Ontology-based data mining approach implemented for sport marketing

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ABSTRACT

Since sport marketing is a commercial activity, precise customer and marketing segmentation must be investigated frequently and it would help to know the sport market after a specific customer profile, segmentation, or pattern come with marketing activities has found. Such knowledge would not only help sport firms, but would also contribute to the broader field of sport customer behavior and marketing. This paper proposes using the Apriori algorithm of association rules, and clustering analysis based on an ontology-based data mining approach, for mining customer knowledge from the database. Knowledge extracted from data mining results is illustrated as knowledge patterns, rules, and maps in order to propose suggestions and solutions to the case firm, Taiwan Adidas, for possible product promotion and sport marketing.

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1. Introduction

Sport marketing involves all activities that purport to satisfy the demand and desire of sport customers through the procedure of exchange (Mullin, Hardy, & Sutton, 1993). Owing to increased advertising, media broadcasting, promotion and endorsements, organized sport is no longer only a sport but a business as well. Sport marketing is the most obvious form of commercialization in sport and yet sport events and marketing patterns have attracted comparatively little academic attention (Polley, 1998). Although sport marketing research has been carried out on areas such as sport tourism (Funk & Bruun, 2007; Morgan, 2007; Kim & Chalip, 2004), sport Internet marketing (Beech, Chadwick, & Tapp, 2000), sport event sponsorship (Mason & Cochetel, 2006), and hedonic consumption (Hightower, Michael, & Thomas, 2002), however; a few research has been found on the specific segmentation of customer profile of sport products, events, and endorsers with media broadcasting for possible sport marketing. Since sport marketing is a commercial activity, precise customer and marketing segmentation must be investigated frequently and it would help to know the sport market after a specific customer profile, segmentation, or pattern come with marketing activities has found. Such knowledge would not only help sport firms, but would also contribute to the broader field of sport customer behavior and marketing.

On the other hand, ontology was first developed in Artificial Intelligence (AI) to facilitate knowledge sharing and reuse, and had gained wide popularity in the early 1990s in several field applications, such as knowledge engineering, natural language processing, and knowledge representation. Since then, its popularity

has extended to more and more research fields. Nowadays, ontology is also a popular research topic in knowledge management, cooperative information systems, electronic commerce, information retrieval, intelligent information integration and medicine, among others (Corcho, Lopez, & Perez, 2003; Davies & Fensel, 2003; Fensel, 2001). The term ontology in philosophy refers to the theory about the nature of existence, while in computer science; it is a term referring to all the core concepts, including their terms, attributes, values, and relationships that belong to a specified knowledge domain. Ontology has become increasingly popular because it promises a shared and common understanding of knowledge domains that can be communicated between people and application systems. This article investigates the potential contextual relationships between customers, purchase behavior, sport events, and marketing activities using ontology. To achieve such, this study designs the questionnaire and constructs a data base for further data mining.

In addition, as an enterprise asset, the customer occupies an important position. Most of the parties involved in marketing such as customer profile, advertising, media broadcasting, promotion, and endorsements are aware of the importance and need for marketers to acquire and share better knowledge of their customers. However, this is easier said than done since customer knowledge is concealed in customers. It is available but difficult to access, and there is little possibility to explore the full volume of data that should be collected for its potential value. Thus, how to effectively process and use data is becoming increasingly important. This calls for new techniques to help analyze, understand or even visualize the huge amounts of stored data gathered from business and scientific applications (Liao et al., 2004). Among the new techniques developed, data mining is the process of discovering significant knowledge, such as patterns, associations, changes, anomalies

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and significant structures from large amounts of data stored in databases, data warehouses, or other information repositories (Keim, Pansea, Sipsa, & Northb, 2004; Liao, Chen, & Wu, 2008). In the literature, there are many data mining models such as classification, estimation, predictive modeling, clustering/segmentation, affinity grouping or association rules, description and visualization, as well as sequential modeling. Similarly, there are also many application methods, including association rule, sequential pattern, grouping analysis, classification analysis and probability heuristic analysis (Anita & Dirk, 2005; Arie & Sterling, 2006; Goodwin, Dyne, Lin, & Talbert, 2003; Liao, 2005; Liao, Hsieh, & Huang, 2008; Mehta & Bhattacharyya, 2004; Musaev, 2004). Knowledge of customers extracted through data mining can be integrated with customer profile, sport events, and marketing knowledge from research and then provided to sport firms.

Accordingly, this paper investigates the following research issues on sport marketing of Adidas in Taiwan. They are (1) generating an sport ontology about sports products, consumers, the case firm – Adidas in Taiwan, advertising media, and endorsers; and at the same time, constructing a relational database and design a questionnaire according to this ontology, (2) collecting information using questionnaire to construct a physical database for recording consumer basic data, consumer behavior, media preference, brand awareness and endorser data, (3) implementing ontology-based data mining approach to acquire customer information, and (4) investigating possible customer profile and marketing segmentation using association rules and cluster analysis, and (5) understanding customer knowledge and making useful suggestions for sport marketing of the case firm. The rest of this paper is organized as follows. In Section 2, we present the background of the case firm – Taiwan Adidas. Section 3 describes the methodology, including research framework, ontology design and development, sport marketing ontology, system architecture, database design, questionnaire design and collection, association rules and cluster analysis, and data mining tool – SPSS Clementine. Section 4 illustrates the initial analysis results. Section 5 presents the marketing strategy analysis, including associations of different customer clusters. Section 6 discusses research findings, including knowledge map for sport marketing, marketing map for media and endorser, and possible marketing patterns. Finally, Section 7 contains a brief conclusion.

2. Case firm – Adidas in Taiwan

Taiwan Adidas comprises three departments: Product Department, Sales Team, and Marketing Department.

2.1. Adidas Product Department

Adidas Sport Performance Division: Though focusing on the performance of product, it does not ignore the appeal in design in order to attract customers to buy products, such as basketball-related products, tennis-related products and soccer-related products, regardless whether the customers are players or audience. In 2007, shoes accounted for 55% of the total volume of sales while clothing accounted for the remaining 45%.

Adidas Sport Heritage Division: It aims to extend Adidas's unique and pure tradition to fashion market, including Adidas Originals line division. As for Originals line, old products without exercise-related function are launched again; therefore, the price of Originals is higher than all other Adidas products. In 2007, shoes accounted for 70% of the total volume of sales while clothing accounted for the remaining 30%.

Adidas Sport Style Division: Quality goods including sports shoes for male and female, garments and accessories were designed by Yohji Yamamoto. It is the future of sports clothing. The trademark of "Adidas Sport Style" was created in 2001, inspired by the rapidly changing world we live in – a fundamental concept of the entire "Sport Style Division".

2.2. Adidas Sales Team

First, direct retail outlets account for 30% of all stores in 2007. In addition, direct retail outlets are those selling Adidas products only, which can be also called Adidas specialty stores. For instance, each department store has an Adidas counter.

Second, distribution stores account for 70% of all stores in 2007. Distribution stores are those selling various brands of sports products; with Adidas being one of the many brands in the general sports stores.

2.3. Adidas Marketing Department

This department comprises the following three divisions: (1) Public Relation Division which is responsible for media, channel, magazine and catalogue, (2) Promotion Division which is in charge of the promotion campaign, and (3) Sport Marketing Division which looks for possible endorsers at home and abroad.

Within its brand portfolio, Taiwan Adidas primarily pursues two strategic options. One is market penetration – gaining market share across all markets in which it competes, and the other is market development – expanding into new markets and addressing new consumer segments. Accordingly, in 2007, Taiwan Adidas started to figure out how to understand the preference and behavior of Taiwanese customers on sport events, media selection, and celebrities as potential endorsers in order to initiate possible sport marketing activities.

3. Methodology

3.1. Research framework

Owing to limited access to Adidas' internal database that stores information of consumers and product sales record, the research began with understanding consumer behavior and preference for media selection and endorsers to construct a relational database. Fig. 1 shows the research framework. The first step involves collecting five sorts of information about consumers including individual information, consumer behavior in purchase of sports products, media contacted, brand awareness of sports products and sports product endorsers. According to the collected information, a database system is built to effectively store, update and gather consumer and product data, by means of affinity grouping and clustering to further mine knowledge rule of consumer preference.

3.2. Ontology design and development

There are many different tools available for ontology design. In this study, Protégé (2000) developed by Stanford Medical Informatics, was chosen as the ontology design tool. Protégé (2000) is an open-source, java-based ontology tool with a pleasant editing environment containing several third-party plug-ins. Protégé implements a rich set of knowledge-modeling structures and actions that support the creation, visualization, and manipulation of ontologies. It allows users to easily construct domain ontologies by entering data and storing them in formats like XML, RDF, or OWL.