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A Survey on Automatic Bargaining Using Machine Learning

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ABSTRACT: Towards the end of this decade e-commerce has been evolved a lot and has really changed our world. Almost every product is just a click away. These online retailers are also very well able to build confidence in customers about the quality and genuineness. Electronics, household goods, footwear, clothes are among the most popular online purchased items, even ordering food online is very common. Even most of the times its easy to order online rather to visit shop. Availability of Internet to users mainly through smart phone (since even a person does not have a laptop/desktop he has a smart phone) has brought this revolution. So clearly e-commerce is the future, even retail shops of many kinds may vanish. Though e-commerce sites offer a lot, but even today one thing is missing that is “Bargaining”. Even today for the most of shoppers bargaining is the most attracting charm of the local market. So if we were able to provide this feature of “Bargaining” in e-commerce sites it will prove a milestone.

KEYWORDS: Automatic Negotiation; Automatic Bargaining; E-commerce; Machine-Human Negotiation; Machine learning for negotiation; Dynamic pricing

I. INTRODUCTION

From the beginning when online retailing began, a lot of sites and tools came to help the shoppers so that they can find the available best deal (i.e. the lowest price). These are called “shopping bots”. These shopping bots are the website or apps which search the other sites for the same product and compare the prices and help buyer to find out the best available price by showing him the comparative pricing chart. But none of the site really offers the bargaining power to the shopper.

There is a lot of scope of bargaining in the E-Commerce sites, but it is not possible for the e-commerce companies to hire so many persons as it will be impractical and impossible to have one person per shopper. Also it will be very costly to have so much staff strength because their expenditure to maintain large staff will be more than their profit. Therefore surely some machine (software) is needed which can do bargaining on behalf of the seller. In this paper we have discussed about various researches in the field of automated bargaining.

II. LITERATURE SURVEY

In [1] authors did detailed study of possible causes of mistrust between human and negotiating Agent (Machine). They focus in reducing mistrust in Agent-Human negotiations. In this [1] they have analyzed the effect of proactive communication by the selling agent. For the analysis of effectiveness of proactive communication they considered two groups of quantitative measures. The first group - economic outcomes, which include the utilities derived from the agreement at both the individual and similar/joint level. The second group of measures pertains to the social - psychological outcomes of a bargain and includes measures of the Shoppers’s perceptions of the bargain, the other party, and the self. What they found in their experiment result that simple gesture of offering cooperative information exchange [1] can prove very effective in building the trust.

The research done by Naveen D. Chandavarkar [2] proposed bargaining for online transaction or online purchase by using historical data about the product. Price of a selected product is derived based on the analysis done on the historical data of a product sold. They considered history of last few days, to calculate next day’s price and this is



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called dynamic pricing. The price of a product for next day is calculated and set at the end of every day. The calculated price depends on the information collected from various sources like web sites, etc into the main server. When the bargaining starts their system compares the price set for the day with amount entered by the client for negotiation. Client has limited number of tries to bargain, at the end either he can get best deal or exit from the process.

Kumar Ujjwal & Jay Aronson [3] designed a selling agent using Genetic algorithm capable of negotiating with human buyers. In general any seller always want to maximize profit and any buyer want the lowest price, [3] their selling agent follow a “Tit for Tat” strategy i.e. different price for different customers depending on their bargaining strategy. This strategy will also take into account the prices entered by buyer in previous attempts. Hence the seller’s price at any time will also depend on buyer’s most recent offer. Initially the selling agent offers a price above minimum and below maximum (Min max set by seller) price. If the buyer accepts that price the deal is completed otherwise negotiation process begins where buyer make an offer price for purchasing, this can be accepted/rejected by the agent. At any point of time either buyer or seller accepts the price, the negotiation is a success and process stops otherwise fails. The selling agent propose subsequent price to the buyer depending on various factors.

In [4] authors take into consideration the depreciation factors of e-content while deciding a reasonable price range. In this they first determine the customer’s willingness to pay (WTP) and based on WTP the correct bargaining strategies are selected, and then depending on this strategy the price concessions are decided during bargaining process to offer the differentiated prices as well as try for maximum profits. The value of many items varies a lot with the people whom you are dealing with, how useful or relevant is that product for that Person, value also varies with the geography and time. To cope up with the business rivals, the prices of such items should change dynamically based on the factors (Depreciation factors OR Appreciation factors) that can affect its price.

In machine-driven bargaining, each and every agent participating will set some predefined parameters or preferences in their agent, like Min and Max threshold values, favourite product, his initial value, preferred brand, reservation value, deadline, dialogue strategy, etc. But he does not know or have very little information available regarding its opponent’s preferences and parameters. So there are chances that both agents can usually constitute failure or cause poor utility value at the tip of bargaining. Prior to the research [5] many others also proposed several algorithms for automatic bargaining with incomplete information, but the thing which was missing was that they were not utilizing the information provided by the opponent during the bargaining process and also they were finding it difficult to gain the information about opponent’s probability distributions of these parameters.

III. PROPOSED WORK

In the proposed system, we are going to build a centralized bargain engine, which will provide capability of automatic bargaining between shopper (Human) and e-commerce site, without any human intervention on seller’s side. Web services will be exposed which can be called by a e-commerce site to check if the price which customer entered is ok to make the deal or some negotiation required, if negotiation is required it will respond with “Reject-With-Re-Negotiate” and if shopper has exhausted the number of attempts available to him, it will respond with “Reject”. The key difference in proposed approach and pervious approaches is that not only the product behaviour and market conditions are taken into consideration previously but here the customer’s past and current behaviour will also play an important role in deciding the bargaining strategy.

The proposed system will consist of different modules. In this system data about the product sales, product value with region and timeline and customer behaviour history is very important. The data collection will be done through “Data Collection Module”. The “Integration Module” will integrate the different systems to collect the required data. The “Processing Module” will process the requests from clients to determine the bargaining strategy.

Following will be the steps involved in automatic bargaining:

1. Initially current maximum price of that particular product set by the seller will be offered to the customer.
2. Customer starts negotiating by entering the initial price which is lower than price offered by seller.
3. System Analyses MIN and MAX limit based on following factors.
 - a. Pricing/Negotiation history of the product Category.



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- b. Pricing/Negotiation history of the product group.
 - c. Pricing/Negotiation history of the product.
 - d. Negotiating behaviour of customer, derived from customer bargaining pattern from past purchases.
 - e. Negotiating behaviour of customer, derived from customer bargaining pattern from current ongoing negotiation.
 - f. Timelines, Product life cycle, Popularity.
4. Once MIN-MAX is determined, the customer willingness to pay (WTP) is determined.
 5. If the price which customer is demanding is falling towards/below MIN range determined above, then system will reject the negotiation and ask customer to try again, except otherwise.
 - a. Though customer price fall in range but rejection made in initial attempts just to tempt customer so that he can enter price greater than initial attempt.
 6. Customer again enters a new price which is greater than earlier.
 7. Once again step 3-6 are repeated, and system accepts/rejects the deal.
 - a. Deals towards MIN are also accepted if system finds that customer is not going to pay more and no other customer is going to pay more. This again depends on many factors.

IV. CONCLUSION AND FUTURE WORK

In “Automated Bargaining” (Machine-Human), various historical and current data like product sales history (in current and other sites) and customer behaviour (present and past) can be used efficiently to implement the automatic negotiating agent. We also proposed new system when successfully implemented will be able to provide the powerful feature of bargaining in E-Commerce sites. The proposed system will take in consideration many factors in deciding the bargaining strategy which were previously either not used at all or were not used together. And if it works, all shoppers win.

REFERENCES

1. Yinping Yang, Horacio Falcão, Nuno Delicado, & Andrew Ortony, “Reducing Mistrust in Agent-Human Negotiations”, IEEE Computer Society, 2014, Page 36-43.
2. Naveen D. Chandavarkar, “Dynamic Pricing With Historical Data Based Analysis For Online Bargaining”, IET, 2013, Page 136-140.
3. Kumar Ujjwal, and Jay Aronson, “Genetic Algorithm based bargaining agent for Implementing Dynamic Pricing on Internet”, Proceedings of the 2007 IEEE Symposium on Foundations of Computational Intelligence, 2007, Page 339-343.
4. Li Ma, Xiaofeng Li, “Bargaining-based E-Content Pricing for 3G Data Services”, 2008 International Conference on Advanced Computer Theory and Engineering, 2008, Page 79-83.
5. Fu-Ming Lee, Li-Hua Li, Pao-Hsiao Chen, “A Study on Dynamic Bargaining Strategy under Time Constraints and with Incomplete Information”, Proceedings of the 2005 IEEE/WIC/ACM International Conference on Intelligent Agent Technology (IAT'05) , 2005, page 1-6.

BIOGRAPHY

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