

Mining product maps for new product development

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Abstract

Many enterprises have been devoting a significant portion of their budget to new product development (NPD) in order to distinguish their products from those of their competitors, and to make them better fit the needs and wants of customers. Hence, businesses should develop products that fulfill the customer demands, since this will increase the enterprise's competitiveness and it is an essential criterion to earning higher loyalties and profits. This paper presents the product map obtained from data mining results, which investigates the relationships among customer demands, product characteristics, and transaction records, using the Apriori algorithm as a methodology of association rules for data mining. The product map shows that different knowledge patterns and rules can be extracted from customers to develop new cosmetic products and possible marketing solutions. Accordingly, this paper suggests that the cosmetics industry should extract customer knowledge from the demand side and use this as a knowledge resource on its supply chain for new product development.

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1. Introduction

It is well understood that new product development (NPD) is critical for long-term firm performance and competitive advantages. However, it is difficult to anticipate what certain customers will value and when changes in those preferences will emerge. A failure to anticipate these changes can force suppliers into a reactionary mode, where success is determined by how quickly one can respond to new desires as they emerge. Because new products take a substantial time to develop, suppliers should anticipate changes in what customers will value as early as possible (Flint, 2002). Therefore, a strong market orientation and customer knowledge competence are vital to the success of new products (Bonner, 2005). Most of the businesses involved in the production chain such as the manufacturers, suppliers and retailers are aware of the importance

and need for enterprises to acquire and share better knowledge of their customers. But this is easier said than done since customers' preferences are concealed in the customers. It is available but not easily accessible, and there is little possibility to explore the full volume of data that should be collected for its potential value. Inefficient utilization can render the data collected useless, causing databases to become 'data dumps' (Keim, Pansea, Sipsa, & Northb, 2004). Therefore, how to effectively process and use customer 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 & Chen, 2004). Among the new techniques developed, data mining is the process of discovering significant knowledge, such as patterns, associations, changes, anomalies and significant structures, from large amounts of data stored in databases, data warehouses, or other information repositories (Hui & Jha, 2000; Keim et al., 2004). In addition, there are many data mining models in the literature such as classification, estimation, predictive modeling, clustering/segmentation,

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affinity grouping or association rules, description and visualization, as well as sequential modeling. Similarly, there are also many application methods, including association rules, sequential patterns, grouping analysis, classification analysis and probability heuristic analysis (Fan, Lu, Madnick, & Cheung, 2002; Hui & Jha, 2000; Goodwin, Dyne, Lin, & Talbert, 2003; Mehta & Bhattacharyya, 2004; Musaev, 2004; Tsechansky, Pliskin, Rabinowitz, & Porath, 1999). Knowledge of customers extracted through data mining can be integrated with product and marketing knowledge from research and then provided to both upstream suppliers and downstream retailers. Thus it can serve as an important approach for new product development. When effectively utilized, such knowledge extraction can enable enterprises to gain a competitive edge through production of customer-oriented goods that provide better satisfaction to consumers and by speeding up the product development process (Menon & Tong, 2005; Shaw, Subramaniam, & Tan, 2001).

Map display is a powerful tool with the ability to convey a large amount of information in a limited space, and it also provides an interactive tool to allow the user to interact with the underlying information (Lin, 1997). Thus, the mapping approach, which focuses on the use of IT, can be used as a tool to support new product development. Holmlund and Strandvik (1999) proposed perception configuration as a new concept, and introduced configuration maps as tools for analyzing perceptions in business relationship studies. Tülin and Russell (1998) presented market maps with a probabilistic spatial panel data model that allows the positions of products sharing the same name to be correlated across product categories. In a business setting, the combination of perceptions by two parties (such as buyers and sellers) can be represented as a perception configuration. All the perceptions are depicted on the horizontal and vertical axes of the map. This map can be used to capture both the composition and the dynamics of perception configurations, and it is generically applicable to dyadic perception studies. Daniel, Wilson, and McDonald (2003) utilized a marketing map to represent the best practice in marketing and also used the process map to understand how IT can be deployed in order to support a marketing information system. The map mainly illustrates the links between various stages of the marketing process. Based on this idea, this research implements a product map to illustrate that new product development is essentially the function that matches the enterprise's offers to customers' demands.

This paper investigates the following research issues in the development of new cosmetic products: What exactly are the customers' "needs" and "wants" for cosmetic products? Can product design and planning for product lines/product collection be integrated with the knowledge of customers? Can the knowledge of customers be transformed into knowledge assets of the enterprises during the stage of new product development (NPD)? To investigate these

research issues, the Apriori algorithm is a methodology of association rules for data mining, which is implemented to mine customer knowledge. Knowledge extracted from data mining results is illustrated as knowledge patterns and rules on a product map in order to propose possible suggestions and solutions for NPD and marketing. The rest of this paper is organized as follows. In Section 2, we present research design, which discusses research problems and introduces the proposed data mining system, including system framework, relational database design, and physical database design. Section 3 presents the data mining process, including the Apriori algorithm, and the knowledge extraction process. Section 4 illustrates results analysis and a product map for NPD. Discussions and future works are presented in Section 5; and Section 6 presents a brief conclusion.

2. Research design

2.1. Research problems

Firstly, as the perfume, cosmetic, and toiletry preparations industry entered the 1990s, it faced many challenges including regulatory changes, product safety concerns, calls for scientific data to document product claims, increasing environmentalism, desire for natural ingredients, pressure from the growing animal rights movement, as well as economy and market channels for product distribution (Kumar, 2005). Lawmakers in USA began investigating possible revisions to the traditional 'drug' and 'cosmetic' definitions established under the Food, Drug and Cosmetic Act. Since the distinction between cosmetics and drugs was sometimes vague. According to FDA guidelines (FDA, 2001), the term 'cosmetic' means (1) articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body or any part thereof for cleansing, beautifying, promoting attractiveness, or altering the appearance, and (2) articles intended for use as a component of any such articles; except that such term shall not include soap. However, the products claiming to offer medical benefits or physiological effects were called over-the-counter (OTC) drugs. Examples of the latter included antiperspirants, sunscreen products, hair care products, shampoos to cure or remove dandruff, etc. Therefore, cosmetics product development is not only concerned with market reasons but also with safety concerns (Katušin-Razem, Mihaljevic, & Razem, 2003; Morohoshi et al., 2005; Pauwels & Rogiers, 2004). Secondly, cosmetic products are a kind of biomedical and truly personal product, which is popular with both woman and man on different age scales (Chang & Chang, 2003). Therefore, cosmetic products contain diversified product lines and collections in order to fit the needs and wants to specific customer segments. This means that customer-orientation is the main concern for investigating market segmentation according to customers' attributes, preferences, and personal factors. Thus, customers' needs and wants are important resource

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