Chapter 17
Social Network Analysis:
Basic Concepts, Tools, and Applications

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ABSTRACT

The study of social network analysis has grown in popularity in the past decades and has been used in many areas. It is an interesting and useful field that gained an increasing popularity due to the explosion of social media that has emerged with advances in communication systems, which play a critical role in forming human activities and interactions in social systems. The authors present some techniques from a data mining perspective and statistical graph measure that can be used in various applications such as to perform community detection, clustering in a social network, identify spurious and anomalous users, predict links between vertices in a social network, model and improve the information diffusion, design trust models, and improve other applications. Then, the authors provide a recent literature review of such applications and thus outline challenges of social network applications.

INTRODUCTION

Networks are omnipresent everywhere and almost in every situation. Biological, social, computer and Web networks can be represented as a graph. Taking the social network as a primary example, they contain billions of individuals (vertices) interacting with each other by exchanging contents, photos, and videos (Hannema & Riddle, 2005). Another example is the Web network that consists of billions of pages as vertices and their hyperlinks to each other as edges (Broder et al., 2000). So, collecting and processing the input of Web users (queries, clicks), social interaction (posting contents, retweets, likes, comments) make the appearance of diverse forms of networks, such as the query graph (Zhao & Han, 2010) and social graph. The authors argue that social network constitutes a rich network to study and analyze since it contains wealthy sources of information about both users and links that represent relationships between these users.

A Social network includes a set of nodes that can be individuals, organizations or computers which are connected by different types of relationships, for instance, scientists in a discipline, employees in a firm, co-authors of a research paper, and computers in wireless networks. The relationship in the social network depends mainly on the studied network, it could be a friendship, scientific collaboration, business relationship, and so on.

Online social networks have become one of the most powerful and crucial sources of information that permit to its users to share, discuss and exchange ideas and opinions about a topic of interest. The main goal of social networks is to generate opportunities, to develop friendships by supporting a system that enables its users to organize and update their own profile, and sharing, exchanging contents of interest to users within the network. As well as, they improve learning for its users by sharing valuable contents on the subject of interest and permit making social connections within users preferences and find people of interest by sharing profiles for academic and business purposes.

Social network analysis (SNA) is an in-depth analysis of social networks, which tries to measure the flows between entities of social graph in the aim to extract insight and knowledge (Wasserman & Faust, 1994; Knoke & Yang, 2008). SNA enables performing both mathematical and visual analysis of interactions between social entities, which permits to understand the patterns that occur in social network and discovers complex communications, gets features and properties of the network and the change and evolution of the structure of the social graph.

The main goal of this chapter is to review progress and developments regarding interesting applications in social network analysis such as diffusion of information (Mekouar, El-Hammani, Ibrahimi, & Bouyakhf, 2015), community detection (Bedi & Sharma, 2016), link prediction (Al Hasan & Zaki, 2011), anomaly detection (Mekouar, Zrira, & Bouyakhf, in press), and trust models (Mekouar, Ibrahimi, & Bouyakhf, 2014). This is with the aim to provide a simplified view of the advancement of such applications in the field of social network analysis. In this sense, the authors point out strengths and weaknesses of existing approaches and provide some data mining techniques that may be applied to such listed applications of SNA. As well as, the authors provide measure metrics used in social network analysis for the purpose of analysis from graph theory perspective. Therefore the authors provide some tools to analyze, visualize and gain insight from the social graph.

Some surveys investigate relational and cultural structures with a few simple network concepts. Some other papers investigate the analysis of individuals and ties that bind them (Erçetin & Neyişci, 2016; Serrat, 2017). This chapter concentrates on discussing, analyzing and outline limitations that should further be explored of some major applications in social network analysis. The chapter provides readers with essential background to understand the basic concepts of data mining and graph theory applied to some potential applications of SNA.

This research chapter is designed to serve as guidelines for scientists and practitioners who intend to design new methods in this field of study and provide the readers with recent advancements in some of the most influential topics in the social network. This study will permit readers from different backgrounds to understand social network analysis easily and will be helpful to use and develop new approaches based on techniques from data mining and graph theory perspectives.

The rest of the chapter is organized as follows. Section 2 describes some data mining techniques used in social network analysis. Next, structures, properties, and graph models are provided in Section 3. Section 4 includes some tools used for visualization purpose of social network. Section 5, outlines some major applications of social network. Section 6, provides interesting challenges and future research directions. Finally, section 7, concludes the chapter.

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