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Employing a data mining approach for identification of mobile opinion leaders and their content usage patterns in large telecommunications datasets

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ABSTRACT

Recent technological advances in communication infrastructure, especially those in the realm of mobile services, have drastically impacted how people interact socially. The more ubiquitous and convenient mobile approach has steered away users from the traditional computer-mediated systems. As the mobile trend continues, understanding usage behavior patterns of its users becomes critical to harness the power of this new technology. One particular user group, opinion leaders deemed tremendously influential on the usage behavior of other users, is the main focus of this study. Existing literature on the mobile usage pattern of opinion leaders is limited to theoretical rather than empirical studies. This research attempts to bridge the gap. Drawing from one of the largest Taiwanese telecommunications databases, we try to identify mobile opinion leaders and further cluster their mobile usage patterns by mining the actual data. This study exploits a combination of techniques, including statistics, data mining, and pattern recognition, in our data analysis. Four main characteristics and seven usage patterns of mobile opinion leaders were identified. There are two main contributions of this work. The first contribution is the application of opinion leadership theories applied in the traditional marketplace into mobile services based on a big data system; the second offers a taxonomy to logically analyze each pattern of mobile content usage behavior gathered from mining the data to provide better planning blueprint for future mobile resource consumption.

1. Introduction

The mobile services industry is growing rapidly, and more people are now adopting new mobile Web services. According to the reports of the International Telecommunication Union (Sanou, 2015), there were > 7 billion mobile cellular subscriptions worldwide in 2015, up from < 1 billion in 2000. Globally, 3.2 billion people are using the Internet and 2 billion of these users are from the developing countries. Further, a huge amount of data is increasingly being placed at the forefront of this communication due to the explosion of data coming from a wide array of technologies and greater/explosive Web content consumption (Chen, 2016; Garth, 2014). As the evolution of the mobile services industry proceeds even further, more value can be extracted by understanding the usage patterns of individual consumers or specific groups.

Studying specific groups and their influence from this gigantic and complex database, particular mobile Web services, is an important topic that has attracted the attention of a variety of marketing researchers.

Traditionally, people seek the opinion and advice of their peers regarding various decisions they make. This behavior gives rise to a certain set of individuals in social networks, referred to by many as opinion leaders (Sharara et al., 2011). Considering the importance of these specific people or groups in social networks, previous studies have shown they have various titles (e.g., opinion leaders, key players and influential people; to be consistent, we suggest calling them as “opinion leaders”). In this paper, we use that term to refer to any influential group in the traditional social networks (Momtaz et al., 2011). From a marketer perspective, the early work that targeted women's clothing fashion opinion leaders in media planning by Eric Vernet (2004) concluded that “the media planner can benefit from choosing opinion leaders as a specific media target because this will indirectly secure a free audience and can boost the impact of the advertising message” (p. 105). In this regard, opinion leaders potentially spread their messages through word-of-mouth to affect other users' behavior.

Today, mobile services not only include voice and text messaging, but also provide computer-like applications, such as document viewers,

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Internet browsing, and multimedia for consumers to use and communicate with other users. In addition, social changes have been unprecedentedly quick, and individual communications with others has become more frequent through the use of the mobile social networks (Turkle, 2015). Those mobile user patterns are more complex than those of the previous computer-mediated systems. In this way, the exponential growth of mobile Web services provides opinion leaders with a wide range of social influence.

Meanwhile, marketers have always tried to develop communication strategies to meet the accuracy needs of mobile Web service content among the opinion leaders who informally influence the attitudes or behavior of other common people through product- or service-related conversation, referred to as “electronic word-of-mouth” communication. The study by Lu, Tseng, and Yu (2011) further suggested that mining usage patterns can help the discovery of specific (sub)groups, then used in applications like targeted specific favorite advertising and/or personalization of content. Presumptively, mining Web content usage patterns can analyze the most suitable information to offer and serve as content preference mechanism to meet the needs of opinion leaders based on their actual mobile behavior (Lu and Tseng, 2009).

Surprisingly, little empirical research has yet investigated how mobile opinion leaders actually use Web content drawn from an amount of data analytics to further build up their usage patterns from data mining. Much of the contemporary writing on opinion leaders' usage patterns of Web content consumption is theoretical rather than being empirically informed. Therefore, there is a need to move beyond the more generalized discussions on the characteristics of mobile opinion leaders and their usage patterns for Web content consumption in a specific developing country (e.g., Taiwan, holding one of the world-leading positions in technology and innovation, according to the Ministry of Economic Affairs' reports in 2016) to look for rich empirical detail in the complex ways in which new technologies are being used in real ways and in the real world (Graham, 2004). Particularly, three main telecommunications entities in Taiwan hold a majority of the market shares, namely Chunghwa Telecom (35.4%), Taiwan Mobile (28.8%), FarEastone (28.6%) and others (7.3%) according to the 2015 shareholders' meeting and report on FarEastone (2015). The data for this current study comes from one of these three telecommunication companies. One-third of all telecommunication usage market shares are in Taiwan, and they may provide phenomena to use and identify mobile opinion leaders and their Web content usage patterns. Based on the foregoing logic and suggestions, this study draws from one of the largest Taiwanese telecommunications databases to identify mobile opinion leaders and further cluster their Web content usage patterns by mining actual usage data.

The remainder of this paper is organized into five sections. First, the theoretical background of traditional opinion leadership characteristics discussion for identifying and examining hypotheses in mobile service data and mining user behavior patterns in mobile Web environments is described. Following that theoretical background, the research methods are explained. The final three sections discuss the results of the data analysis, the conclusions, and the managerial implications of the findings for theory and practice, as well as limitations and future research.

2. Theoretical background

2.1. Opinion leadership characteristics

Lazarsfeld et al. (1944) were the initial scholars who found that public communication does not directly flow to the mass, but is interpreted first by opinion leaders and then delivered to the common people. The process was elaborated by Katz and Lazarsfeld (1955) and Katz (1957): the mass medium → the opinion leaders → the common people. That is the so-named “two-step flow of communication”. The main contributions of this theory are that (1) Information can be transferred not only by medium, but also by an interpersonal

communication social network; (2) There is an interface between that medium and the interpersonal communication social network. More importantly, the interface is the opinion leader; (3) The influences of opinion leaders and interpersonal communication social networks on information communication and individuals' decisions are far larger than that of any typical mass medium (Zhang and Dong, 2008).

Before making decisions, consumers often seek to reinforce their opinions through gaining consensual validation from certain others. Among these certain others are consumers who can exert an unequal amount of influence on the decisions of others; they are ‘opinion leaders’ (Rogers and Cartano, 1962). Opinion leadership refers to “the degree to which an individual is able to influence other individuals' attitudes or behavior informally in a desired way with relative frequency” (Rogers, 2003, p. 271). In this light, opinion leaders are those consumers who influence the motivations, attitudes, opinions, beliefs and behaviors of others (Valente and Pumpuang, 2007). Although their influence is informal, opinion leaders do play an important role in the information acquisition of the consumer decision-making process and consequently can influence the outcomes of many marketing strategies (Assael, 1992). Indeed, Berkman and Gilson (1986) suggested that consumers believe the information they receive from communication with domain-specific opinion leaders to be more credible than that they receive from advertising messages.

While several theoretical frameworks for the characteristics of opinion leaders (Goldsmith and Flynn, 1994; Rogers, 2003; Weimann et al., 2007) have been proposed in traditional markets, Rogers (2003, p.316–318) has remained a popular theoretical model. According to his framework, the six generalizable characteristics of opinion leaders are: (1) have greater exposure to mass media; (2) are more cosmopolitan; (3) have greater contact with change agents; (4) have greater social participation; (5) enjoy a higher socioeconomic status; and (6) are more innovative. However, the work done on identifying opinion leaders by Chen and Weng (2015) proposed that current researchers have begun to notice new technologies and areas (e.g., mobile Web services) that have been largely ignored in the past.

With the expansion of mobile services, their work examined and suggested four main characteristics of opinion leaders that need to be considered to identify them from the mobile service data. In this study, the task of determining characteristics for identifying mobile opinion leaders utilized the work of Chen and Weng (2015), mainly including enduring involvement, exploratory behavior, innovation, and mobile competence. Following the descriptions given each characteristic in terms of appropriateness from a theoretical perspective, these four characteristics were used to identify and examine the hypotheses regarding mobile opinion leaders as drawn from the telecommunications database.

2.1.1. Enduring involvement

Involvement is the interest, enthusiasm, and excitement that consumers feel for specific product/service categories, and it reflects the personal relevance of these categories. Given its widely accepted theoretical framework, consumer involvement can be distinguished between enduring involvement as an individual attribute and situational involvement related to a specific behavior (Bergadaa and Faure, 1995). According to these concepts, enduring involvement emphasizes long-term attachments rather than transitory situational feelings or states (Jang and Lee, 2000). Prior studies have suggested that enduring product/service involvement is one of the major underlying motives of opinion leaders, whereas situational involvement bears no relationship to opinion leadership (Richins and Root-Shaffer, 1988; Venkatraman, 1990).

Consumers with enduring involvement will demonstrate an interest and familiarity with a product/service over time (Valente and Pumpuang, 2007). Consumers will maintain perceptual vigilance for information concerning products/services with high enduring importance and maintain a strong and continuing interest in that product/

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