, information diffusion, decision-making, customer relationship management, and learning support in or through social networking and online communities. It presents methodologies and describes solutions related to these difficult issues in the field. This book offers a comprehensive viewpoint of the upcoming evolution and trend of social networks, and the potential impact it may bring to the business and society.

Research on social network modeling and analysis relates to a lot of cross-disciplinary, interdisciplinary, and trans-disciplinary issues. It is a continuously and rapidly evolving field. This book is highly expected to help researchers to become aware of the very wide range of social network issues from the perspectives of both computer science and social science. It can serve as a reference work for domain researchers interested in social networking and online community behavior modeling and analysis, and a text for novice social networkers looking for an overview of the field. It can lead the interested readers to a brand new starting point of the research field.

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Preface

Sociality is the most unique characteristic of human beings. Humans usually strive to create relations with others by sharing their thoughts, emotions, and even their actions. Sometimes, it is not necessary to even have a direct interaction between actors to say that there is a social relation between them. It is enough that one of them is acting under the assumption that the others shared the same meanings that caused him to act. This uniqueness implied an important philosophical question that was considered centuries ago, "How do people communicate?" What are the rules that really control these communications? Half a century ago, it was almost impossible to provide qualitative or quantitative assessment to help providing accurate answers to these questions. However, as the population of the world is growing day by day, the importance of answering this question is increasing. That's because the spread of news, rumors, and even the diseases have become very hard to be controlled.

Sociology is the branch of social sciences that considers investigating empirically the social activities of the human being. Its concerns include both micro and macro levels of the human-to-human interactions. In other words, it considers both the face-to-face human interaction and the overall society behavior. After the technological advancement in the communication field and the creation of the Internet and mobiles, the ability to provide an insight has grown tremendously. Fortunately, the ability to study the human society and answer the questions mentioned has grown.

Social networks are how any community is modeled. They have emerged as a major trend of computing and social paradigms in the past few years. The social network model helps the study of the community behavior and thus leverages social networks to researchers' demands.

Social networks in most works are treated like any complex network with modeled sociological features. The social actor is a simple node, and the relationships are simple links connecting the nodes with specific and non-specific directions. This book's contributors hypothesize that understanding the information flow, patterns, and distribution in social networks and online communities will lead to characteristic finding of the nature of those networks.

An essential characteristic of any network is its resilience to failures or attacks, or what is known as the robustness of a network. The definition of a robust network is rather debatable. One interpretation of a robust network assumes that social links connecting people together can experience dynamic changes, as is the case with many friendship networks such as Facebook, Hi5, et cetera. Individuals can easily delete a friend or add a new one, with and without constraints. Other networks, however, have rigid links that are not allowed to experience changes with time such in strong family networks. Hence, it is vital to find a quantitative measure of a networks' robustness.

This book is designed for professionals, researchers, and graduate students working in the field of social networks, both from theoretical and practical point of views. The book will also provide insights

to the executives responsible for understanding the technology and utilizing it to have a positive impact on their business.

The audience for the book include, but are not limited to researchers, computer scientists, physicists, chemists, sociologists, computer network designers, chatters, bloggers, social networkers, web developers, and people and enterprises involved in marketing/advertising using the internet and mobile systems.

Chapter 1, "*Social Networks and Communities: From Traditional Society to the Virtual Sphere*," describes the different meaning and operational definitions that the concept of community covered in Social Network Analysis. The aim is to introduce the readers to a critical view of the use of the concept of community in social network analysis and in particular to the study of complex interaction environments, such as Internet and mobile media. The development of the field of network analysis is described by means of case studies and scholarly examples from various fields of empirical network research (political science, communication sciences and technology studies). In particular, the chapter explores the research process that evolved from the first ethnographic studies of social groups, and proceeds to exploration of new forms of interaction in online and computer mediated environments.

Chapter 2, "*Network Perspective on Structures Related to Communities.*" The application of network perspectives to communities requires some appreciation of the variety of ways people are now writing about communities. From the 1940s well into the 1960s the local community was the recognized social unit that sociologists and anthropologists studied. People who write about communities nowadays are using terms in a wide variety of ways. The "little communities" that anthropologist Robert Redfield (1960) wrote about fifty years ago have very little in common with the present-day "community of nations, the community of Jamaica Plain, the gay community, the IBM community, the Catholic Community, the Yale Community, the African American community, the 'virtual' community of cyberspace," all mentioned by Robert Putnam (2000). In the decade since Putnam, electronic connections have expanded logarithmically in both number and speed, and the community problem is even more vexing.

In chapter 3, "*Civic Engagement and Communication Technology Networks,*" individuals address public issues by becoming involved with civic groups and performing civic activities such as charity and political work. Changes in communication technology have led to changes in civic engagement, and it is now possible to perform civic activities digitally. Actors develop social networks as they use various communication technologies, and the resultant networks act as passive constraints on individual activities. This chapter investigated face-to-face, telephone, email, private electronic, and public electronic communication networks. Private electronic communication networks develop through text messaging, instant messaging, and private chat, and public electronic communication networks emerge through the exchange of messages over blogs, social network sites, and Twitter.

Chapter 4, "*The Social Construction of New Cultural Models through Information and Communication Technologies*," contains a theoretical reflection on the meaning of the new forms of social relations in this ICT-based culture, as well as on the need to define new analytical tools to enable an adequate interpretation of this new cultural context within the framework of globalization and digitalization. The work analyzes the cultural significance of the new concept of cyberculture and the new socio-cultural concepts regarding to ICTs.

Chapter 5, "*From Virtual to the Simulated World: An Agent-Based Model of Friendship Network in Second Life.*" A prototype agent-based model of the friendship network in Second Life is presented. Second Life is a 3D virtual world that allows users to engage in various social activities, meet friends, form communities, attend events of interests, and trade online with other users represented through their virtual 3D avatars. For social and behavioral scientists, this provides an opportunity to investigate the

dynamics of social interaction and formation of interpersonal and group affiliation ties. Initial results from the model concerning friendship ties are reported.

Chapter 6 is titled "*Analysis of Success Factors in Social Networking Website Development.*" The popularity and rapid growth of social networking Websites is undeniable. Unfortunately, it is hard to guarantee the success and sustainability of these Websites. This chapter focuses on identifying the key success factors for each phase in agile iteration development for social networking Websites. Qualitative and quantitative analysis were adopted using Web analytical tools to gather and measure these success factors. This chapter will benefit Website designers and developers by suggesting the success factors for each agile iteration development phase.

Chapter 7, "*Knowledge Discovery from Online Communities*," overviews the most notable research trends and application systems concerning data mining and knowledge discovery from user-generated content. It first introduces the most popular social media features. This chapter also overviews the most appealing approaches to social network analysis and user behavior modeling. Finally, it categorizes and thoroughly describes the state-of-the-art data mining algorithms and tools oriented to knowledge discovery from online communities. A particular attention is focused on semantic knowledge inference and automatic understanding of the user-generated content.

Chapter 8, "*Information Diffusion in Social Networks*," provides an overview of information and innovation diffusion in scale-free, small-world social networks. The material is suitable for network science specialists, as well as for interested professionals in the fields of Sociology, Psychology, and Marketing. Both static and dynamic aspects are discussed, as well as message taxonomies. The text addresses the role and the strategic position of influential spreaders of information; the pathways in the social networks that serve as conduits for communication and information flow; mathematical models describing proliferation processes; short-term and long-term dynamics of information diffusion, and secrecy of information diffusion.

Chapter 9, "*Social Network, Information Flow and Decision-Making Efficiency: A Comparison of Humans and Animals.*" In animals, including humans, group or community members not only have to take decisions satisfying the majority of individuals (i.e. decision accuracy), but also have a relatively short period to do so (i.e. decision speed). The decision efficiency will vary according to the way individuals are inter-connected, namely according to the social network. However, the traditional approach used in management and decision sciences has been revealed to be insufficient to fully explain decision-making efficiency. This chapter addresses the question of how social network may enhance collective decision-making by increasing both the accuracy and the speed of decisions.

Chapter 10 is titled "*Extracting and Measuring Relationship Strength in Social Networks.*" The growth of the Internet and online communities has led to increasing importance for understanding the social network structure of communities and the relationships between members. The mapping from online communications and behaviors to relationships should identify valid relationships so that the structural properties of the resulting social network are stable in the face of incomplete or inaccurate data. This chapter shows how slight variations in data processing steps for identifying relationships can lead to very different networks. It considers a number of design choices and the network structure variability they introduce and measures its effectiveness in performance on a prediction task.

Chapter 11, "*Bringing Qualitative and Quantitative Data Together: Collecting Network Data With the Help of the Software Tool VennMaker*," describes the gathering of network data by means of both qualitative and quantitative methodologies. An overview of the important visual approaches (e.g. network pictures and network maps) is given. Following, an example of a migration-network study was

investigated with the aid of the software program VennMaker. Finally, the advantages and disadvantages of data collection based on digital network maps are discussed.

Chapter 12 is "*Observing the Evolution of a Learning Community using Social Network Analysis.*" This chapter proposes an empirical correlation between the stages of development of a learning community and a set of social network metrics. Social Network Analysis was applied to observe a learning community built around a Master's Program in an Italian University. It was found that the evolution of social network metrics - such as Density, Betweenness Centrality, Contribution Index, Core/Periphery Structure – matched the formal stages of community development, with a clear identification of forming, norming, and storming phases.

Chapter 13 is "*Social Networks and Terrorism.*" This chapter explains how international terror networks, consisting of individuals and organizations spanning countries and continents, form and evolve. Terrorism is violence committed by groups with political goals, targeted against civilians, and intended to create fear in a population. Social network analysis, which uses visual and matrix algebra methods to study such networks, can help counterterrorist organizations to detect, disrupt, and dismantle terrorist groups.

Chapter 14 is titled "*Social Network Sites: Modeling the New Business-Customer Relationship.*" This chapter focuses on the new facets of the relationship between customers and businesses and analyses the important role that Social Network Sites (SNSs) can play in its strengthening. The era of Web 2.0 has empowered consumers, by amplifying their voices and providing them with venues for information search and sharing. SNSs represent one of the most successful examples of social technology and since the business sector needs to adapt to customers' changing profile and behaviour, SNSs have proven to be important tools in terms of upholding the business-consumer relationship. Nonetheless, their primordial social and informal nature recommends thoroughness in order to maximise their potential, while avoiding their perils.

Chapter 15 is called"*Community Structure Extraction for Social Networks.*" This chapter applied two graph partition approaches to extract community structures from social networks. The spectral approach is based on the minimization of balanced cut and its resulting solution comes from the spectral decomposition of the graph Laplacian. The modularity-based approach is based on the maximization of modularity and implemented in a hierarchical fashion. The method is able to extract useful information from the community structure, such as what is the most influential component in a given community. This information can be used to improve marketing efficiency by customized advertisement. Network visualization and navigation can also benefit from the community structural information.

Chapter 16 is titled "*Towards a Bespoke Framework for Eliciting Consumer Satisfaction in Second Life.*" This chapter focuses on the development of a framework for eliciting consumer satisfaction perceptions in the context of the social virtual world Second Life. An introduction to Second Life is followed by an overview of the relevant literature. The framework and the inter-related component parts that it is made up from are then described in detail. This is followed by an evaluation of the framework through semi-structured in-world interviews as well as the refinement of the framework as a consequence of our evaluation. Finally, an overview of how the framework can be used by others is given along with the wider context of its use.

Chapter 17 is "*Finding Similar Users in Facebook.*" A crucial aspect in the analysis of Online Social Networks is to determine whether two users of the network can be considered similar, or not. This reflects in several interesting applications, such as the possibility of finding social aggregations or targeting commercial promotions with proficiency. This chapter provides an approach to estimate the similarity

among users of a network using information about their social ties and the analysis of their activities. It draws several local measures of similarity considering different indicators, and combines them obtaining a global measure of similarity by applying metrics introduced in Social Sciences combined with techniques as the linear regression.

Social networks and online communities are complex networks with minimal sociological features modeled. The objective of this work is to provide a clear and consolidated view of current online communities and social networks' models and their accuracy in representing real life social networks. This book seeks to explore the new methods to model, characterize, and build such networks and communities. The book addresses the need to explore the critical issues (cultural, security, threats, legal, and technical) confronting social networking, the emergence of new mobile social networking devices and applications, and how social networks impact the business aspects of organizations. Network robustness is also a vital property that needs to be addressed.

The concepts, models, and algorithms outlined in the book would provide useful information about social behavior and how well the network is connected. It would analyze how social networks and online communities can disseminate information in the existing networks. Contributors hypothesize that understanding the patterns of information distribution in the network will lead to characteristic finding of the nature of those networks, the capacity of this social network to store information, and accurately study the state of the network using information equilibrium.

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Acknowledgment

The work presented in this book could not have been possible without the guidance and support of many people. First, and foremost, I would like to acknowledge and thank the help of my co-editor, Dr. Khaled Mahdi, who has provided me with substantial assistance. He helped me in taking the opportunity of pursuing this work and directing my efforts to complete it. I wish to thank our Assistant Development Editor, Mike Killian, at IGI Global Publisher, for his confidence and patience in working with us on the project.

We are gratefully thankful for the authors of these book chapters and all the reviewers. They have paved the way to produce such a book with their continuous support, patience, and endless efforts to help finishing the writing of the content of the book and meeting all the milestones and deadlines.

Last, but not least, I would like to thank my Synergy Research Group (http://synergy.ku.edu.kw) faculty members, students, external collaborators, and alumnus for their encouragement, support, and faith in our abilities to accomplish anything we set out to do. Would also like to thank them for being a source of motivation and encouragement.

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Section 1
Social Networks and Communities

Different meanings and definitions of offline and online communities are found in social network analysis. This section aims to demonstrate the intrinsic capability of communication technologies enabled through the Internet and mobile applications in the form of exchange of messages over SMS, emails, blogs, and social network sites. It emphasizes those technologies' expansion in both speed and number in the creation of virtual online social networks and communities as opposed to the traditional local/nation civic communities and social groups that are usually created by traditional forms of communications; face-to-face, telephone, or mail.

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