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Listen to me — Evaluating the influence of micro-blogs

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ABSTRACT

Social networks have become increasingly popular in recent years. Among the many social networking tools, micro-blogging is one of the most unique and convenient because it is short, responsive, spontaneous and mobile. These properties allow micro-blogs to move beyond basic information sharing and make them a popular media for sharing opinions. In this study, we examine the persuasiveness of micro-blogs by developing a framework that first identifies opinion leaders and then analyzes their persuasiveness. To develop the framework, we download micro-blogs, blogger information and the relationships among them into a database, identify spammers, decompose communities into sub-nets, identify opinion leaders and conduct persuasiveness analyses. The results show the framework can identify opinion leaders and their opinions effectively. It was found that negative opinions are less persuasive than positive opinions, and positive opinion leaders are more aggressive in distributing positive messages than negative opinion leaders are in distributing negative messages.

1. Introduction

Micro-blogs have gained tremendous popularity since their introduction in 2005, with the number of registered users growing exponentially. Twitter.com is the most successful example of a micro-blogging application. According to Twitter Counter, at 10:40 on July 9, 2011, the three most popular Twitter communities were Lady Gaga, Justin Bieber and President Barack Obama. On that date, those communities had 11,496,577, 10,888,22,1 and 9,042,215 followers (readers), respectively. Six months later, at 17:37 on February 26, 2012, the three most popular communities were Lady Gaga, Justin Bieber and Katy Perry with 19,656,282, 17,762,720 and 15,462,239 followers, respectively. On that same date, President Barack Obama had 12,702,110 followers and was ranked eighth. A micro-blog platform helped Lady Gaga to reach 19,656,282 followers by February 26, 2012, not counting 'retweets', which re-direct information to other communities. These figures suggest that the influence of today's media has unlimited potential. Another notable example is how young NBA star, Jeremy Lin, was recently promoted. Lin was essentially unknown, but within two months became extremely popular, to the extent that Time magazine identified him as one of the world's most influential people in 2012. In addition, Madison Square Garden, which owns the New York Knicks franchise, saw its stock jump 7%, which translates into $170 million to the company's market cap (www.forbes.com). During Lin's promotion, Twitter proved such an effective media tool that "Linsanity" was tweeted 47,083 times during a Lakers game.

Many companies have noticed that viral marketing, such as word-of-mouth (WoM) marketing and social networking, is an advantageous strategy for distributing information and attracting clients [41]. WoM marketing is effective because it is not directly linked to the merchant. In the context of a social network, WoM marketing is even more appealing, because credibility can be easily and powerfully established within a trusted community. For example, CNN Breaking News, *The New York Times* and many other established entities use Twitter to build followings. Dell has posted coupons on Twitter, and uses the platform to communicate directly with customers by collecting feedback and responding to complaints [33]. Comcast has also designated an employee to deal with service complaints expressed on social networks [42].

When a social network becomes an effective media outlet through which to communicate with clients, one must then ask how companies can use this new platform to maximize their influence on their clients. It is useful for companies to identify ways of distributing both positive and negative news persuasively using the new platform. A company must first identify the opinion leader, his/her opinions and the extent of his/her influence within the community. An opinion leader is able to influence the attitudes and/or behavior of others in a desired way [48]. In a social network, an opinion leader may be either an opinion initiator or a reviewer. He/she normally expresses strong opinions that are motivated by the desire for self-enhancement, the enjoyment gained from helping others, economic rewards, or other factors [49]. The social network becomes a recommendation system that aggregates and distributes opinions to its participants. Opinion leaders are central to the relationships within groups and networks, as well as to discussions of matters

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of general interest [32]. The extent of their centrality and prestige may indicate their influence on these relationships and discussions [50].

From a technical perspective, this study treats a social network as a simple connected graph and identifies the initial node that distributes information to the maximum number of nodes. This involves (1) evaluating a node's contribution (a micro-blogger in the focused social network) to other nodes (other micro-bloggers in the community); (2) identifying the preferences and attitudes of the most influential node (the opinion leader in the micro-blog community); and (3) appraising the opinion leader's influence (persuasiveness analysis).

There are many types of platforms with different properties within a social network. For example, weblogs are effective for sharing information whereas micro-blogs are useful for gaining influence, i.e., convincing others to accept opinions. This study proposes a framework to identify opinion leaders and analyze their influence. We identify the influence of opinion leaders in a directed social network, specifically through micro-blogs. To identify opinion leaders, we first decompose a social network into sub-nets and then use the bloggers' properties, affiliations with and standings in certain communities for identification purposes. We then analyze the persuasiveness of positive and negative messages according to the different attitudes of opinion leaders.

The remainder of this paper is organized as follows. Section 2 reviews related works on micro-blogs. Section 3 presents the methodology and Section 4 provides the demonstration. Section 5 presents the discussion and concludes the study.

2. Related works

In the age of Web 2.0, social media has drawn a significant amount of attention, with micro-blogs generating particular interest among the various networking platforms. Micro-blogs, unlike weblogs, specialize in minimal content [11,21]. For example, a Twitter post is limited to 140 characters. Accordingly, micro-bloggers and their followers normally use mobile devices, such as phones and PDAs, to input and access information. In this way, opinions are not limited by time or space and those disseminating the information can broadcast their opinions anywhere and at any time.

2.1. The related literature of micro-blogs

Currently, there are two major research directions related to the study of micro-blogs. The first focuses on the information content. For example, Naaman et al. [35] and Boyd et al. [4] noted that the most common micro-blog posts are related to the blogger's personal status ("me, now"), including statements, random thoughts, opinions/complaints and information sharing. It has also been noted that bloggers who continuously release excess information about their lives might subconsciously do so to appear more important [40]. Hughes and Palen [19] analyzed the characteristics of users who adopt micro-blogs in various scenarios and Ehrlich and Shami [9] studied the different uses of micro-blogs in the workplace. Morris et al. [34] compared user preferences in the adoption of micro-blogs rather than alternative media tools to acquire information, whereas Krishnamurthy et al. [27] explored the time factor related to geographical distribution using micro-blogs. Letierce et al. [31] and Honeycutt and Herring [17] analyzed the use of special emotion expressions in micro-blogs.

Micro-blogs have become a new, reliable platform from which information seekers can acquire useful content and information providers can release profit-making messages [22]. For example, O'Connor et al. [39] found that the collected public opinion expressed through tweets is close to actual public political opinion. In another interesting observation, the use of three months of tweets about a movie provided a highly accurate prediction of the film's box-office revenues [1]. Interestingly, in unexpected crisis situations such as the Southern California wildfire in 2007, Hurricanes Gustav and Ike in 2008 and the flooding of the Red River Valley in 2009, Twitter became a back-channel media tool that provided more accurate information than its mainstream counterparts [45,46]. The timely nature of micro-blogs can give the information they disseminate higher value, such as in reporting earthquakes [43].

Micro-blog discussions can also assist in the collection of media responses, which can be very useful in situations such as presidential debates [7,44]. Jansen et al. [20] found that 20% of micro-bloggers evaluate actual products or brands (50% positive and 33% negative). One study noted that a negative micro-blog would cost a company 30 customers [11].

The second research direction is from the social network perspective. A study of the differences between micro-blogs and human social networks found significant deviation in the non-power-law follower distribution, the diameter length and the level of reciprocity [28]. Studies have shown that a completely different network topology is established in micro-blogs [51]. For instance, the nodes (users) within a network are associated by keywords or topics. The links (relationships) between nodes represent information sharing. Although a link between nodes establishes a follower–followee relationship, it cannot guarantee a direct relationship unless at least two posts have been issued [18]. Some network properties, such as scale-free [21] and long-tailed [30] networks, have also been studied. Yardi and Boyd [52] found that micro-blog networks could be decomposed into sub-nets with clear geographical connections.

Research on micro-blog networking is still at an early stage, and although some studies have reported interesting findings, a great deal remains to be explored. For example, the integration of two key research directions may enable researchers to explore relevant problem domains, such as the relative levels of influence of users in social network. In brief, proponents of the first research direction address information, preferences, political standing, geographical distribution and many other aspects with reference to individuals, whereas the second research approach involves examining community-based factors. In this study, we seek to determine how individuals, specifically opinion leaders, exert their influence over a social network, specifically in the form of micro-blogs.

2.2. Influence maximization

Influence maximization is the process of identifying the nodes within a social network that can be used to maximize the distribution of influence [6,8]. One approach is to analyze the importance of nodes with higher influence by acquiring factors such as the degree, closeness and betweenness centralities of the nodes. Kiss and Bichler [26] compared the influence of different centralities on nodes and discovered that out-degree centrality is a simple and effective way to identify highly persuasive nodes. Java et al. [21] and Letierce et al. [31] found that some micro-blog nodes have the properties of the types of higher hubs and authorities typically seen on web pages. Kwak et al. [28] adopted the PageRank algorithm to rank the tweets and retweets on Twitter and found that they ranked very differently. Gayo-Avello [15] compared HITS, PageRank and other algorithms and determined that spammers do actually distort analysis results. Westerman et al. [51] also suggested that spammers be removed before analyzing the importance of network nodes. In our previous work, we also suggested criteria for evaluating the importance of weblogs in social networking [32].

An alternate research direction focuses on information dissemination [37]. For example, Kempe et al. [23] applied a heuristic greedy algorithm using the nodes' degrees and centrality to analyze two diffusion models: a linear threshold model and an independent cascade model. Similar work was conducted by Chen et al. [36] and Kimura et al. [24], who modified the Kempe et al. [23] approach to improve computational efficiency. Galstyan et al. [14] analyzed the information dissemination in two different network structures, bi-community Erdos–Renyi graphs and scale-free graphs, and found that both the structural properties of the networks and their community structures had important