Autonomous Seller Agent for Multiple Simultaneous English Auctions

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ABSTRACT

The growth of online auction is due to the flexibility and convenience that it offers to consumers. In the context of online auction, deriving the best reserve price can be associated to the seller’s optimization problem. Determining this reserve price is not straightforward due to the dynamic and unpredictable nature of the auction environment. Setting the price too high will lead to the possibility of no sale outcome. Putting the price too low may produce a sale with less profit due to its lower selling price. The authors propose a strategy to derive the best reserve price based on several selling constraints such as the number of competitors (sellers), the number of bidders, the auction duration, and the profit the seller desired when offering an item to be auctioned. However, to obtain the best performance, the strategy must be tuned to the prevailing auction environment where the agent is situated. This paper describes the seller agent’s performance under varying auction environments. The purpose of the experimental evaluation is to assess the ability of the agent to identify its environments accurately to enable it to come up with the best reserve price.

Keywords: Auction Theory, English Auction, Heuristic Approach, Online Auction, Re-Auction, Reserve Price, Risk Type Seller, Seller Agent, Seller Strategy, Selling Algorithm

INTRODUCTION

The growth of online auctions has enabled a large multitude of goods and resources which hitherto would have been too uneconomical to be traded over the Internet (Binder, Mori, Portabella, Tamma, & Wooldridge, 2004). Nowadays, most sellers are looking for online venues to improve their exposure of goods, to reduce the marketing and sales cost, as well as to increase their sales volumes, profit and revenues (Reynolds, Gilkeson, & Niedrich, 2007). Online auction is a process where a good or service is sold through a competitive bidding procedure to the highest bidder(s) (Beam & Arie, 1998). To date, there are 2558 electronic auction companies listed (http://internetauctionlist.com/Search.asp) and the number of online auction houses is increasing over time. Among the most popular auction houses are eBay, WebStore, eBid, OnlineAuction, and Overstock. eBay however has emerged as the online market leader with sales totaling

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to USD14.7 billion excluding vehicles (http://investor.ebayinc.com).

There are four single-object auction types which are widely used and analyzed both theoretically and practically within the context of auction literature (Wurman, 2001). This includes the ascending-price auction (English auction), the descending-price auction (Dutch auction), the first-price sealed-bid auction, and the second-price sealed-bid auction (Vickrey auction). A single-object auction can be also held using different formats based on its different rules of games. The selling format includes the no reserve price auction (no reserve price for the item), the public reserve price auction (the price is publicly announced), the private reserve price auction (the price is not announced) and the buy it now auction (the item can be sold at a known fixed price). In this context, reserve price is defined as the smallest price at which a seller is willing to sell a good or service. Keeping the reserve price secret is a way of restoring the linkage of price paid to the purchased object by inducting a greater participation, thereby increasing the seller’s profit (Vincent, 1995). Mathematically, this result is consistent with findings from McAfee and MacMillan (1987a) which indicated that maintaining the price uncertainty among the bidders will result in the increase of the seller’s profit. In many auctions, sellers will typically use the secret reserve price in their auctions and this phenomenon has been documented by several authors (Ashenfelter, 1989; Hendricks, Porter, & Wilson, 1994; Elyakime, Laffont, Loisel, & Vuong, 1994).

The widespread nature of Internet auctions has invited a rich subject of study with respect to the goods exchange mechanisms (Lucking-Riley, 1999). To date, auction has been used as a form of price discovery. In online auctions, the seller’s main problem is to choose the best reserve price, or acceptance rule, during each round of auction (Grant, Kajii, Menezes, & Ryan, 2006). Setting a high price may not result in a sale, whilst setting a low price may result in the item being sold at an unsatisfactorily low price (Law & Anthony, 2007). In cases when the item is auctioned off, the profit the sellers obtained is incredibly low and is way below the market price. For this reason, a great deal of attention has been devoted in deciding and setting the reserve price for use in online auction settings such as in Harris and Raviv (1981), Maskin and Riley (1980), Steven (1979), and Riley and Samuelson (1981).

Several critical issues must be considered when sellers offer an item to be auctioned. At any point in time, there are multiple auctions that are selling the same item simultaneously. They may organize their auctions using different selling choices with different start bid price, reserve price, and also the selling duration. Also, bidders tend to appear in a random arrival process with varying bidding behaviors and with the intention of obtaining the item at the lowest price. Each bidder has his own valuation of the item that he is interested in and this value is not known to the seller. In a real auction, the number of competing sellers and the number of bidders who will be participating in the auction are unknown. These issues complicate the strategic setting of the reserve price of an item.

In this work, we study the market in which sellers compete by offering auctions with homogeneous goods for buyers. To cope with the uncertainty of the price determination inherent in multi auction context is a complex decision making problem (He, Jennings, & Prugel-Bennet, 2006). Due to the resale options subjected to re-auction (Grant et al., 2006), setting up the reserve price for a given item to be auctioned has become more complicated. There is no clear-cut in deciding the best reserve price (Katkar & Riley, 2006) since observers are always uncertain of the exact amount of the reserve price, as only the upper bound (where price is met) and the lower bound (where price is not met) are disclosed. Particularly, several factors must be considered when deciding for the single optimal price (Law & Anthony, 2008). Firstly, we are uncertain on the number of competitors who will be competing as it is possible to have multiple sellers selling the same item. Secondly, we cannot determine the
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