Estimation of Dominant Features of Commodities Based on Shopping Behavior Analysis

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Abstract. It is necessary to provide suitable assistance to each consumer in shopping to choose preferable commodities. Each consumer does shopping with checking dominant features of the commodities according to his own criteria [1]. For example, "I want a cloth of a good material", "I want a T-shirt in cool color", and so on. We have developed an experimental shopping space equipped with ubiquitous sensors such as cameras and RFID-tag readers. In our experiment, each subject freely walked around the shelves to find the preferable T-shirts. Our system observed typically the time of three actions, "Look at", "Touch" and "Take" a T-shirt. In this study, we have tried to estimate the dominant features with each consumer through suggest the approach to recommend information in consideration of personal dominant features from observation and analysis of shopping behavior to perform suitable assistance.

Keywords: Purchasing Behavior, Behavior Analysis, Dominant Features.

1 Introduction

In recent years, the choice to commodities of consumers spreads by the diversification of them in the store. However, it is the problem that consumers feel a burden to find them. So it is necessary that we provide the service that they don't feel a burden. There are shops that they are recommended information to show commodities on digital signage [1]. But it is thought that the consumers do shopping with dominant features [2]. For example, "I want good clothes of the material. I want T-shirt of cool color". The service by current digital signage cannot consider dominant features. In this study, we suggested the approach to recommend information in consideration of personal dominant features from purchasing behavior analysis.

2 Approach of Our Study

We focused on consumer's purchasing behavior to grasp their dominant features. We thought behaviors that are important for consumers are different each their dominant features. For example, the subject who has dominant features in colors compares

clothes. Thus, we supposed that an action of "Look at" became important for them. We explain our past study here. We have developed an experimental shopping space equipped with ubiquitous sensors such as cameras and RFID-tag readers as shown in Fig.1. In our experiment, each subject freely walked around the shelves to find the preferable T-shirts. Table 1 shows the definition of three actions. Our system observed typically the time of three actions, "Look at", "Touch" and "Take" a T-shirt. Thus, we adopted three action times and preferable rate, like and dislike, to the T-shirt as explanatory variables and a response variable, respectively, and have applied multiple regression analysis [3]. The multiple regression types are as follows.

$$y = \alpha\, Look + \beta\, Touch + \gamma\, Take + \varepsilon \qquad (1)$$

Therefore, we focused on regression coefficient in this study. We can expect that the difference in important action appeared as difference in regression coefficient. We grasp their dominant features to compare the regression coefficients of each group of consumer and all them.

Table 1. The definition of three actions

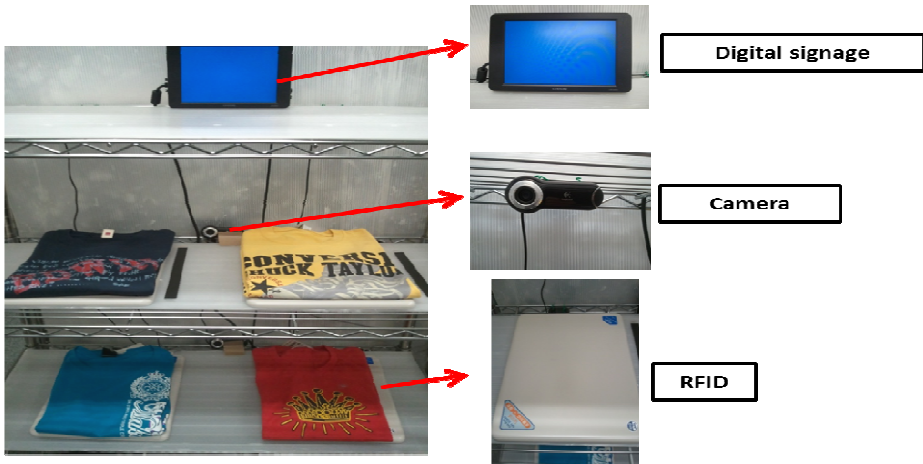| Action	Definition
Look at	Action that a subject looks at commodities.
Touch	Action that a subject touches commodities to check feel of a material.
Take	Action that a subject takes commodities.

Fig. 1. Experiment space

3   Our Experiment

Experimental procedure is as follows. We had subjects answer a paired comparison question about element of dominant features, and we assumed the first place the dominant features that they have. Table 2 shows element of dominant features.

Table 2. Element of dominant features

Colors	Patterns	Materials	Shapes	Price	Bland	Size

(1) In experiment space, we had 20 subjects choose the favorite clothes in 24 pieces of T-shirts from doing purchasing behavior.
(2) We had 20 subjects evaluate the degree of the interest for 24 pieces of T-shirts in total by five phases of evaluations.

4　　Analysis Method

Firstly, we assumed the subject with the same feelings the same group by a paired comparison. We adopted three action times and preferable rate, like and dislike, to the T-shirt as explanatory variables and a response variable, respectively, and have applied multiple regression analysis. We adopted that the grade of over 3 indicates interest of subjects about five phases of evaluations, and 1, 2 indicates not interest. We compared a difference of the size of the regression coefficient each dominant feature with size of the regression coefficient of all the subjects. And we grasped the behavior that is important for subjects each dominant features.

We evaluated the equation of regression each dominant feature. We substituted the behavior time by an experiment for the equation of regression of the group each dominant feature and the equation of regression of a subject. And we got the total of the absolute value of the difference of the value the equation of regression of the group each dominant feature and the value of the personal equation of regression that we substituted the behavior time. Therefore we estimated the value that the total was the smallest with the dominant feature that the subject had.

5　　Experimental Result

Table 3 shows the regression coefficient each dominant feature group.

Table 3. Regression Coefficient Each Dominant Feature Group

dominant features group	Intercept	Look at	Touch	Take
Colors	−0.0593	0.1198	−0.1066	0.0535
Patterns	0.1149	0.1181	0.1447	0.0003
Materials	0.0672	0.1084	0.247	0.0122
Shapes	0.0868	0.0826	0.0299	0.0496
All subjects	0.1013	0.1021	0.0712	0.0265

The group which had dominant feature in colors had high ratio of "Look at" and "Take". Next, the group which had dominant feature in patterns had high ratio of "Look at" and "Touch". The group which had dominant feature in materials had high ratio of "Touch". Finally, the group which had dominant feature in shapes had high

ratio of "Take". However, the group of price, brand and size were not different from the regression coefficient of all the subjects.

We estimated the dominant features of the subjects and evaluated whether the dominant features we estimated corresponded with dominant features they had. Table 4 shows estimated precision of each dominant feature.

Table 4. Estimated precision of each dominant feature

	Colors	Patterns	Materials	Shapes	All
Subjects who has dominant features	3	5	4	8	20
The number of people that an estimate proved right	2	2	3	5	12
Estimated precision(%)	66.7	40	75	62.5	60

The estimated precision each dominant feature exceeded 60% except patterns. The estimated precision of the pattern was 40%.

6   A Study

The reason that resulted in table 2 is thought about as follows. It is thought that a ratio of "Look at", "Take" became higher because the group which had dominant feature in colors compares the color of the T-shirt and takes to check an overall color. It is thought that a ratio of "Look at", "Touch" became higher because the group which had dominant feature in patterns looks at patterns of the T-shirt and Touch them. Next, it is thought that a ratio of "Touch" became higher because the group which had dominant feature in materials checks the feel of a material to touch T-shirts. Finally, it is thought that a ratio of "Touch" became higher because the group which had dominant feature in shapes takes to check the shape of T-shirts. Because 24 pieces of T-shirts made a little difference about price, brand, size, I thought that it was not different in regression coefficient.

We consider the reason the estimated precision of patterns had become 40% in table 3. A ratio of "Look at", "Touch" was high in the group which had the dominant feature of patterns at first. However, because the group which had dominant feature in colors had high ratio of "Look at" and the group which had dominant feature in materials had high ratio of "Touch", we thought the group which had dominant feature in patterns was estimated that it had dominant feature in colors or materials by mistake.

7   Conclusion

In this study, we revealed difference in regression coefficient each dominant feature to grasp them that consumers have by analyzing purchasing behavior. And as a result of having estimated dominant features by using a provided model type, the dominant features except patterns became the high estimated precision.

In future, we think the method to improve estimated precision and examine new analysis that reveals dominant features.

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