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ABSTRACT

Due to the increasing demand for e-commerce, it is necessary to provide a new approach that is not same with off-line stores for internet customers. Since the efficient communication with customers is indispensable for recent e-commerce businesses, goods recommendation systems automatically suggest some products with customer’s previous spending preference by customer’s interest analysis using some sophisticated multi-media functions. However, current goods recommendation systems require high cost and time to develop and maintain the systems and it is difficult to understand and maintain the system by administrators. Therefore, many researchers are trying to complement these weak points for easy utilization and less expenditure using a small scale personalization service.

This paper proposes a new goods recommendation system using a web mining technique with association rules. In addition, we use a collaborative filtering technique for the small scale personalization service. Although association rule finds the rules based on the confidence and support between items in a massive database, it only considers the relationship between items without customer’s personal preference. To overcome this defect, we use an improved Apriori algorithm to provide recommendation rule using item to item relation.

Keywords: e-commerce, goods recommendation system, association rules, personalization

1. INTRODUCTION

E-commerce is the new electronic trade method between merchandisers and purchasers in the virtual internet world. Although one of indispensable components for the success of e-commerce is efficient communications with customers, current e-commerce systems could not provide sufficient communications. Therefore, more enhanced approaches are essential to improve the e-commerce system such as automatic goods recommendation system [1].

Current goods recommendation systems using log file analysis method have a limitation to provide interesting goods information which should reflect each customer’s preference. Although data mining or CRM (Customer Relationship Management) system are applied to influence the customer’s interest, it is not easy to develop and manage these systems. Recently the researches for a small scale personalization service have been vigorously studied to satisfy the low cost and the ease of utilization [2]. For personalization methods, although collaborative filtering method is widely used, the difficulty of initial assessor and the scarcity of customers’ evaluated data are still remaining as unsolved problems.

In this paper, the association rules are utilized using customer’s database information which provides the purchase related preference. We used improved Apriori algorithm [3] which uses the local information of data and compensates the scarcity of customer evaluated data using item to item relationship which can recommend the highly related goods to customers. In addition, the individual preferences are reflected to the proposed method by collaborative filtering [4]. Therefore, the proposed system can easily find the customer specific information and recommend personalized goods from user query. The list of customer specific goods recommendation is automatically suggested by our program.

The rest of this paper is organized as follows: the brief overview of related research is described in section 2. Section 3 elucidates the design of goods recommendation system for our proposed approach. In section 4, we introduce the implementation result of our method.

2. RELATED WORKS

Goods recommendation system provides a recommendation list which is interesting to the potential customers by a personalized information filtering technology. In this section, we describe the brief overview of the web mining, personalization, association rules, and Apriori algorithm.

Web mining uses data mining methods to automatically find and extract the requisite information from web pages or services. Web mining can be classified
3. THE DEVELOPMENT OF A GOODS RECOMMENDATION SYSTEM

Our goods recommendation system utilizes the web mining technique using association rules and uses the collaborative filtering technique for the small scale personalization service. Although association rules extracts the rules from the massive database by support and confidence between items, this method ignores the personal preference and only depends on the relation between items. To overcome this disadvantage, the proposed approach utilizes the relation between items into our system. Thus our goods recommendation system adds the relation between items using the large item set from each customer and whole customers and creates the recommendation rules using improved Apriori algorithm.

3.1. The structure of goods recommendation system

Figure 1 shows a module which creates the recommendation rules and a recommendation database by the recommendation engine. When a customer registers to the system as a new user or purchases any goods (1), good purchasing data and customer data are stored into the system as a transaction data.

When a web marketer requests the creation of recommendation rules, the recommendation engine collects the customers' transaction data by each customer, and then creates the large item set (2). The generation of a large item set is based on the calculation of support for transactions which should be over the pre-defined level of support. The selected large item set both based on the whole customers and based on the each customer is added into the database of the large item set. Association rules are applied to data of large item set to create the goods recommendation rules (3) and then the pattern is found from this goods recommendation rules. The pattern analysis step (4) recommends the goods to customers by the discovered pattern. These recommendation goods are nominated from the discovered recommendation rules which have the strong relation for goods in the current customer's cart (5).

by web content mining, web structure mining, web usage mining [4, 5, 6, 7]. Web usage mining [6] utilizes the web log record, cookie information, content data and user's mouse click or scroll data. These data provide the user's access patterns or interesting parts which can be possible to generate the personalization service. Web usage mining is one of the most widely applied technique in web mining approaches and we applied web usage mining into our method as well.

For website personalization, the collaborative filtering approach has been widely used for recommendation system. This method utilizes the enforced user information and classifies the groups using similar preference. Then the same group has the same list of recommendations. Group classification and cross recommendation are automatically generated by the system. If the sufficient information is accumulated in the system, a new web customer promptly starts the service and it can satisfy the preference of a new customer. In addition, since this method did not require any opening of users' information, it is well suit for the recent trend of information security.

However, when the new items are added into the system, someone should evaluate the preference of these items. Since the various items can not be evaluated by all customers, the evaluation data of user-item relation is not easy to achieve the enough numbers of data. These vulnerable points are previously mentioned initial assessor problem and the scarcity of customers' evaluated data.

Current e-stores are using 4 types of recommendation methods to provide the personalization of system: non-personalized recommendation, attribute-based recommendation, people-to-people correlation, item-to-item correlation. Item-to-item correlation approach utilizes the small scale of items which are selected by customers and nomimates the highly correlated items.

Association rules in data mining use the frequency of data and the probability which occurs simultaneously and reveal the relationship between item groups. Therefore, to find significant relationship from various items, the standards which should efficiently compare each association rule are essential: support, confidence, and lift. Before the analysis of association performs, we initially set up the minimum standards for support, confidence, and lift. The association rules which are over these minimum standards only can be generated to extract the meaningful rules. Support describes the proportion of transactions that contain the relationship between items. Confidence describes the proportion of transactions containing item B among the transactions containing item A, so it reflects the relative correlation. Lift supposes to purchase item A and then estimates the probability of purchase of item B. Apriori algorithm creates the large item set and well known method to implement the association rules.
Figure 1. The structure of goods recommendation engine module

The proposed processes to discover the association rules from given database consist of two steps described in table 1.

Table 1. The process to discover the association rules

| Step 1 | • Find the all item sets using the pre-defined minimum support (0.5).
|        | • The support for each item set is a number of transactions which correspond to the item set.
|        | • The large item set is the item set which satisfies the pre-defined minimum support and this large item set is discovered by the improved Apriori algorithm.

| Step 2 | • To create the association rules from the database, all the large item sets should be discovered to find the subsets which are not an empty set.
|        | • Each subset which is over the minimum support can generate the association rule.

3.2. The design of goods recommendation system engine module

The proposed goods recommendation system engine is implemented using the Java beans, and figure 2 shows a class diagram for goods recommendation engine.

Figure 2. The diagram of good recommendation engine

RecommendRng class starts the good recommendation engine and sets up the minimum support and the minimum confidence. The recommendation rules are delivered to Recommender class. Recommender class provides the recommended goods information using a goods list and a recommendation format under the assumption that recommendation rules are already created. RuleCreator class generates the recommendation rules through the RelationRule class. RelationRule treats the transaction data and utilizes the association rules to perform the goods recommendation rules using the improved Apriori algorithm. Transaction class manages the basic information to add or delete the transaction data into the database system. TransactionMemProc class controls the transaction data using the computer memory which is stored with linked-list and creates the substitute item sets. OrderNode class manages the transaction data which consists of order number, customer ID, and a list of goods code. ConstantData class and Trace class manages the log information.

4. THE IMPLEMENT OF GOODS RECOMMENDATION SYSTEM

Our goods recommendation system is based on the Linux operating system and web server and database system are implemented independently. An Apache 2.0.52 is utilized for web service as a Web server and Tomcat 5.0.28 is installed for JSP. MySQL 4.0.22 is also used as a Database server.

We used all actual data sets which are purchased from the existing internet shopping malls by e-commerce customers. Figure 3 shows the captured shot of the main page using the proposed goods recommendation for customer "haha" and "kyung-ho lee" after login. If there are no items to recommend, pre-defined goods which are nominated by a web manager or goods on sale will be display on that part.
Our goods recommendation system is based on the web mining technique to discover the relationship from the customers' purchases. Improved Apriori algorithm is applied to find the association rules.

When a customer desires to achieve the personalized recommendation from the internet shopping malls, existing goods recommendation systems require troublesome tasks such as setting up the interest items when the customers register as a member. However, since our goods recommendation system utilizes the item to item relation using improved Apriori algorithm, any previous history for certain customer can nominate items without any additional works.

The proposed goods recommendation system is tested on the actual internet shopping mall and proves the easiness of utilization because our system automatically nominates the recommendation list and does not require any registration process for a new user or additional steps during the shopping.

6. REFERENCES


5. CONCLUSIONS

Due to the explosive increase of internet trades, the efficient communication with customers is becoming a hot issue in the e-commerce. In addition, to preserve the long relationship with current or previous customers, the goods recommendation system should provide the personalized service for each user and utilize the well-designed multimedia functions for easy utilization. However, the development and management of goods recommendation system requires expensive cost and time. Moreover, it is not easy to understand and maintain the detail of system by administrators. To overcome these problems, a small scale personalization service is vigorously studied for the goods recommendation system.