



The agent-based negotiation process for B2C e-commerce

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ABSTRACT

B2C e-commerce is becoming more widespread as more people come to recognize its convenience and its ability to rapidly respond to requests and as more products and services become available. However, many electronic marketplaces, especially in the business-to-consumer, are in essence some kind of search engine where buyers look for the best product in a database of products offered by sellers. Usually, such e-marketplaces do not use agent technology at all although agents could significantly improve the services provided both for the buyers and the sellers. Further, negotiation capabilities are essential for B2C e-commerce systems. In an automated negotiation, intelligent agents engage in broadly similar processes to achieve the same end. In more detail, the agents prepare bids for and evaluate offers on behalf of the parties they represent with the aim of obtaining the maximum benefit for their users. Nevertheless, in the current situation, price is the only criterion by which agents are created. This factor is easy to measure and automate. However, the criteria for advanced transactions need to be elaborated, for example, details of giveback and dividend. In this paper, we present a multiple-attributes negotiation model for B2C e-commerce, which deploys intelligent agents to facilitate autonomous and automatic on-line buying and selling by intelligent agents while quickly responding to consumers. These include a 4-phase model, information collection, search, negotiation, and evaluation. We also apply fuzzy theory and analytical hierarchy process to develop the system interface to facilitate the user inputs. Finally, an example of the notebook purchasing process is illustrated.

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1. Introduction

The internet has fundamentally changed the environment of business, because it offers sellers and buyers a powerful communication channel and makes it possible for the two parties to come together in the e-marketplaces. B2C e-commerce is becoming more widespread as more people come to recognize its convenience and its ability to offer a quick response to requests and as more products or services become available. Electronic commerce is a business practice associated with e buying and selling information, products, and services on the Internet. Electronic commerce is increasingly popular in today's businesses (Du, Li, & Chou, 2005). There are more and more organizations paying attention to the advantage of this new tendency. So, e-commerce is now playing a more and more important role in our daily life (Anumba & Ruikar, 2002). Business-to-consumer is similar in concept to the traditional method of retailing, the main difference being the medium used to carry out business by the internet. Such a method of carrying out business transactions assumes the consumer has access to the WWW. By selling direct to customers or reducing the number

of intermediaries, companies can achieve higher profits while charging lower prices (Laudon & Laudon, 2000).

The internet offers consumers greater benefits from increased information and lower transaction costs, which includes search costs. There are more choices than in the traditional economic environment. At present, B2C e-commerce offers functions focusing on catalogue browsing, term screening and search. Customers have to spend much time searching and scanning to find products which achieve their demands. It can see although users can get a lot of information, it will take much time to filter useful information. In addition, more information does not mean higher efficiency. Although people can buy goods at home, they cannot avoid spending much time reviewing products on Internet.

Negotiation in B2C commerce is also a time-consuming process because all parties desire to maximize their own payoff while they may have opposing goals. If some of the parties do not concede, it could take forever to reach an agreement (Choi, Liu, & Chen, 2001). Negotiation is an inseparable component of many e-commerce activities, such as auctions, scheduling, contracting, and so on, and is one area that can greatly benefit from automation (Serguevskaia, Al-Sakran, & Atoum, 2006). Negotiation is a very extensive subject spanning from pre-negotiation to post-negotiation analysis, both at the local and social level. Thus, a considerable

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amount of work on negotiation is available in the literature from different domains, such as operational research, economics, and decision theory (Wanyama & Far, 2007).

Software agent technology is a new approach in e-negotiations. Use of software agents to represent the negotiating parties could greatly decrease efforts and the time needed to complete negotiations. Intelligent agent software is the action of human decision-making behavior in the form of a computer program. Intelligent agent software can help users to perform some actions involving search, negotiation, trade off and so on to improve effectiveness. It also improves the consumer's bargaining position with the opposition from the internet and traditional channels. A negotiation support system (NSS) refers to a specialized group support system designed to help negotiators achieve optimal settlements (Zhu, Guan, Wang, Zhou, & Liao, 2005). Morge and Beanue (2004) present an agent-based negotiation support system having the following functionalities: Information sharing among stakeholders, Auto-negotiation between agents, and Modeling of group decision-making. Faratin, Sierra, and Jennings (2002) proposed an agent negotiation protocol which depends on utility, similar to the analytic approaches. Much effort has been spent on designing agents for automated negotiation (Li, Giampapa, & Sycara, 2003). However, traditional e-marketplaces do not use agent technology even though agents could significantly improve the services provided both for the buyers and the sellers. Moreover, prior research only focused on how to achieve maximum profit. The criteria for advanced transactions needs to be elaborated, for example, details of giveback and dividend. Therefore, this paper proposes a multiple-attributes negotiation model for B2C e-commerce.

2. A solution approach of intelligent agent to negotiation

2.1. Intelligent agent

Sycara, Paolucci, Ankolekar, and Srinivasan (2003) precisely defined intelligent software agents as programs acting on behalf of their human users to perform laborious information-gathering tasks. Other scholars consider agent architecture linking aspects of perception, interpretation of natural language, learning and decision-making is provided (Schleiffer, 2005). There is no universally accepted agreement for a definition of the concept of an agent, probably because each definition grew directly out of the application area the definer had in mind. For an analysis of such definitions (Schleiffer, 2002) it is illustrated most of these definitions are built around human-level descriptions of agent activities, regarding software agents as some form of an artificial secretary, or as "the electronic counterpart of their real-world namesakes" (Schleiffer, 2005).

For B2C e-commerce applications, many types of choice to the consumers have also introduced the problem of information overload. Meanwhile, there are so many e-shops and products available to consumers that it has become too time-consuming to find the best deal (Wang, Tan, & Ren, 2004). As electronic commerce becomes more popular, the role of automated negotiation systems is expected to increase. For example, when a virtual shopping mall receives product orders from a customer, it is necessary to make the delivery orders automatically without human intervention, generate a request for proposal (RFP) and announce it to multiple delivery companies. Then, the mall and delivery companies will negotiate over the price and quality (for example, delivery date) of a specific delivery service (Lee, Chang, & Lee, 2000). Thus, there is a need for IA to assist in the negotiation process for B2C e-commerce.

According to automated negotiation, Beam and Segev (1997) defined negotiation in electronic commerce as the process by which two or more parties multilaterally bargain resources for mutual intended gain, using the tools and techniques of electronic

commerce. Negotiation is critical in resolving conflicts of multi-agent systems in distributed artificial intelligence (Wang & Chou, 2003). Given the ubiquity and importance of negotiations in various contexts, research into negotiation theories and techniques has attracted attention from multiple disciplines such as distributed artificial intelligence (DAI), social psychology, game theory, operational research, and more recently in agent-mediated electronic commerce (Lau, 2007). The different methods of negotiation can result in different effects on the process and result. The main objective of negotiation is to improve the negotiation efficiency and maximize the benefit.

B2C e-commerce is becoming more widespread as more people come to recognize its convenience and its ability to offer a quick response to requests as more products and services become available. As this adoption spreads, the impetus for employing software agents increases to enhance and improve the trading experience (He, Jennings, & Leung, 2003). As discussed above, the main purposes of this paper are to develop a multiple-attributes negotiation model for B2C e-commerce and provide more benefits and a quicker response.

2.2. Intelligent negotiation agent architecture

In this section, an agent-based architecture called an intelligent negotiation agent (INA) architecture is designed to enhance the existing B2C e-commerce process rather than to modify it, although the process may be modified before such a system is built. The INA researches both the technology and the methods needed to improve the way information is gathered, managed, distributed and utilized to decision-makers in key business functions and operations. Several researches have studied agent architecture. Nguyen and Jennings (2005) proposed a model for the buyer agent consisting of three main components: a coordinator, several negotiation threads and a commitment manager. And some researchers claimed three key processes are needed to make the agent work effectively and simulate the real world buying experience: Identifying a proper set of criteria on which to transact, Identifying agents with whom to transact, Negotiation (Sarkis & Sundarraj, 2002). The Kasbah e-marketplace is one of the early attempts at exploiting agent technology for automated negotiations in e-commerce (Maes, Guttman, & Moukas, 1999). Buyer agents and seller agents proactively seek out potential buyers or sellers and negotiate with one another on behalf of their owners. The objective of each agent is to complete an acceptable deal based on the user-specified constraints such as initial asking (or bidding) price, a reservation price, a date by which to complete the transaction, and restrictions on which parties to negotiate with and how to change the price over time (Lau, 2007).

In this paper, INA architecture which includes buyer agents and seller agents is proposed. Buyer agents can search products, and negotiate and access negotiation records. The seller agents negotiate with the buyer agent and access products and a consumer database. The architecture characteristics:

- **Intelligent:** The agent automatically customizes itself to the preferences of its customer (or client), based on previous experience and imprecise information from interaction with customers. The agent also automatically adapts to changes in its environment.
- **Autonomous:** An agent is able to take the initiative and exercise a non-trivial degree of control over its own actions through service agreements.
- **Cooperation:** An agent does not blindly obey commands, but makes suggestions to modify requests or asks clarification questions. It also cooperates with other agents to query the modules needed.

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