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Doctoral Dissertation

Development of Personalized Information Mining  
Techniques for Product Recommendation

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## Abstract

In recent years, products' sense or design have been as a very important part for marketing, in other words, customers choose the right merchandise usually depending on their feelings about it, so an efficient products recommendation system would increase the desire to buy. This research is applied in Japanese traditional crafts, named "Kutani-ware". As a Japanese traditional industry, there are many problems today, specifically, the scale of the industry has become smaller, and so as the employees of this industry. To revitalize this industry, the most important thing is to increase the sales, so an efficient recommendation system is urgent needed.

For the sense that from customers to the products, we can define many features to describe these products, and people can evaluate these features instead of evaluating the products. In this way, a complex and non-standard problem can be split into some easier problems. According to this, much Kansei data that can measure general feelings to the products is obtained; these data is treated as a database that can describe the products. With using some Kansei data analysis methods and computer technologies, an efficient recommendation system has been developed and more suitable products can be recommended to customers.

This research focuses on developing a new method to assist customers when they are making their purchasing, which will base on customer's sense or feelings to the products. People always make their purchasing depending on their feels to the products, so how to abstract their desires according to their sense is an important way in marketing, the existing methods always focus on selecting and scoring features about a product, and have not concerned the differences between different kinds of features (in this research, there are two kinds of features: Kansei features and context features), and for collecting evaluation data, the uncertainty from the existing methods when evaluators have to face to a huge number of samples also have not been concerned. So in this research, we have made a new kind of structure to console the two kinds of features, in order to make a better way to take the relationship into account, which exists in different kinds of features. And we have also proposed a new kind of method on collecting the evaluating data, which is divided the evaluation issues into some simple comparison issues. In the end of this research, we also made an evaluation between existing methods and the new method, from this way we could find which method is better and why it is, and also we could find some points to improve it.

The methods on collecting data and recommending products would be useful supplements of Kansei Engineering and Data Mining, which are the important parts of Knowledge Science. The new method on collecting data as general understanding, which is based on partial-comparison procedure, can be treated as a new aspect on Data Mining and Kansei Engineering. Especially, we have to face to a huge number of objects for evaluation. The ontological structure used for recommending products in this research is also a contribution of Kansei Engineering. With this special structure, the personal requirements of the consumer can be divided into several simple requirements, which can be easily measured.

For detail, the thesis focuses on the following points:

- Exploring of information personalization method.

The existing evaluation methods on collection the data of the general feelings of the product are mostly using the

semantic differential method, which is executed with M-point approach. By this kind of method, evaluators may feel confused when the quantity of the evaluation samples is big. This research proposed a new method on evaluation the samples, which is based on the comparison procedure. Specifically, we select some samples randomly for evaluators, and make a comparison (sub-ranking list) on each attribute by them. Then an integration method is proposed for integrating the sub-ranking list into an integral ranking list, which is treated as the evaluation Database for the following research. With the evaluation Database, a new target-oriented method on personalizing consumer's requirements is also proposed.

- Adjusting of the algorithm using ontological structure.

Ontological structure have been justified as an useful method in many fields, with this structure, a complex and disordered problem can be described as many simple entities, and the relationship between these entities could also be concerned. This research takes this structure into account, specifically, we separate customer's desire into some small and simple entities, so customer's desire can be described by these entities, this kind of structure also has another advantage, because of the simple entities, we can concern the relationship between entities, and also between the features easily.

- Design of the recommendation system.

In the end of this research, a recommendation system is developed, and a subjective evaluation test on the comparison of the methods is also executed. The whole system includes two parts: recommendation part and comparison part. Firstly, we use the comparison system to collect Kansei data and Context data as general understanding on the products; and with using the data, the recommendation system can recommend a ranking list for consumer according to their special tastes.

**Key word:** Partial Comparison Process, Kansei Engineering, Kansei Evaluation, Decision Making Analysis, Multi-Attribute Decision Making.