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A Study on Consumer Behavior Predict in e-Commerce based on Rough Set

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Abstract: This research study adopted the method of user interest concept tree based on domain ontology and proposed a new multi-agent based consumer behavior forecasting model in e-Commerce to overwhelmed the limitations of outdated consumer behavior forecasting method. The algorithms consist of rough sets rule. The algorithm is used to attribute reduction for e-Commerce consumer actions prediction. With rule extraction model of rough sets, the rules of e-Commerce consumer behavior prediction are picked up. Practical example of consumer behavior prediction demonstrations that the novel proposed approach can be touched found knowledge efficiently and can be converted the obtainable rules easily. It has robust ability of fault tolerance and can recover the speed and quality of knowledge acquisition. The method has good practical value. From the test results, compared with the original method, it can effectively analyze and predict e-Commerce customers consumer behavior and can be decided that the customer's complete ingesting trend.

Key words: e-Commerce, consumer behavior, multi-agent, olerance, knowledge acquisition, ingesting trend

INTRODUCTION

With the rapid development of internet, e-Commerce has developed rapidly. The internet is increasingly becoming an integral part of our lives, online shopping is becoming a new shopping channel. Many enterprises and businesses have begun to catch the development trend of information and each established their own websites and forums and on the basis of the traditional business model, the use of internet technologies, open e-Business model, renewal and modernization of enterprises marketing and strategic development of the original model. In increasingly competitive time in order to get the survival and development of enterprises under e-Commerce, consumers are key factors and consumer behavior to a certain extent on enterprise development with the overall pattern will have a big impact (Abbattista *et al*., 2002). Therefore, understanding of consumer behavior and information behavior will no doubt provide them with goods and services, greater relevance there by improving the quality under the environment of e-Commerce sales and customer services thereby enhancing the competitiveness of online businesses (Kuo *et al*., 2005).

The study according to the experience of e-Commerce expert, based on the agent technology, under the web environment, take Sun JDK5, Eclipse3.1, Dreamweaver and so on as the development environment, uses the B/S structure and based on the J2EE standard development pattern has constructed an consumer behavior predict expert system of e-Commerce using Java language (Li and Cui, 2005). It provides the product information of consumers interested. This improves efficiency and effectiveness in running e-Commerce platform in the internet environment there by improving the quality of online businesses, sales and customer service, enhance the competitiveness of online businesses. e-Commerce web sites, understanding consumer behavior characteristics of shopping behaviors and information on the site will doubt provide them with goods and services leads to greater targeted; conducive to shopping sites to web site organization, effective use of information content and management, improve the quality under the environment of e-Commerce sales and customer services there by enhancing the competitiveness of online businesses has the vital significance (Zhang and Han, 2007).

MATERIALS AND METHODS

Rough set theory: Followed by theory of probability, fuzzy set theory, Rough Set Theory (RST), introduced by

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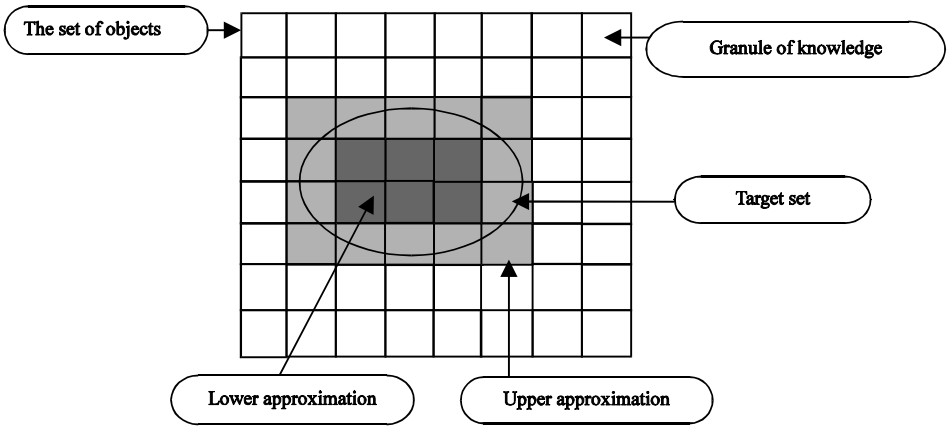

Fig. 1: Rough set approximation

Pawlak is a mathematical approach to deal with uncertain, vague and imperfect knowledge in an information system. RST has an edge over others in uncertain data analysis because it does not need any prior or further information about data.

Rough set primarily are used in attribute selection problem and also used for classification tasks. The power of rough set realized as given a set of values, it determines which are the elements definitely belongs and which are likely to belong, e.g., lower and upper approximation (Zhang, 2012). It is graphically represented in Fig. 1.

RST has been applied successfully while decision making in various fields. Decision rule can be extracted from attribute value table. Also, decision rules can be automatically extracted as performed from clinical data sets. Most of these methods are based on generation of discernibility matrices and reducts. Decision-making based on rough set theory has been developed. This approach was tested on a medical dataset for patients with lung abnormalities. Rough set along with soft set has been well used for decision making over an institutional data set. Furthermore, multi-criterion decision making has been effectively accomplished in extending rough set technique over intuitionistic fuzzy approximation space. In addition to these, it also measures the uncertainty associated with an incomplete information system.

RESULTS AND DISCUSSION

Predict consumer behavior based on rough set of e-Commerce: Predict the specific operation of e-Commerce consumer behavior based on rough set theory shown in Fig. 2 includes the following steps: by collecting consumption data for e-Commerce, consumer completeness of the data and discrete, the completion of the e-Commerce consumer behavior prediction basic data preprocessing, to remove redundant data e-Commerce

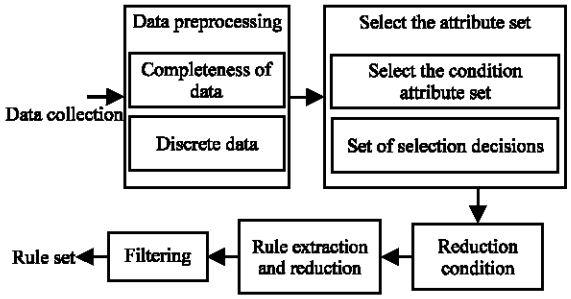

Fig. 2: e-Commerce consumer behavior prediction based on rough set theory

consumer behavior, the completion of the reduction of consumer behavior to predict the condition attributes set (Liu *et al*., 2009; Zhang and Ai, 2009). Through the e-Commerce consumer behavior prediction rules extraction and reduction, draw the necessary set of rules to predict consumer behavior by calculating the rule of confidence and coverage, the rules filtered to give e-Commerce decision rule to predict consumer behavior.

Data preprocessing: Based on e-Commerce and consumer behavior to predict the characteristics of the prediction process, the establishment of e-Commerce knowledge of consumer behavior prediction tables and then build e-Commerce consumer behavior prediction system. Prior to this the consumer behavior predicted parameter values are summarized in a table into knowledge.

Here in this study, K = {U, R} use as a simplified form to represent K = {U, R, V, f} as Table 1 shows on the field U = {ct1, ct2, ct3, ct4, ct5, ct6}, the condition attribute set R = {ca1, ca2, ca3, ca4, ca5, ca6} which represent different attributes of different commodities. Let condition attribute set to C = {ca1, ca2, ca3} = {a, b, c}; decision attribute set to D = {ca4} = {d}.

Table 1: Record customer spending decision table

	Condition attributes			Decision attribute
Variables	Ca1	Ca2	Ca3	Ca4
Ct1	Y	Y	N	Y
Ct2	N	N	Y	N
Ct3	Y	N	Y	Y
Ct4	Y	Y	Y	N
Ct5	N	Y	N	N
Ct6	Y	Y	N	Y

Reduction condition attributes set: This study used an improved attribute reduction algorithm which is based on discernibility matrix to analysis e-Commerce consumer behavior condition attributes. Algorithm is described as follows:

Algorithm:

1. Enter K = {U, C∪D, V, f}
2. Calculating a conditional attribute dependency, γ_a (D) (a∈C) if γ_a (D) = 0, C = C-{a}
3. On the condition attribute set of Υ_a (D)#0, write the lower triangular matrix M_{nxn} (K) = $(c_{ij})_{n\times n}$ where i, j = 1, 2 ,…, n:

$$C_{ij}=\begin{cases}\{\alpha\left|(\alpha\in C)\wedge(f_\alpha(x_i)\neq f_\alpha x_j))\right\},f_D(x_i)\neq f_D(x_j),\\ \phi,f_D(x_i)\neq f_D(x_i)\wedge f_C(x_i)=f_C((x_j)\\ -,f_D(x_i)=f_D(x_j)_0\end{cases}$$

4. Search for differences in the matrix, if the value of all the elements of the matrix are not equal then go to (4) If there is a value of the matrix element, Φ then exit; Φ
5. Search for differences in the matrix and assign all of its single-property element, output $CORE_c$ (D)

Output:

COREC (D) = {α | (α∈C) ^ (∃cij, ((cij∈Mnxn (K)) ^ (cij = {α})))}

6. Draw all possible combinations of attributes D contain relatively nucleus, if satisfied ∀ $c_{ij}\in M_{nxn}$ (K) when cij#ø; B∩cij#ø; B independence. Then it isassigned to and through all of the property portfolio contains relatively nucleus; REDc (D) (D) and through all of the property portfolio contains relatively nucleus
7. Output REDc (D) calculate REDc (D) the importance attributes σCD (α) = γc (D)-γc-{α} (D) wherein, α∈C if σCD (α)>0.9 then REDc (D) ⇐COREc (D)∪α traverse all the combinations of properties REDc (D), calculate the reliability of REDc (D)
8. Output REDc (D), the algorithm ends

Extraction and reduction rules:

1. Output K = {U, C∪D, V, f}
2. B0 = COR EC (D), A = C–B0 = {β1, β2 ,…, βm} (βI∈A, m = card (C), i = 1, 2,…, m) Sorting according to the attribute of importance, namely strike OA, Tl+1 (OA) and OTl+1 (OA) (0 = 1 = m), posB0 (D) and posC (D)
3. Determine equality. If equal, output B0 = m in {R E DC (D)}, go to (11); otherwise go to (4)
4. If I = 1, flag = 0, Z, B, B0
5. If Y = OT, (OA)
6. Take y∈Y, B⇐B0 U{y}, calculate posB (D) and then determine whether posB (D) and posc (D) are equal, if posB (D) = posC (D) and flag = 0 then X = B, flag = 1; If card (U/Z)>card (U/B) then Z = B, flag = 0
7. Y = Y-{y}
8. If Y≠ø, turn to (6)
9. If flag = 1 then m in {REDC (D)} = Z, turn to (11)
10. i = I + 1, if I = m, turn to (5)
11. Output m in {REDc (D)}, the algorithm ends

CONCLUSION

The study adopt an improved attribute reduction algorithm prediction condition attribute reduction algorithm which is based on discernibility matrix to analysis the set of e-Commerce consumer behavior and by the extraction and reduction rules generated draw a new theory which is based on rough set e-Commerce consumer behavior prediction and this method achieves better practical results.

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