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E-Retailing with Automated Negotiation System for Sellers

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ABSTRACT: In this era of e-commerce, you can buy almost every product online. Online sellers are well able to win the trust of the buyers. You can purchase everything from electronics to personal care online, you can pay via multiple methods, you can get delivery in one day and many more facilities but one thing you can't do is you can't "Bargain". Here an approach of automatic bargaining using machine learning (ML) is presented which requires no human intervention from seller's side. In this approach product pricing trends, seller discounts, seller margins and customer bargaining behavior are used for deciding the bargaining strategy.

KEYWORDS: Automatic negotiation; automatic bargaining; e-commerce; human-machine negotiation; machine learning for negotiation; dynamic pricing

I. INTRODUCTION

Since the e-retail begun, many software providers came with tools and sites to assist the shoppers to find out the best deal. These tools are called "Shopping Bots", which basically searches multiple sites for the same product and compares the prices and help buyer by showing him all the prices in form of comparison chart, so that he can choose the best offer. Today also many sites still offer bargaining but that is manual i.e. human is involved at seller's side to negotiate. But this approach seems to be impractical and not scalable, as it is not possible for the e-commerce companies to hire so many employees. Large staff also means more cost to company, so the solution is software which can negotiate just like human sellers. Here first various past researches in this field are discussed, then the new system developed to attain "Automatic Bargaining" using machine learning is explained.

II. RELATED WORK

Trust is very important while finalizing any deal, same is with the human (Buyer) and a machine negotiating agent (Seller). The researchers in [2] did a comprehensive study of causes of mistrust in Agent-Human negotiations. Their main focus was to find ways to reduce the mistrust in this kind of negotiation so that the rate of reaching at a successful deal can be increased. In their experiment they considered two groups of quantitative measures, first economic outcomes and second social - psychological outcomes. They conducted their research keeping "Proactive Communication" by seller at the center and analyzed its effect on making successful deal. The first group - economic outcomes, which include the utilities derived from the agreement at both, the individual and similar/joint level. Second group of measures pertains to the social - psychological outcomes of a bargain and includes measures of the Shopper's perceptions of the bargain, the other party, and the self. Their final result shows that even a simple gesture of offering cooperative information exchange [2] can prove very effective in building the trust and can take deal to success.

The concept of dynamic pricing has also been researched by many, in this the price of a product for a day is derived based on the historical data of last few days of that product about its sale, demand and price offers by other sellers. In [3] researcher calculated price depending 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. System has limited the client with maximum number of tries to bargain, at the end either buyer can get best deal or exit from the process if buyer breaches this limit.

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Genetic algorithm is also used in the field of automatic bargaining, Kumar Ujjwal & Jay Aronson [4] designed a selling agent using this algorithm to negotiate with human buyers. Every buyer wants lowest price and seller wants maximum profit, [4] this selling agent follow a "Tit for Tat" strategy i.e. different price for different customers depending on their bargaining strategy. Price entered by the buyer in previous attempt is also an input to their selling agent, hence seller's price will also depend on buyer's most recent offer. The process starts with the selling agent initial offers with a price above minimum and below maximum (Min max set by seller) price, then the buyer makes an offer price for purchasing, this can be accepted or rejected by the agent. At any point of time either buyer or seller accepts the price, then the negotiation is a success and process stops, otherwise it continues and selling agent propose subsequent price to the buyer depending on various factors.

In [5], 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 different price to different customers and also it tries for maximum profit. 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, favorite 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 [6], 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. ALGORITHM AND SYSTEM ARCHITECTURE

This automatic bargaining system uses ML to act as a negotiating agent. The advantage of using ML is that it learns from the past negotiations and sales. While negotiating it takes into consideration the product sales and market profile, seller's preferences and buyer past bargaining behaviour.

A. *System Architecture & Workflow:*

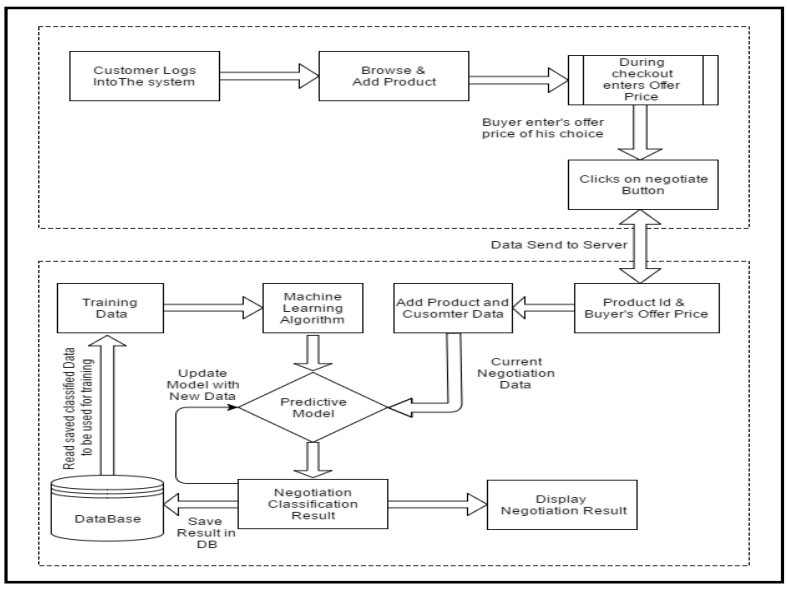

Fig.1. System Architecture

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Figure "Fig. 1" represents high level working of the automatic bargaining system in form of simple workflow diagram.

B. *Algorithm:*

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.
    b. Pricing/Negotiation history of the product group.
    c. Pricing/Negotiation history of the product.
    d. Negotiating behavior of customer, derived from customer bargaining pattern from past purchases.
    e. Negotiating behavior 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. 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. 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.

Following is the flow chart diagram of processing of the automatic bargaining system designed for the experiment conducted. It implements the algorithm explained above.

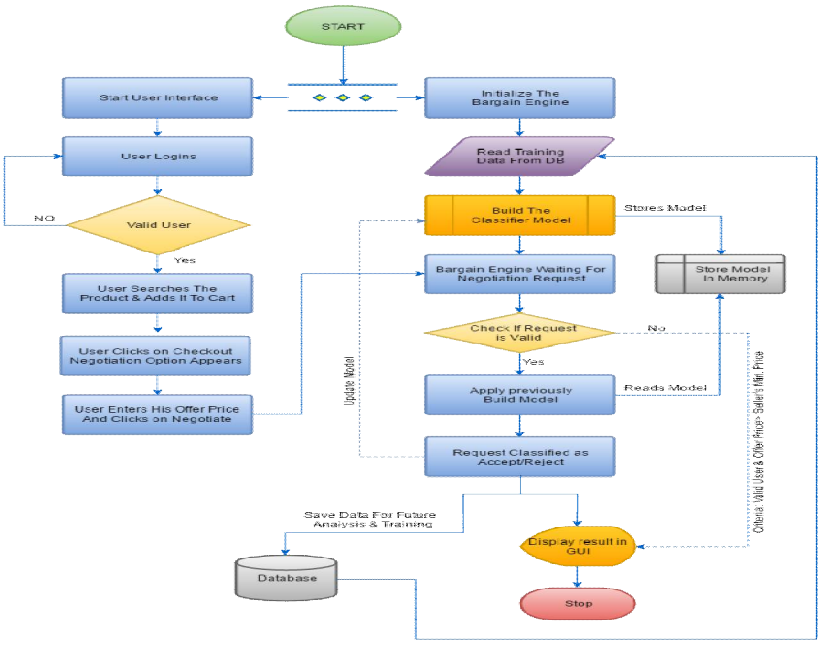

Fig.2. Flow Chart of the Automatic Bargaining System

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IV. EXPERIMENTAL SETTING

For the experiments the demo e-commerce site is built using broadleaf's enterprise ecommerce platform which is open source platform. For storing data H2 database is used which is a Java SQL database because it is very fast and open source. As ORM tool, Hibernate with JPA2 is used so that CRUD operations can be done very at high speed leveraging its L1 caching. For ML Weka-3.7.13 API is used, all these run on java platform, for the same JDK1.6 is being used.

For training and testing pricing and sales data of few products is being used. Pricing is prices of the products at different times, its min and max set by seller, its min and max in the market. Sales data like at what price customers purchased the product maximum, at what season it have high sales number. Negotiation trends for the product, negotiation trends for the product group, both of these values in percentage. Customer past negotiation index, it's the percentage of average value of what customer was able to bargain from sellers initial offer price. All these values are used in numeric form, mostly average or percentage value.

V. RESULTS

A. *Instance Classification Results:*

For evaluation, 4406 training instances were taken. In which 4318 instances were correctly classified and 88 instances were misclassified as presented in table 1. As this system follows the concept of incremental learning, it becomes more intelligent with time.

Table 1. Instances Classification Accuracy

Classified Instances	No. of Instances	Percentage
Correctly Classified Instances	4318	98.0027 %
Incorrectly Classified Instances	88	1.9973 %

B. *Confusion Matrix:*

The performance of a system is commonly evaluated using the data values calculated using the confusion matrix. The confusion matrix of the Automatic Bargaining System is presented in table 2.

Table 2. Confusion Matrix

a	b	Classified As
408	2	a=ACCEPT
86	3910	B=REJECT

C. *Detailed Accuracy Analysis:*

Detailed accuracy of the model by class regarding true positive rate (TP), false positive rate (FP), precision, recall, f- measure, receiver operating character area (ROC Area) and precision recall curve area (PRC Area) is presented in table 3.

Table 3. Detailed Accuracy by Class

Accuracy parameter	ACCEPT	REJECT	Weighted Avg.
TP Rate	0.995	0.978	0.980
FP Rate	0.022	0.005	0.006
Precision	0.826	0.999	0.983
Recall	0.995	0.978	0.980
F-Measure	0.903	0.989	0.981
MCC	0.896	0.896	0.896
ROC Area	0.984	0.984	0.984
PRC Area	0.804	0.998	0.980

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VI. CONCLUSION AND FUTURE WORK

This research gives a glimpse of intelligent unmanned bargaining processes in electronic commerce. In the current approach system's intelligence keep on increasing as here ML is used which continuously learns from the past experiences (negotiations and sales), this results in increased accuracy. Overall accuracy of the system is more than 98%.

Also for different kind of customers system behaves in accordance to their negotiation power, which helps in increasing seller's profit. So for the best negotiator system will be more strict and lenient for others. Though in this experiment small number of product and customer data is used for training and testing but in future if implemented in real e-commerce site it will prove a mile stone. As bargaining is an integral part of normal commerce, similarly automatic bargaining is future of electronic commerce.

REFERENCES

1. Shailendra Kumar and Sweta Kale, "A Survey on Automatic Bargaining Using Machine Learning", International Journal of Innovative Research in Computer and Communication Engineering, Vol.3, Issue 12, Dec. 2015.
2. Yinping Yang, Horacio Falcão, Nuno Delicado, & Andrew Ortony, "Reducing Mistrust in Agent-Human Negotiations", IEEE Computer Society, 2014, Page 36-43.
3. Naveen D. Chandavarkar, "Dynamic Pricing With Historical Data Based Analysis For Online Bargaining", IET, 2013, Page 136-140.
4. 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.
5. 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.
6. 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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