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Mining affective experience for a kansei design study on a recliner

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ABSTRACT

As the technical performance of products progresses, it is becoming more important to design products that satisfy customers' affective experiences. Hence, many studies about Kansei engineering or Kansei design have been conducted to develop products that can satisfy customers' affective experiences. In the Kansei design method, it is important to select affective variables related to the design elements of the product in order to accurately grasp the emotions of customers. Therefore, this study seeks to develop an affective variable extraction methodology that can reflect users' implicit needs effectively and efficiently. In this study, users' affective variables were extracted from online reviews and classified using a self-organizing map (SOM). For verification, the study selected the Amazon e-commerce service and performed a product experiment on recliners. The experimental results show that the most frequently used affective variable in the use of recliners is 'comfort', which is related to various affective variables. In addition, 15 clusters for affective experiences of recliners extracted from Amazon.com were classified through the SOM. The findings suggest that text mining techniques and the SOM can be used to gather and analyze customers' affective experiences effectively and efficiently. The results of this study can also enhance an understanding of customers' emotions regarding recliners.

1. Introduction

Due to technological advances in product development, engineers are finding it harder to achieve product differentiation in terms of performance, functional features, and price. Therefore, product development engineers and companies are focusing on developing products that satisfy their customers' affective needs, expressed as subjective and abstract concepts, such as aesthetics and preferences. In recent years, engineers have been performing a quantitative analysis of customers' affective needs known as 'Kansei engineering' (Dahlgaard et al., 2008; Nagamachi, 2002). Since the concept of Kansei engineering was introduced, its methodologies have been applied to various products, such as vehicles and mobile phones (Yang, 2011). Kansei design is the process of designing a product using the Kansei engineering methodology.

Kansei engineering has developed various methods for collecting affective vocabularies to measure customer emotions or product impressions (Henson et al., 2006). Literature reviews and interviews are among the most commonly used techniques. However, collecting customer emotions in this way may pose some problems. First, bias may occur in the affective adjectives because of subjectivity, gender, or cultural differences among the interviewees. For example, Kuwano et al. (2007) have found that Japanese and Germans differ in their emotional evaluations of car sounds. Thus, even if the product attributes are the same, there may be differences in the affective variables people express according to cultural differences. There may also be individual differences in the kinds of words people use to express a particular affective attribute (Montefinese et al., 2014). Second, when performed based on selected affective adjectives, an experimental evaluation generally has a small number of test subjects due to the nature of the test. This makes it difficult to obtain a comprehensive grasp of the results obtained from various age and race groups and to generalize affective models based on the test results, leaving open the possibility of bias based on operator intentions.

Text mining techniques can solve these problems. Since people express their experiences with products on the web, share their experiences with others, and acquire information about products (Hennig Thurau et al., 2004), web-based text mining has advantages over conventional methods of obtaining affective adjectives, such as literature reviews or expert interviews. For instance, it can identify words used by end-users at first hand. This ensures that words selected for the evaluation of emotions do not cause any semantic confusion to end-users

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and that such words are easily understood, which in turn facilitates the evaluation test. In addition, it can efficiently gather opinions from a wide range of end-users and obtain vocabularies that are more complete in their meaning and that can be collected faster than is possible via emotional word-collection through interviews. Thus, the collected vocabularies and the vast amount of data involved could remedy the bias present in the conventional methods.

Most of the studies to understand the affective experience of users by applying the methodology of text mining are focused on the user's preference when using a specific product or service. These researches are those that perform frequency analysis to find the most frequently used affective vocabulary in the review, or to find an algorithm that improves the classification accuracy of a product's rating. However, affective experiences of users for a specific product vary widely, and it is important in Kansei engineering to understand the relationship between affective experiences that occur when using a product.

Therefore, we propose a method of selecting affective variables for a Kansei design. We identify end-users' affective experiences by collecting and analyzing online reviews using text-mining techniques and clustering analysis, including a self-organizing map (SOM). The target product of our case study is a recliner, and online product reviews is obtained from Amazon.com.

The remainder of this paper is organized as follows. Chapter 2 reviews the research related to this study. Chapter 3 describes the study's data collection and research methods, and Chapter 4 presents the results of the experiments. Chapter 5 discusses the results of the study. Finally, Chapter 6 concludes the paper.

2. Related studies

2.1. Kansei engineering

We can define Kansei engineering by describing consumer emotions regarding a product in terms of design parameters (Nagamachi, 1995). The mission of Kansei engineering is to determine design parameters systematically based on sensory evaluations. In addition, it generally applies in the new product design process, with the aim of achieving lead-time reduction and establishing accurate guidelines for the future design process. Kansei engineering engages in various attempts to detect end-user emotions, as its main purpose is to identify and reflect them in product design, rather than focus on engineer-oriented product development.

The typical procedure of Kansei engineering is that proposed by Schütte (2005) and is schematized in Fig. 1 below. As the figure shows, Kansei engineering considers two aspects: semantic space and product/service properties after the domain is selected.

The procedure spans the semantic space in three steps: collecting Kansei words (affective variables or vocabularies), selecting Kansei words, and compiling data. In the traditional domain of Kansei engineering research, the most common methods of collecting affective variables for products are literature reviews and interviews (Schütte et al., 2004). A literature review is a method of extracting vocabulary related to the subject through published papers and reports. Because it collects vocabulary used in the research related to the object of study, it is highly reliable and can be used immediately without requiring a reconstitution of the data. However, the method has disadvantages; for example, it cannot find new vocabularies, and the amount of data can be limited. In addition, extracting affective vocabularies through a literature review is likely to miss the vocabulary used by people in everyday life. Thus, it can be difficult for participants to rate the affective variables due to the unfamiliar vocabularies in the questionnaires. Finally, it may be difficult to select the appropriate affective vocabulary for products lacking in research.

Focus group interviews (FGIs), a method of gathering information on a specific topic through dialogue among a group, is also used to collect affective variables. It can be used to collect vocabulary quickly

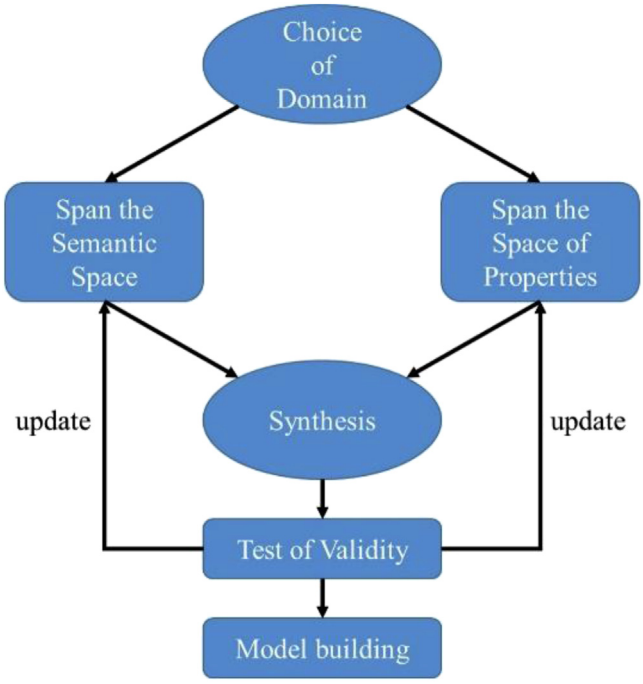

Fig. 1. Kansei engineering procedure.

at a low cost, as well as to grasp the ideas and opinions of a group deeply and precisely. However, since the number of subjects is limited in this method, its representativeness is insufficient, and the result can be influenced by the ability of the moderator.

The problems with the above methods can be resolved by mining external data (e.g. online commercial sites and social media) on the web. Online channels are provided collectively for community-based input, interaction, content-sharing, and collaboration (Kumar et al., 2015). Because people can express ordinary and immediate feelings online, research has been conducted to understand the implicit needs and natural feelings of users regarding various products through online reviews (Salehan and Kim, 2016).

2.2. Online customer reviews

We define online customer reviews (or electronic word-of-mouth, hereafter 'e-WOM') as product reviews posted on a company's website or third-party website (Rose et al., 2011). In addition to information on product-related inquiries, e-WOM also provides information relevant to product experiences, such as product quality, price, and overall ratings after product purchase (Hennig Thurau et al., 2004). Online retail markets, such as Amazon and eBay, are rapidly expanding (Chu et al., 2010). In the online retail market environment, customers are free to express their values and loyalties, and these reviews can affect other people's choices (Gruen et al., 2006). Therefore, online market-related managers strive to handle e-WOM effectively and efficiently. Much research has been done on e-WOM found on different commercial websites across a wide range of elements, such as products, movies, and services (Park and Kim, 2008; Litvin et al., 2008).

In the realm of product design, there is increasing interest in satisfying customer needs in terms of experiences and emotions. Numerous attempts have been made to identify the affective experiences of end-users from various perspectives based on online customer reviews. Several studies performed from the perspective of affective experience examine the effects of online reviews. Wang et al. (2010) examined the relationship between preference scores and affective vocabularies based on user reviews on an online hotel information site. Decker and Trusov (2010) developed a methodology for estimating