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A Model of User's Preference for Retrieving Preferred Clothes

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Abstract: This paper proposes a model of user's preference for retrieving preferred clothes. This paper has designed a decision process of user's preference. This paper has made the user's preference model based on indexes calculated in each step in the process. The process has three steps, i.e. Attention, Evaluation and Decision step. The attention step is that a user pays attention to principal features of clothes that is the features related to his/her interest. The attention step detects the principal features by the rough set and calculating Attention index. The attention index indicates the degree of user's positive (or negative) attention to the principal features. The evaluation step is that a user evaluates interest concerning the principal features. The evaluation step estimates the preferred degree of the principal features of a user by Evaluation index. The evaluation index is calculated by unifying the attention indexes of positive and of negative. The decision step is that a user decides his/her preference for clothes by using his/her evaluation. The decision step estimates the user's preference by Preference index that totalizes the evaluation index of the user. This paper has evaluated the estimation ability of user's preference by the preference index. The result shows that the preference index could estimate the preferred feature. This paper also shows the result that has evaluated the recommendation of clothes by using the preferred feature to 9 users. The average of the rate of which the clothes that include the preferred features of the user have appeared in top 5 is 98 %.

Keywords: User preference, User modeling, Personalization, Information retrieval, Rough set.

1. INTRODUCTION

Personalization services in the e-commerce are catching the attention of Internet users. They, such as Amazon.com or Ebay.com, analyze what item a user likes and recommend candidate items that he/she may like (Sung, 2005)(Fang,2004)(Ingrid, 2001)(Suk,2011). The users of them can find easily the item that best meets their preferences without spending endless hours on the e-commerce site. In order to support searching of the item that a user wants, the personalization services use personalization and recommendation techniques (Robin,2000). Collaborative recommender technique understands items related to users' preference on the basis of similarity of the ratings of the users. The technique recommends the candidate items to a user based on inter-user comparisons. With this technique, the user can know that many users who have similarity

in his/her rating of item selected the recommended item. However, the user may not be satisfied with the recommended item when the user's preference and other user's preference may not be equal. Content-based recommender technique understands a user's preference based on the features of items the user has rated. The technique can model a relationship between the features of items and the user's preference based on only the user own rating. A user may be satisfied with the recommended item than collaborative recommender technique. However, the technique uses the methods, i.e. neural nets, vector-based representations, etc., to simulate user's preference. Therefore the users cannot understand why the item has been recommended to me, through instinct. Therefore, the user sometimes cannot have confidence in items that the service has recommended.

On the other hand, in real world, a user often accepts the recommendation from a friend. One reason is that the friend explains the reason why he/she has selected the item for the user. Another reason is that a user has known friend's attitude of mind about clothes, and the user has known the friend's preference of clothes. This paper assume that a user has affinity to a service and gets comfortable with the service, if a user can understand what the service has thought and how the service has thought.

This paper proposes a model of user's preference for retrieving preferred clothes. This paper has designed a decision process of user's preference to make a model of user's preference. This paper has built the model based on indexes calculated in each step in the process. The process has three steps, i.e. Attention, Evaluation and Decision step. The attention step is that a user pays attention to principal features of clothes that is the features related to his/her interest. The attention step detects the principal features by the rough set and calculating Attention index. The attention index indicates the degree of user's positive (or negative) attention to the principal features. The evaluation step is that a user evaluates interest concerning the principal features. The evaluation step estimates the preferred degree of the principal features of a user by Evaluation index. The evaluation index is calculated by unifying the attention indexes of positive and of negative. The decision step is that a user decides his/her preference for clothes by using his/her evaluation. The decision step estimates the user's preference by Preference index that totalizes the evaluation index of the user.

This paper is organized as follows: Section 2 describes a decision process of user's preference for modeling user's preference. Section 2 explains Attention index, Evaluation index and Preference index as components of the model of user's preference, and also explains the model of user's preference using three indexes. Section 3 shows the evaluation of the proposed model by making a comparison between the preference of clothes that subjects have shown and the preference of clothes that the model has estimated. Finally, this paper describes the conclusion in the section 4.

2. MODEL OF USER'S PREFERENCE

This section describes the decision process of preference and the design of information processing in each step of the process.

2.1. Design of decision process of preference

A product is expressed by several features. The features are composed by attributes, such as color and texture. The features individualized by values, such as blue or red. A user takes notice of the specific features from several features. For example, even if two users see the same clothes, there are situation that one user pays attention to the color of the clothes and another user pays attention to the shape of it. A user has the criteria of features to which he/she pays attention.

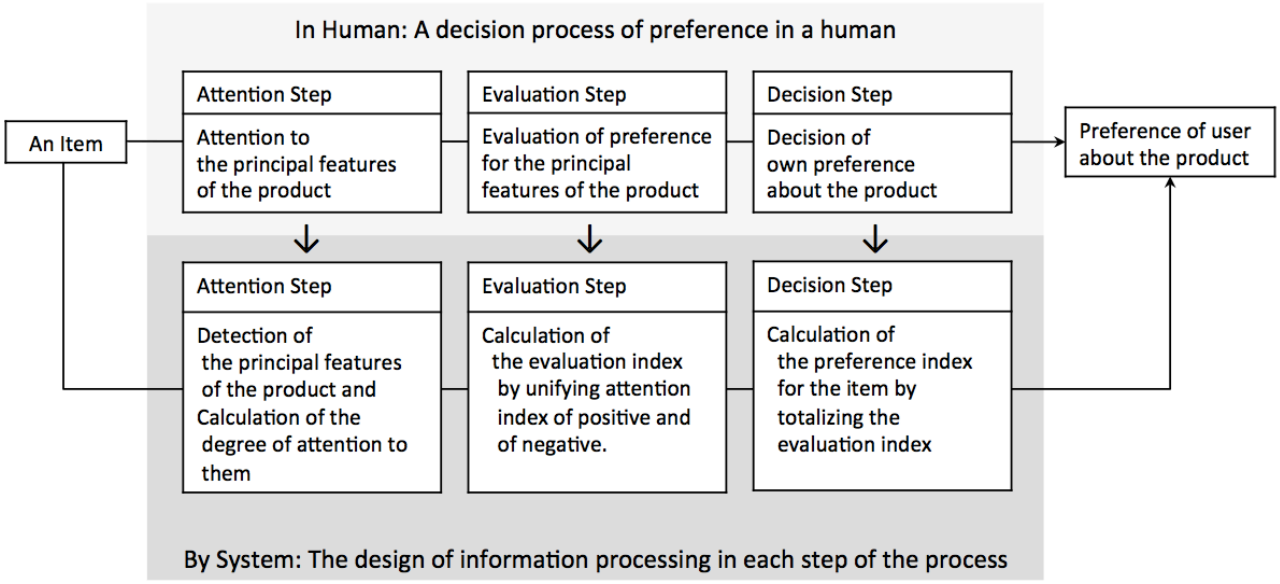

Figure 1: A decision process of preference and the design of information processing in each step

A user judges his/her positive or negative preference of the product based on the features of which he/she has taken notice. This paper assumes that the features of which a user has taken notice are more related to the positive or negative preference than all attributes of the product.

This paper also assumes that a user judges finally his/her preference of a product through a total of preference for the features of the product. In this assumption, this paper has designed a decision process of user's preference that is composed by three steps, i.e. the attention, evaluation and decision step as shown Figure 1.

The attention step is the process that a user pays attention to the principal features of a product. This paper defines the feature related to his/her preference as the principal feature. For example, a user occasionally finds out that he/she has purchased wrong material of clothes after the user has bought or has used the clothes. From this example, this paper assumes that the user has not paid attention to the material when the user has selected the clothes because material is not important. Therefore, as first step for deciding his/her preference for a product, a user only pays attention to product's principal features.

The evaluation step is the process that a user evaluates his/her interest in the principal features. For example, a user often chooses the clothes composed by a favorite color, from several candidate clothes. On the other hand, even if the clothes include favorite features, sometimes, the user does not select the clothes because the combination of them is not good for us. As the second step for deciding his/her preference for a product, a user evaluates his/her interest in the principal features and the combination of them.

The decision step is the process that a user decides his/her preference for a product by using his/her evaluation of each principal feature. For example, a user thinks, " the color in the product is very good, but the shape in it is a little bad. However price of it is low, so I want to buy it ". The user also thinks, "the color and shape of it are very good, so I want the product ". As the third step for deciding his/her preference for a product, a user decides his/her preference for a product by using his/her evaluation.

Table 1: The relation between the features of products and a user's preference for clothes

Product	Features (the attributes, and the value of attributes) of Products						Preference of a user
Clothes	Color	Texture	Category	Neck	Sleeve	Chest Design	
ID_1	Black	Point	Sweater	Turtle	Long	Mark	Positive (Like)
ID_2	Gray	Uniformity	Cut Sewn	Crew	Long	Mark	Positive (Like)
ID_3	Black	Uniformity	Sweater	V	Long	None-Mark	Positive (Like)
ID_4	Brown	Horizontal Stripes	Cut Sewn	Crew	Long	None-Mark	Negative (Dislike)
ID_5	Red	Point	Hood Jacket	Crew	Long	Mark	Negative (Dislike)
ID_6	Deep-Green	Uniformity	Cut Sewn	Crew	Long	None-Mark	Negative (Dislike)

2.2. Design of information processing in each step of the process

This paper designs the information processing of each step in the decision process that a user decides his/her preference of products, through a case study of clothes.

- Attention Step: This paper processes the attention step by detecting the principal features from all features, such as color, shape and so on, of clothes and by calculating Attention index. The attention index indicates how much a user pay attention to the attribute and its value of the principal feature.
- Evaluation Step: This paper processes the evaluation step by calculating Evaluation index. The evaluation index indicates the degree of user's evaluation of the principal feature by unifying attention index of positive and of negative.
- Decision Step: This paper processes the decision step by totalizing the evaluation index of a user. Preference index indicates that the degree of user's preference for the product.

2.2.1. Processing of attention step

In order to process the attention step, this paper extracts principal features of a product by using Rough set (Lech, 2002). The rough set can precisely extract the sets of minimum attributes that certainly distinguish the clothes that a user feels positive preference and the clothes that a user feels negative preference, from whole products. Table1 shows a user's preference for six men's clothes (i.e. ID_1, …ID_6). The user has felt positive preference to three clothes (i.e. ID_1, ID_2, ID_3). Table 1 is called as decision table in rough set. The difference of ID_1 to which he has felt positive and ID_5 to which he has felt negative is only color and chest design of clothes. A color (i.e. dark-brown) and a chest design (i.e. zip-up type) are the minimum attributes and its values to decide the positive preference of the user. The minimum attributes and its values are expressed as IF-THEN rule. The previous example is expressed as "IF the color is dark-brown and the chest design is zip-up type, THEN the user feels positive preference". The rough set describes IF-THEN rules as decision rules. This paper extracts all decision rules from decision table by using the decision matrix based on the reference (Ning, 1995). Table 2 shows all decision rules of positive preference that have been extracted from table 1 using the rough set. The rough set calls the table 2 as a decision matrix. Let $M(D_k)$ denote the decision matrix where D_k ={positive (pos), negative (neg)} is a decision class. Let $M_{ij}(D_k)$ denote the component of $M(D_k)$. For example, each component of $M_{ij}(D_{pos})$ shows minimum attributes that demarcate products related to positive preference of the user. This paper also has extracted all decision rules of negative preference from table 1, in the same way as positive. Let $F(D_k)$ denote the set of all decision rules that belongs to decision class D_k. This paper extracts $F(D_{pos})$ that is inherent in $M(D_{pos})$ by conjunction and disjunction of propositional connective. Equation (1) is $F(D_{pos})$ that has calculated by using Table 2.

Table 2: $M(D_{pos})$: The set of attributes and values that are related to the positive preference of the user

	ID_4	ID_5	ID_6
ID_1	$M_{11}(D_{pos})$ = {(Color, Black), (Texture, Point), (Category, Sweater), (Neck, Turtle), (Chest, Mark)}	$M_{12}(D_{pos})$={(Color, Black), (Category, Sweater), (Neck, Turtle)}	$M_{13}(D_{pos})$={(Color, Black), (Texture, Point), (Category, Sweater), (Neck, Turtle), (Chest, Mark)}
ID_2	$M_{21}(D_{pos})$ ={(Color, Gray), (Texture, Uniformity), (Chest, Mark)}	$M_{22}(D_{pos})$={(Color, Gray), (Texture, Uniformity), (Category, Cut Sewn)}	$M_{23}(D_{pos})$={(Color, Gray), (Chest, Mark)}
ID_3	$M_{31}(D_{pos})$={(Color, Black), (Texture, Uniformity), (Category, Sweater), (Neck, V)}	$M_{32}(D_{pos})$={(Color, Black), (Texture, Uniformity), (Category, Sweater), (Neck, V)}	$M_{33}(D_{pos})$={(Color, Black), (Category, Sweater), (Neck, V)}

Table 3: $F(D_{pos})$: All decision rules of positive preference of the user that have been extracted from $M(D_{pos})$ in Table 2

Rule Number	Extracted rules: $F_i(D_{pos})$
$F_1(D_{pos})$	Color = Black
$F_2(D_{pos})$	Color = Gray
$F_3(D_{pos})$	Neck = Turtle
$F_4(D_{pos})$	Neck = V
$F_5(D_{pos})$	Category = Sweater
$F_6(D_{pos})$	Chest = Mark and Category = Cut Sewn
$F_7(D_{pos})$	Chest = Mark and Texture = Uniformity

$$\begin{aligned} F(D_{pos}) =& ((Color, Black) \vee (Category, Sweater) \vee (Neck, Turtle)) \\ & \vee ((Color, Gray) \vee ((Texture, Uniformity) \wedge (Chest, Mark)) \\ & \vee ((Category, CutSwen) \wedge (Chest, Mark))) \\ & \vee ((Color, Black) \vee (Category, Sweater) \vee (Neck, V))) \end{aligned} \quad (1)$$

Table 3 shows $F(D_{pos})$ that has been extracted from $M(D_{pos})$. In this case, we have extracted 7 rules form data in table 2. This paper extracts $F(D_{neg})$ from $M(D_{neg})$, in the same way as positive.

Moreover, this paper uses Covering index (CI) to evaluate the extracted decision rules. Equation (2) is the definition of $CI(F_i(D_k))$.

$$CI(F_i(D_k)) = \frac{F_i(D_k) \cap O(D_k)}{O(D_k)} \quad (2)$$

Let $F_i(D_k)$ denote one decision rule, which is identified as No.i, of all decision rules that belongs to the decision class D_k. Let $O(D_k)$ denote all products that belongs to the decision class D_k. Let $CI(F_i(D_k))$ denote the covering index of $F_i(D_k)$. For example, in table 3, $CI(F_1(D_{pos}))$ is the covering index of $F_1(D_{pos})$. The $F_1(D_{pos})$ is 2/3 because there are two clothes, i.e. ID_1 and ID_3, to include in $F_1(D_{pos})$ within three clothes belonging to the positive group.

This paper defines Attention index of each attribute and its value. The attention index shows how much the user is paying attention to each attribute or its value when the user sense positive feeling or negative feeling. Equation (3) and (4) is the attention index of attribute and of value.

Table 4: The attention index in positive/negative preference of the user that calculated using decision rules in Table 3

Positive

Attention Index for Attribute	Value	The rate of Attention Index
$AI_{Dpos}(Color)$	1.00	0.41
$AI_{Dpos}(Category)$	0.70	0.28
$AI_{Dpos}(Neck)$	0.66	0.27
$AI_{Dpos}(Chest)$	0.04	0.02
$AI_{Dpos}(Texture)$	0.02	0.01

Attention Index for Values	Value	The rate of Attention index
$AI_{Dpos}(Black)$	0.67	0.27
$AI_{Dpos}(Sweater)$	0.67	0.27
$AI_{Dpos}(V)$	0.34	0.14
$AI_{Dpos}(Turtle)$	0.34	0.14
$AI_{Dpos}(Gray)$	0.24	0.14
$AI_{Dpos}(Mark)$	0.05	0.02
$AI_{Dpos}(Cut\ Sewn)$	0.02	0.01
$AI_{Dpos}(Uniformity)$	0.02	0.01

Negative

Attention Index for Attribute	Value	The rate of Attention index
$AI_{Dneg}(Color)$	1.00	0.52
$AI_{Dneg}(Category)$	0.38	0.20
$AI_{Dneg}(Texture)$	0.35	0.19
$AI_{Dneg}(Chest)$	0.09	0.05
$AI_{Dneg}(Neck)$	0.08	0.04

Attention Index for Values	Value	The rate of Attention index
$AI_{Dneg}(Red)$	0.33	0.17
$AI_{Dneg}(Deep\ Green)$	0.33	0.17
AI_{Dneg}(Horizontal Stripes)	0.33	0.17
AI_{Dneg}(Hood Jacket)	0.33	0.17
$AI_{Dneg}(Brown)$	0.33	0.17
AI_{Dneg}(None-Mark)	0.09	0.05
$AI_{Dneg}(Crew)$	0.08	0.04
$AI_{Dneg}(Cut\ Sewn)$	0.05	0.03
$AI_{Dneg}(Point)$	0.02	0.01

$$AI_{D_k}(att) = \sum_{i=1}^{n} \left(\frac{CI(F_i(D_k))}{Len(F_i(D_k))} \times \frac{1}{Len(F_i(D_k))^e} \right) \tag{3}$$

$$AI_{D_k}(v_{att}) = \sum_{j=1}^{m} \left(\frac{CI(F_i(D_k))}{Len(F_i(D_k))} \times \frac{1}{Len(F_i(D_k))^e} \right) \tag{4}$$

Let $AI(att)$ and $AI(v_{att})$ denote the attention index of the attribute (*att*) and its value(v_{att}), respectively. Let the n and m denote the number of rules that include the attribute (*att*) and its value (v_{att}), respectively. Define $Len(F_i(D_k))$ as the number of attribute in $F_i(D_k)$.

In the case of table 3, the attention index of positive preference of "color" is 1.0 because $F_1(D_{pos})$ and $F_2(D_{pos})$ include the attribute "color" in its rule. Table 4 is the attention index of attributes and of values, concerning positive and negative preference. Table 4 shows that the color attribute affects preference than the design of chest and neck. Equation (5) shows the calculation process of the attention index of positive preference of "color".

$$AI_{D_{pos}}(color) = \left(\frac{\frac{2}{3}}{1} \times \frac{1}{1^e} \right) + \left(\frac{\frac{1}{3}}{1} \times \frac{1}{1^e} \right) = 1.0 \tag{5}$$

2.2.2. Processing of evaluation step

This paper defines Evaluation index in order to simulate user's evaluation of the principal features based on the preference of positive and negative for the principal features. The evaluation index is calculated by unifying the attention indexes of positive and negative. Equation (6) and (7) shows the evaluation index of the attribute (*att)*, and the evaluation index of the value (v_{att}), respectively.

$$EI(att_i) = AI_{D_{pos}}(att_i) \times AI_{D_{neg}}(att_i) \quad (6)$$

$$EI(v_{att_i}) = AI_{D_{pos}}(v_{att_i}) - AI_{D_{neg}}(v_{att_i}) \quad (7)$$

Let *EI(att)* and $EI(v_{att})$ denote the evaluation index of the attribute (*att*) and its value(v_{att}), respectively.

This paper assumes that the user's evaluation to the principal features of the product is influenced by the preference of positive and negative. As the evaluation index of the attribute, Table 4 proves that $AI_{Dpos}(Color)$ is 1.0 and also $AI_{Dneg}(Color)$ is 1.0. This case is that the attribute of which the attention indexes of attribute is high in both of positive and negative preference. Color is more important for the user than other attributes when decides his/her preference. Therefore, this paper has designed the evaluation index of attribute *EI(att)* that emphasizes the attribute that a person focused in both of positive and negative preference. As the evaluation index of the value, table 4 proves that the attention index of Cut sewn appears in positive and negative. This result indicates that the evaluation of the user to the value is the uncertain. This paper assumes that the user does not have clearly criteria about his/her preference for the Cut sewn. Therefore, this paper has designed the evaluation index of value $EI(v_{att})$ that cuts down the value for which a user does not have clearly preference.

2.2.3. Processing of Decision step

This paper designs Preference index by multiplying the evaluation index of the attribute by the evaluation index of the value of the attribute in order to estimate a user's preference for the product. The preference index $PI(v_{att})$ indicates the user's preference concerning each value of each attribute. Equation (8) shows the preference index of the value (v_{att}) of the attribute (*att*).

$$PI(v_{att}) = EI(v_{att}) \times EI(att) \quad (8)$$

In the case that the preference index is a plus value, it indicates that the principal feature is related to user's positive preference. The preference index that is high in a value is more related to preference. Otherwise, in the case that the preference index is a minus value, it indicates that the principal feature is less related to user's positive preference.

This paper also defines Preference model of a user. The preference model expresses the all preference of the user concerning the principal features, i.e. the principal value of the principal attribute. This paper can estimate the decision of the user's preference for the product by the preference model. Equation (9) shows the preference model of the user *X* that is composed by the preference index.

$$PM(X) = \left(PI_1(v_{att}(1)), \quad PI_2(v_{att}(2)), \quad \cdots, \quad PI_i(v_{att}(i)), \quad \cdots, \quad PI_l(v_{att}(l)) \right) \quad (9)$$

$$PM_i(X) = PI_i(v_{att}(i))$$

Let *PM(X)* denote the preference model of the user *X*. Let *l* denote the number of principal features in the user *X*. $v_{att(i)}$ denote principal features of the user X that is equal to the value of the attribute related to his/her preference. $PM_i(X)$ indicates the component of *PM(X) and* equals $PI_i(v_{att(i)})$.

Table 5: The preference index of the person X

Preference Index	The value of Preference Index	Preference Index	The value of Preference Index
PI(Black)	0.13	PI(Cut Sewn)	0.00
PI(Sweater)	0.07	PI(Crew)	0.00
PI(Gray)	0.06	PI(No-Mark)	-0.01
PI(Turtle)	0.01	PI(Horizontal-Stripes)	-0.01
PI(V)	0.01	PI(Hood Jacket)	-0.04
PI(Mark)	0.00	PI(Red)	-0.08
PI(Uniformity)	0.00	PI(Deep-Green)	-0.08
PI(Point)	0.00	PI(Brown)	-0.08

Table 5 shows the preference matrix of the user X in descending order. This result indicates that the preference of the user X is strongly related to black. In order to estimate the preference of the user for the product, this paper calculates total of the preference indexes that compose the product. This paper defines the total of the preference indexes as the product index. Equation (10) shows the product index of preference of the user *X* for the product *I*.

$$IP(X,I) = \sum_{i=1}^{l} PM_i(X) \tag{10}$$

Let *IP(X,I)* denote the product index of the preference of the user *X* for the product *I*. In the case of the product that is higher in the total value of the preference index than other products, this paper estimates that the product is suitable for the preference of the user.

3. EVALUATION

This paper has evaluated a basic performance of the proposed model in the two points below:

- Objective of experiment 1: This experiment 1 makes sure that Preference index can correctly estimate a user's preference of a principal feature of clothes.
- Objective of experiment 2: This experiment 2 makes sure that Product index that calculated using Preference model can correctly estimate products suitable for the user's preference.

Subjects in both experiments are 9 subjects who are all 20's men. A subject has evaluated his preference for 50 sample clothes that are selected randomly from 520 sample clothes. The sample clothes have been expressed by 6 attributes and its values as shown in table 6.

3.1.1. Experimet 1

This experiment paper has evaluated an estimation capability of Preference index that express subject's preference of principal features. The steps of this experiment is follows:

1. A subject answers the principal feature, e.g. blue and check pattern, of clothes related to his/her preference based on his/her experience before he evaluates his preference for the sample clothes.
2. The subject evaluates his/her preference for 50 sample clothes.
3. This paper evaluates that preference index can estimate the principal feature that the subject has answered.

Table 6: The attributes and its values that express features of sample clothes in this experiment

Attributes (6) (Number)	Values (35)
Color (11)	Black, Blue, Brown, Dark-Brown, Deep-Blue, Deep-Green, Gray, Green, Pink, Purple, Red, Red-Purple, Yellow
Texture (5)	Check, Horizontal-Stripes, Point, Uniformity
Category (5)	T-Shirt, Parka, Polo-Shirt, Y-Shirt, Knit
Neck (7)	Collar, Crew, Henley, High, Hood Jacket, Turtle, V
Sleeve (2)	Half, Long
Chest (4)	Button, Mark, Zip-Up, No-Mark

Table 7: The top 5 preference index of Subject A & B

Subjects	Subject's answer to the preference feature of the clothes	Preference Index (Top 5)	
Subject A	Blue color	Deep-Blue	+0.14
		Blue	+0.11
		Gray	+0.04
		Uniform	+0.01
		Half	+0.01
Subject B	Henley neck design	Henley	+0.26
		Gray	+0.10
		Black	±0.00
		Uniform	±0.00
		Nothing	±0.00

* The subject has answered the principal feature of clothes before the subject evaluates this experiment.

This paper shows the result of the subject A and B in this experiment. The table 7 shows that the subject A has answered that the blue color is the principal feature of the clothes when he decides his preference for the clothes. The subject B has answered that the Henley neck design is the principal feature of the clothes.

In the subject A, the table 7 indicates that the preference indexes of the blue color and the deep blue color are the plus value and higher than other values. The result almost matches the preference that the subject A has answered. In the subject B, the table 7 also indicates that the preference index of the Henley neck design is the plus value and higher than other values. The result also matches preference of subject B has answered. Both of results show that the preference index is effective to estimate a user's preference of clothes.

3.1.2. Experimet 2

In the experiment 2, this paper evaluates the estimation capability of Product index of a subject that calculated using Preference model of the subject. A subject has answered his preference for the 50 sample clothes. The preference model of the subject has been calculated based on the answer data. The product index that estimates the product suitable for the subject is calculated by the preference model of the subject.

Figure 2 shows the order of clothes suitable for preference of the subject C. The order is estimated by the product index for the subject.

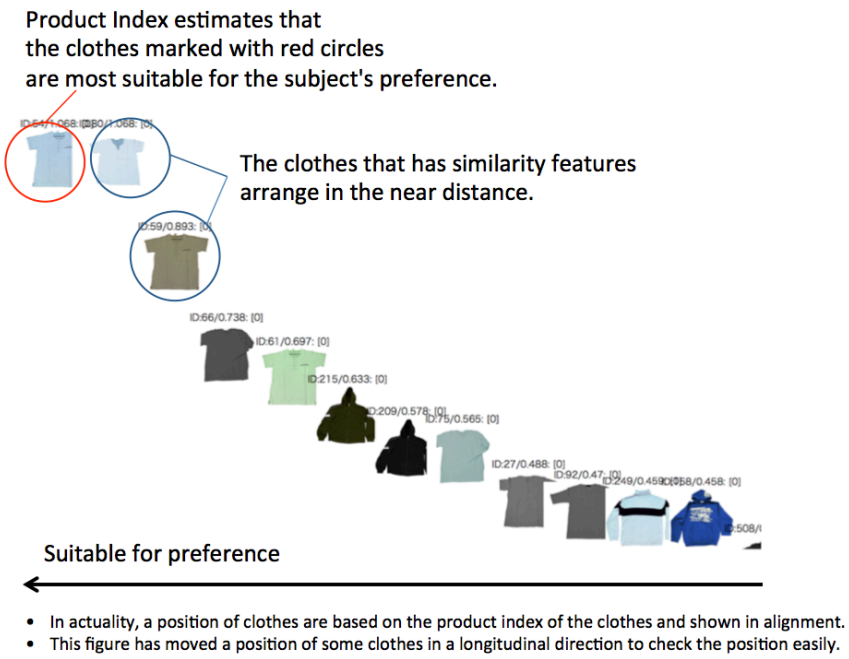

Figure 2: The result shows the estimated clothes based on the product index of preference of the subject C

Table 8: The prediction rate of top 5 & 10 concerning the product index of preference in each subject

Subjects	Prediction rate of Top 5	Prediction rate of Top 10
A	100	100
B	100	100
C	100	100
D	100	90
E	100	90
F	100	100
G	100	70
H	100	100
I	80	90
Average	98	83

The clothes that the product index of preference is the plus value will be suitable for preference of the subject. This study has compared the estimation result by the product index of the subject's preference and the preference that the subject has answered. In the case figure 2, the predicted rate of the product index of preference in top 5 is 100% and in top 10 is 100%. The table 8 shows the predicted rate of clothes index of preference of each subject. The average of the predicted rate in top 5 is 98 % and in top 10 is 83%. This result indicates that the product index calculated by preference index is effective to the recommendation for clothes.

4. CONCLUSION

This paper has proposed a model of user's preference for retrieving preferred clothes. This paper has designed a decision process of user's preference that is composed of three steps, i.e. Attention, Evaluation and Decision step. This paper has made the user's preference model based on indexes calculated in each step in the process.

The attention step is the first step of the process that recognizes the specific attributes of a clothes related to his/her preference from all attributes of the clothes. This paper has modeled the attention step by calculating Attention index that is the degree of attention of a user to a principal feature. The attention index is calculated the principal features that is extracted using the rough set. The evaluation step is the second step of the process that the user evaluates his/her preference of the principal features based on the evaluation of positive and negative preference. This paper has processed the evaluation step by Evaluation index that estimates his/her preference for each principal feature. The evaluation index is calculated by unifying the attention index of positive and negative. The decision step is the final step of the process that the user decides his/her preference for clothes based on his/her evaluation of the principal features in clothes. This paper has simulated the final step by calculating Preference index and Preference model. The preference index is the degree of individual's preference for principal features of clothes. The preference model expresses individual's preference for clothes. This paper estimates the clothes suitable for a user's preference by Product Index that calculated using the preference model of the user.

This paper has had two types of experiment to evaluate the preference index and the preference model. One experiment has shown that the preference index indicates possibility of estimation of the principal feature related to his/her preference. Another experiment has shown that the product index that calculated using the preference model can estimate the clothes suitable for subject's preference. The result has shown the average of the predicted rate about the preferred clothes in top 5 is 98 % and in top 10 is 83%.

In the future works, we will apply to the preference model to other items and will increase the precision of estimation of user's preference.

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