Social Network Analysis: A Survey

Darren Quinn, University of Ulster, UK
Liming Chen, University of Ulster, UK
Maurice Mulvenna, University of Ulster, UK

ABSTRACT

Social Network Analysis is attracting growing attention as social networking sites and their enabled applications transform and impact society. This paper aims to provide a comprehensive review of social network analysis state of the art research and practice. In the paper the authors’ first examine social networking and the core concepts and ingredients of social network analysis. Secondly, they review the trend of social networking and related research. The authors’ then consider modelling motivations, discussing models in line with tie formation approaches, where connections between nodes are taken into account. The authors’ outline data collection approaches along with the common structural properties observed in related literature. They then discuss future directions and the emerging approaches in social network analysis research, notably semantic social networks and social interaction analysis.

Keywords: Data Collection, Interaction Analysis, Semantics, Social Network Analysis, Social Networking

1. INTRODUCTION

The World Wide Web has brought change to a point where it would be difficult to imagine a world not connected through online networks. In 2010, over 58% of Europe’s population of 813 million were internet users (Internet World Stats, 2010), and online social networking sites has emerged as one of the latest innovative applications from the Web, with high-profile sites such as Facebook (http://www.facebook.com) and Myspace (http://www.myspace.com). Their social and economic impact for individuals and business has been described as profound, in the rendering of a new global footprint (Charron et al., 2006). Their usage has evolved from initially being a communication tool towards a content sharing and socialising platform for like-minded people. A diversity of sites have emerged, ranging from the generic social networking sites such as Facebook to specialised content sharing social networks such as Youtube (http://www.youtube.com) and Flickr (http://www.flickr.com), or for specific domains such as ageing users, sites such as Eons (http://www.eons.com) and Sagazone (http://www.sagazone.co.uk).

As such, research of online social networks, which are commonly referred to as Social Network Analysis (SNA), have gained
increasing attention. SNA intends to model and analyse the interdependent relationships and hidden patterns that make up a social network structure, e.g., friendships, kinships beliefs or interests. Social networks have been studied extensively in multiple disciplines with works in communication (Wasserman & Faust, 1994), anthropology (Barnes, 1972) and sociology (Wellman, 1983). Examples include its application in Epidemiology to understand the spread of disease in a population (Klovdahl, 1985), or in Computing Science to understand the impact of community structures in online social networks (Mislove et al., 2007). The recent emergence of online social networks can be viewed as being the contemporary equivalent of social networks that have traditionally been observed and studied predominantly through the social science of anthropology. As such, research of online SNA is only a recent development, still in its infancy.

Online social networks have many unique characteristics that differentiate them from traditional social networks in terms of formation, evolution and analysis approaches. Firstly, online social networks form and evolve in a bottom-up way with individual users driving, shaping and controlling the networks. Secondly, an individual or group’s social network is no longer location restricted, allowing users access to social networks which may previously have been restricted by a particular location or demographic. An enhanced network reach is providing users with greater exposure and visibility to relatable communities and information. Thirdly, online social networks allow for more controlled, directed communications and contact to draw information from specific domains of interest. In addition, contact frequency and information disclosure are self imposed, allowing the user to perform in an observational or contributory role within a network. Given the unique features of online social networks, SNA requires a new wave of approaches and methods different from the approaches traditionally applied in social sciences to gain insights and discover intrinsic regularities. Currently there are a whole raft of SNA approaches being developed, ranging from network modelling, community formation and semantic analysis (Kumpula et al., 2007; Pfeil & Zaphiris, 2009; Eréteo et al., 2009).

As discussed SNA has the potential to be applied to a broad range of areas. The intention of the survey will be to review the area of social network analysis, with particular focus on investigating the impact online social networks have made on the area, discussing past, present and future approaches and their potential application. As part of the survey, a literature review was performed using a variety of techniques which included, searching within the bibliographic databases of Web of Science and Google Scholar with key terms and phrases (e.g., social network analysis, survey). A further review process followed whereby all literature was assessed for suitability within the survey scope. All relevant literature was further classified for inclusion within distinct sub categories and discussed within the appropriate section headings of the survey. The survey remit will not be to discuss areas in specific detail, as has already been achieved in a number of related works and studies, but rather to provide a general insight into common approaches within this broad area. The aim of the paper will be to review the current state of the art of SNA, and to identify and discuss the trends, approaches and technologies of SNA and potential future directions. It will discuss the fundamental areas and related works associated with SNA. The remainder of the paper is organised as follows. Section 2 discusses the trend of social networking sites and their application and trends in related research. Section 3 investigates the motivations of why social networks should be modelled. A range of social network models and their effect on a network structure are further examined. Tie formation and evolution as key network concepts are reviewed. Section 4 focuses on data collection approaches (traditional and contemporary) and discusses common structural properties in understanding the user role in a network, and social network metrics. Section 5 discusses the potential future directions of semantics in...
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