Automated Fuzzy Bidding Strategy for Continuous Double Auctions Using Trading Agent’s Attitude and Market Competition

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ABSTRACT

This paper designs a novel fuzzy competition and attitude based bidding strategy (FCA-Bid) for continuous double auction in which the best transaction price is calculated on account of the attitude of the agents and the competition for the goods in the market. The estimation of attitude is based on the bidding item’s attribute assessment, which adapts the fuzzy sets technique to handle uncertainty of the bidding process. Additionally, it uses heuristic rules to determine the attitude of bidding agents. The bidding strategy also uses and determines competition in the market (based on the two factors, number of the bidders participating and the total time elapsed for an auction) using Mamdani’s Direct Method. Then the range for the trading price will be determined based on the assessed attitude and the competition in the market using the fuzzy reasoning technique. The final transaction price is calculated after considering the conflicting attitudes of the seller and the bidder toward selecting the transaction price.

Keywords: Attitudes, Bidding Strategy, Electronic Commerce, Fuzzy Sets, Software Agents

1. INTRODUCTION

The advent of electronic commerce have dramatically progressed the traditional trading mechanisms i.e. online auctions (e.g. eBay, Amazon etc.) and has turned up as a powerful tool to allocate goods and resources (Gimpel, Jennings, Kersten, Ockenfels & Weinhardt, 2006). Disclosure to the new market and prospects caused by online trading has augmented the sellers and buyer concerns. Online auctions has raised its significance as a constituent for research as it offers convenience to the traders over traditional auctions; buyers and sellers are not required to go to any specific geographical location, buyers can bid and buy at any time of day, sellers can economically reach a larger...
market for their goods, and large groups of buyers can be aggregated on short notice.

The emergence of software agent technology has set up an innovative framework for the online auction mechanism. Software agents have become an integral component of the online trading for buying and selling the goods due to its extraordinary adaptive and trainable capabilities. These software agents represent expert bidders or sellers to fulfill their requirements and belief and consequently are trained to achieve these aims. The software agents can perform variety of tasks similar to analyzing the current market situation to predict the future trends, deciding the bid amount at a particular moment of time, evaluating different parameters of the auction, monitoring progress of the auction and many more. These negotiating agents outperform their human counterparts because of their systematic approach to perform complex decision making situations (Das, Hanson, Kephart & Tesauro, 2001). So there are more openings of maximum profit and contentment for the expert bidders or sellers. The software agents make decisions on behalf of consumer and endeavor to guarantee the delivery of item according to the buyer’s preferences. For this to be effective these agents must have the prior knowledge of the auction’s characteristics whether these are certain or uncertain.

The agents can use different auction mechanisms (e.g. English, Dutch, Vickery etc.) for procurement of goods or reaching agreement between agents. However, in many applications, these simple auction protocols are inadequate because there are multiple sellers and multiple buyers who want to trade simultaneously. Such auctions are called double auctions (Anthony & Jennings, 2003). A slightly complex kind of double auction is the continuous double auction (CDA) in which buyers submit increasingly higher bids and sellers submit increasingly lower asks. A transaction occurs when the highest bid is at least as high as the lowest ask. In these auctions buyers are faced with difficult task of deciding amount to bid in order to get the desired item matching their preferences.

Much research has already been done by the researchers to formulate different bidding strategies to be adopted by the software agents according to the changing market situations (Kowalczyk, & Bui, 2000; Sim & Wang, 2004; Anthony & Jennings, 2003; Stone, Littman, Singh & Kearns, 2001; Luo, Jennings, Shadbolt, Leung & Lee 2003). However, there is no optimal strategy that can be used in all cases. The bidding strategies have been designed in which agents exhibit a number of characteristics like; adaptive to the latest state of the environment, can make some degree of compromise when generating and responding to bids, flexible in setting and adjusting thresholds of acceptable price, and needs to be able to manage his behaviors by time if there is a fixed deadline for the auction. Strategies based on flexible negotiation agents perform better as compared to the strategies based on fixed negotiation agents (Ma, & Leung, 2007; Faratin, Sierra & Jennings, 1998).

The bidding strategies for the software agents can be static or it may be dynamic (Murugesan, 2000). The static agents may not be appropriate for the negotiating market situations like extent of competition may vary as traders leave or enter into the market, deadlines and new opportunities may increase the pressure. The dynamic or we can say flexible negotiation capabilities for software agents in the online auctions have become a central concern (Ma, & Leung, 2007). Agents need to be able to prepare bids and evaluate offers on behalf of the users they represent with the aim of obtaining the maximum benefit (He, Leung, & Jennings, 2003) for their users according to the changing market situation.

This paper advances the state of the art in the following ways. In this paper we focus on the design of a novel bidding strategy based on the above mentioned factors to be used by the software agent to submit bids and asks in a series of continuous double auctions (CDAs). A novel fuzzy competition and attitude based bidding strategy (FCA-Bid) for continuous double auction is designed in which the best transaction price is calculated on account of the
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