Internet Auctions:
Selected Issues and Problems

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Auctions are one of the important mechanisms for selling items on the Internet. Most Internet auctions follow an English auction format, but such auctions can last for many days. Some bidders have an urgent need of the item on auction and are unable to wait till the end of the auction for the item. Such bidders can make use of a new type of bid called a Timed bid. A Timed bid has a bid value and a time of action. The bid value is significantly higher than the current going price, and the time of action is the time by which the Timed bidder wants the item, which typically is much before the pre-announced auction close. The auctioneer must decide prior to the time of action whether to accept the Timed bid. If he accepts the bid he allocates the item to the Timed bidder, thereby terminating the auction in case only one unit of a single item is being auctioned. If he rejects the Timed bid, the auction proceeds without interruption but the Timed bidder leaves the auction irrevocably.

A Timed bid can be public or private. A Public Timed bid is broadcast to all bidders as soon as it is placed, while a Private Timed bid is a secret contract between the Timed bidder and the auctioneer. Since the Timed bidder has an urgent need of the item, he has a higher valuation of the item at the time of action than at other

times. This provides an opportunity to both the Timed bidder and the auctioneer to realize additional gain from the auction process. In this thesis, we compare the expected revenue of the auctioneer from Timed bid auctions against that expected from English auctions. We show that Public Timed bid auctions yield a higher expected revenue to the auctioneer than English auctions. For Private Timed bid auctions, we find a lower bound on the expectation of the revenue to the auctioneer. This lower bound is shown to be higher than the expected revenue from English auctions when eight or more bidders participate in the auction.

For a Public Timed bid auction, the decisions to be taken by the auctioneer are quite simple in nature, and it would be possible to design a software agent that can do his work. This agent will keep track of the going price and arbitrate among competing Normal and Timed bids. However, to evaluate Timed bids in a Private Timed bid auction, the auctioneer needs to predict the final winning price in an auction that is still in progress. In this thesis, we present two methods for predicting final prices in Internet auctions. These methods examine available data on past Internet auctions of items like laptops, cameras and phones. However, Internet auctions of these items experience large number of last minute bids, called snipes. To characterize sniping, we examine data on sniping derived from camera and laptop auctions downloaded from eBay. A simple probabilistic model is proposed that assumes that an auction that already has a snipe is more likely to attract another snipe than an auction that has not been sniped. This model helps to explain the observed data on the number of auctions with i snipes, $i > 1$. Another critical issue in sniping is the timing of a snipe. Because of uncertainties regarding communication delays, a bid inputted into a client machine t seconds prior to the end of the auction, where t is small, might not get registered at the server before the closing time. Assuming that the probability a snipe would be registered successfully varies as the complement of a negative exponential in t, it is possible to estimate the time at which a bidder should plan to input a snipe

on her client machine to maximize her probability of winning the auction. The time so derived can be correlated with the distribution of snipe timings observed at the server.

This thesis proposes two methods, one based on heuristics and the other based on Artificial Neural Networks (ANN) for predicting final prices in Internet auctions. The heuristic method uses two kind of graphs, called Bid Arrival Plots and Appropriate Level Plots, that are constructed using data available from Internet auction sites. By a careful examination of the graphs, it is possible to forecast the final bid value of an auction that is still in progress. The methodology was applied to eight different auctions at 32 time instances. It predicted the final winning prices fairly closely on most of the test cases. We were also able to associate a risk measure with a prediction. However, in some test cases, the methodology indicated that the current auction had not progressed long enough for a fair prediction to be made. The ANN based method uses back-propagation neural networks as building blocks for making prediction of final prices. It classifies auctions into different auction classes. An incomplete auction is first classified, and then the corresponding neural network is used to make the prediction of the winning price. Results are reported on three data sets, one each for camera, laptop and phone auctions on eBay. These methods of predicting final prices in Internet auctions can be used as a Decision Support System for holding Private Timed bid auctions.

Papers from this Thesis

Conference Papers

Saroop, A. & Bagchi, A. (2000) Decision support system for Timed bids in Internet auctions. In *Proc. WITS-2000, tenth annual workshop on information technology and systems* (p. 229–234). Brisbane, Australia.

Saroop, A. & Bagchi, A. (2001) Expected revenue in Internet auctions in the presence of Timed bids. In *Proc. WITS-2001, eleventh annual workshop on information technology and systems* (p. 151–156). New Orleans, USA.

Saroop, A. & Bagchi, A. (2002) Artificial Neural Networks for predicting final prices in eBay auctions. In *Proc. WITS-2002, twelfth annual workshop on information technology and systems.* Barcelona, Spain.

Under Review

Saroop, A. & Bagchi, A. (2003) Sniping in eBay auctions: A data driven analysis.