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Bargaining strategy formulation with CRM for an e-commerce agent

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Abstract

The growth of electronic commerce has created the need of automated bargaining agents for improving the efficiency of online trans-actions. From the perspective of customer relationship marketing (CRM), establishing and maintaining the best possible relationship with valuable customers is a good way to survive in the competitive global market. In order to retain valuable customers, high share customers ought to be treated differently from the low share customers in the bargaining process. In our research, we formulate strategies for a bargaining agent based on the CRM principle. Bargaining tactics are expressed as fuzzy rules that mimic a human bargainer's knowledge and judgment in making decisions. Actions of the bargaining agent are determined by using approximate reasoning from the set of fuzzy rules. Our bargaining agent and three other bargaining agents found in the literature are employed in an experimental online store. Experimental results indicate that our bargaining agent is more efficient and creates greater customer satisfaction and cus-tomer loyalty than do the bargaining agents from the literature.
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1. Introduction

The fast growing Internet and World Wide Web have provided a new channel for marketing and selling. As esti-mated by Nordan [1], retail revenue online contributed to half a percent of total retail sales worldwide. However, the underlying problem seems to be that many retailers have been unable to convert these revenues into profits [2]. For this reason, retailer managers are now facing the problem of how to ensure online revenues generates higher profits for each transaction.

The low transaction profitability of online shops has arisen from the following combination: reduced barriers to product information, easier access to a great number of potential suppliers, and increased threat of substitutes [2]. Furthermore, the Internet has reduced the differentia-tion among products and services and hence has switched the focus of customers to price discounting [3]. Conse-quently, buyers generally surf through many shops and compare their list prices of the target product to look for the best offer on the Internet. Therefore, unless visitors of the online shop can be converted into buyers and be kept by creating value for them, online transactions will not be profitable [2].

From the above discussions we find that there are two related factors to enhance the profitability of online stores: providing dynamic pricing to keep customers staying at the store, and appropriate bargaining strategies to increase the chance of closing a deal. A dynamic pricing mechanism can encourage the customer's staying at the shop to negotiate an acceptable price instead of searching for a lower price somewhere else. By a well-designed bargaining strategy, it is expected to increase the chance of converting a visitor to a buyer and hence create profits for the store. The pres-ent study aims to establish the dynamic pricing mechanism in an online shop by a price bargaining function and

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applies the concept of customer relationship marketing (CRM) in the negotiation process to increase visitors' purchasing inclination.

In real life, a buyer and a seller usually bargain over the price of a product to maximize their own interests. People bargaining on the Internet may face a lot of barriers, such as anxiety from competition, communication difficulties over the Internet, and lack of bargaining experience [4]. In order to remove these bargaining impediments, there is a need to implement an automated bargaining mechanism in online stores.

In the literature, there are two famous e-marketplace platforms that provided automated bargaining by allowing users to create autonomous agents to buy and sell goods on their behalf: Kasbah [5] and AuctionBot [6]. At Kasbah, users give agents instructions on how to change the desired price over a time frame. Strategies of these agents are rather simplistic and inflexible, because the functions used to specify the changing rate of desired price are fixed and the opponent's actions are not considered during negotiations. AuctionBot is an online auction server that allows software agents to place bids, create auctions, or request auction information. In addition to the above approaches, Liang and Doong [7] proposed three bargaining agents with different bargaining strategies for an experimental online store. The bargaining strategies of these agents are similar to those used at Kasbah (i.e. they use fixed concession functions without considering the opponent's actions). The common problem of the above approaches is that they did not appropriately take the customer's responses into account in the bargaining process.

The main theme of this paper is to develop an autonomous agent that represents the owner of an online store to bargain with customers. We consider that customers' behaviors are different, and the store should identify a customer's characteristics and apply different tactics to make profits on customers. For blow-in customers, the store will attempt to obtain as much profit as possible from them; on the other hand, for those customers who are very likely to buy and may come back again in the future, the store is willing to sacrifice part of its profit to retain these customers. The above concept complies with the principle of customer relationship marketing, which suggests differentiating customers and applying different marketing strategies to them. Customer relationship marketing enables companies to provide real-time service to customers by developing a relationship with each customer through the effective use of individual account information [8].

In this study, the concept of CRM is implemented on our online store and the intelligent agents will assist customers in finding their favorite products and allowing them to bargain over the prices of products with different concession degree based on the differentiation of customers on their potentiality. Customer potential value is generally defined in the literature, e.g. [9–11], as the expected profits from a customer if this customer purchases additional products or services from the store. The present study mod-ifies the definition of customer potentiality as the loyalty and purchasing probability of a customer, which is considered to be more related to customer's purchasing decision (i.e. buy or not buy). In our approach, the computation of customer potentiality will involve the total monetary value the customer has spent at the store and the statistics of ad views and ad clicks by the customer. Our strategy is first to differentiate customers by computing such an index, and then to apply different bargaining tactics to customers with different index values. Those customers with a greater index are considered as prospective buyers, and they will be granted a wider concession margin in the bargaining process in order to reinforce their purchasing inclination. Our strategy is achieved through a set of bargaining tactics in the format of fuzzy rules. These fuzzy rules enable the bargaining agent to mimic a human bargainer in making decisions.

Recent studies have argued that the relationship between customer loyalty and profitability is weak. For example, Reinartz and Kumar [12] discovered little or no evidence suggesting that customers who purchase steadily from a company over time were necessarily cheaper to serve, less price sensitive, or particularly effective at brining in new business. Nevertheless, the present study still considers loyal customers are important to the store because our purpose is to convert visitors to buyers as discussed earlier. Moreover, the cost to serve a loyal customer is neither more significant nor different from serving a disloyal customer owing to the automated service process by agent technology.

In the next section, we will present the architecture of our online store. Our approach of customer identification and differentiation as well as the formulation of bargaining tactics are discussed in Section 3. Experiments are described in Section 4 to illustrate the performance of our approach by comparing it with the approach of Liang and Doong [7].

2. CRM and the architecture of the online store

Using the concept of customer relationship marketing, we focus on recruiting and retaining customers by incorporating the four steps of one-to-one marketing [13] in our online store. The architecture of our online store is depicted in Fig. 1.

Customers log on to the store through WWW browsers. In our online store, three agents – the ID (Identification) agent, the bargaining agent, and the TM (Tactic Management) agent – work together to carry out one-to-one marketing. When a customer logs on to the store, the ID agent computes the customer's potentiality index according to the customer's profile data retrieved from the profile database. For the case of a new customer, the lowest index value found in the profile database is assigned to this customer. The customer's behavior during shopping is also written to the profile database to update the customer's record. When a customer visits the store, the ID agent