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A Survey on Price Competition Decisions in MCR and TOR

[1]A. VENKATA VAMSHI KRISHNA, [2]K. MAHESH

[1]PhD Scholar, Dept. of Computer Science and Engineering,Chaitanya Deemed to be University

[2]Assistant Professor, Dept. of Computer Science and Engineering,Chaitanya Deemed to be University

Abstract: *In this research, investigates deeply on price competition behaviour between mobile commerce retailers (MCR) and traditional off-line retailers (TOR) in m-commerce era.The problem addresses price competition decisions to assist retailers in deciding just the right price in MCR and TOR while still subject to uncertainty. Efficient time series forecasting techniques, auction-based market mechanism, Spot pricing, including the use of machine learning models, will help to reduce uncertainty and improve results by offering insight on future outcome-based decisions.At present, Machine learning should focus on customer relationship management in the application research of e-commerce tools. Although some scholars have also proposed the theory of applying machine learning technology to e-commerce dynamic pricing tools, many of theories are scattered and general. This paper provides a brief survey on the price competition behaviour between mobile commerce retailers and traditional off-line retailer using various machine learning models.*

Keywords: *Machine learning, customer pricing, mobile commerce retailers, traditional off-line retailers.*

I. INTRODUCTION

With the development of the Internet and the popularization of e-commerce, it has become easier for people to obtain more comprehensive information on goods and services. Changes in the price of goods or services will also have an impact on consumers' shopping behavior in the shortest time, which directly affects corporate profits. To maximize efficiency, companies often adjust the prices of goods or services regularly or irregularly based on certain factors, which is also consistent with the goal of deep reinforcement learning in the field of artificial intelligence. The goal of deep reinforcement learning is to maximize long-term benefits. Therefore, the technical means of deep reinforcement learning can achieve the intelligent pricing of goodsor services. The e-commerce customer's purchase behavior prediction makes a real-time prediction of an online customer's purchase tendency behavior based on the behavioral laws contained in the consumer's historical access click

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operations, server logs, browsing records and product feedback information. Therefore, customers can recommend products, formulate marketing strategies, and determine the purchase and shipment of platform products. Dynamic pricing is a strategy for enterprises to dynamically adjust commodity prices based on customer demand, their own supply capacity and other information to maximize revenues [1], and some scholars also call it personalized pricing. With the continuous development of artificial intelligence technology, increasingly more scholars have sought to use intelligent methods to solve dynamic pricing problems. Deep reinforcement learning is one of the most widely used technologies. It is inspired by the ability of people and animals in nature to adapt to the environment effectively. Learning from the environment through continuous trial and error is an important branch of machine learning. It has a very wide range of applications in the fields of artificial intelligence problem solving, multiagent control, robot control and motion planning, and decision-making control [2], Learning from the environment is one of the core technologies of intelligent system design and decision-making, and it is also a key issue in dynamic pricing in strategy research. The development is of the Internet, increasingly fierce market competition, and the need for customer management have transformed the pricing model of commercial enterprises from fixed prices to dynamic pricing. This transformation relies heavily on the development of the Internet, market competition, and customer management needs. Dynamic pricing in an e-commerce environment is based on the customer's value of a subproduct or service and a dynamic price adjustment strategy for different customers or commodities. Sellers can achieve the goal of dynamic pricing by integrating customer databases that meet specific standards of target customers. When the quantity demanded is random and price sensitive, dynamic pricing becomes an effective method to maximize profits. Varying, dynamic prices are an important feature of e-commerce pricing. Effectively formulating dynamic pricing strategies is an important factor for enterprises to succeed in the field of e-commerce. E-commerce companies need to adopt four methods of dynamic pricing decision-making strategies, namely, a time-based pricing strategy, a market segmentation and limited rationing strategy, a dynamic marketing strategy, and comprehensive application based on dynamic pricing. The time-based pricing strategy is implemented according to the price difference that consumers can bear at different times. The key is to grasp the

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psychological difference of customers' price tolerance at different times [3]. The basic principles of the market segmentation and limited rationing strategy are as follows: using different channels, different times, and different energy expenditures, customers have different price tolerance psychologies; companies have developed special product and service portfolios; and companies differentiate pricing based on different product configurations, channels, customer types, and times. The dynamic marketing strategy takes advantage of the powerful advantages of the Internet to quickly and frequently implement price adjustments based on changes in supply and inventory levels to provide customers with different products, various promotional offers, multiple delivery methods, and differentiated products. In addition, in the actual application process, the enterprise may consider implementing a certain strategy individually or combining strategies. When formulating pricing strategies, the best approach is to experiment with specific customer groups, select the best pricing model, and then adjust the model accordingly. In dynamic pricing, companies can use some modeling methods, such as inventory models, datadriven models, game models, machine learning models, and simulation models, to assist analysis and decision-making

Pricing in the online world is highly transparent & can be a primary driver for online purchase. While dynamic pricing is not new & used by many to increase sales and margins, its benefit to online retailers is immense. The proposed study is a result of ongoing project that aims to develop a generic framework and applicable techniques by applying sound machine learning algorithms to enhance right price purchase (not cheapest price) by customers on e-commerce platform. This study focuses more on inventory led e-commerce companies; however, the model can be extended to online marketplaces without inventories. Facilitated by statistical and machine learning models the study seeks to predict the purchase decisions based on adaptive or dynamic pricing of a product. Different data sources which capture visit attributes, visitor attributes, purchase history, web data, and context understanding, lays a strong foundation to this framework.

Pricing in electronic commerce is based on bargaining. Pricing models that can fast change prices during transaction on the consequence of the buyer's needs is beneficial to electronic commerce. Demand sensitive model is one of the pricing models that can he used for fast changes of prices in electronic commerce. Price setting algorithm for demand

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sensitive model helps sellers to get decision variables, price per noit that maximizes profit for the qnantity ordered by buyers

Machine learning (ML) is a field of inquiry devoted to understanding and building methods that 'learn', that is, methods that leverage data to improve performance on some set of tasks. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as training data, in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks. A subset of machine learning is closely related to computational statistics, which focuses on making predictions using computers, but not all machine learning is statistical learning. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a related field of study, focusing on exploratory data analysis through unsupervised learning. Some implementations of machine learning use data and neural networks in a way that mimics the working of a biological brain. In its application across business problems, machine learning is also referred to as predictive analytics. Machine learning approaches are traditionally divided into three broad categories, depending on the nature of the "signal" or "feedback" available to the learning system.

II. LITERATURE SURVEY

In this review, value creation in mobile contexts are described from both a consumers' and the retailers' perspective as the value of mobile marketing for consumers, and the value of mobile marketing for retailers. The value of mobile marketing for consumers is further divided into mobile device shoppers and consumer perceived value benefits and sacrifices of mobile marketing. The value ofmobile marketing for retailers is divided into the improved value of mobile marketing, and realizing potential value in mobile marketing.

Guitaoet al. [2023] In accordance with the consumer experience, a dynamic optimization model of a retailer inventory system was established in this research. Based on the optimal control theory, analyze the optimal control strategies under four sales modes: online, offline, BOPS, and BOPS-PLUS (BOPS and buy

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offline online-logistics distribution). Through numerical experiments, the inventory control strategies and optimal discounted profits under the four modes are compared and analyzed. The results show that the optimal experience investment and dynamic pricing levels gradually decrease with time, and the inventory state has a vital influence on the discounted profit of the system. The traditional dual-channel retail model is optimal when the channel inventory is not out of stock. In situations where channel inventory is in short supply (both online and offline), a deeply integrated omnichannel retail mode BOPS-PLUS is best.

Roya Soltani et al. [2022] The present study aimed at modelling optimal pricing in a multi-level SC, including suppliers, retailers, and customers, where customers place demand for different products.The proposed model sets pricing and ordering, determines delivery centers, and chooses routes and vehicles to maximize the SC profits. The model was devised using the combined method of simulated annealing and red deer with approximate data to sell mobile products and accessories. The results indicated that customers tended to go for online shopping more than in-person shopping. Increasing the product cost reduces demand for the product and increases demand for a competitive product. In general, the decrease in demand for a product is higher than the growth of demand for a competitive product, i.e., the decrease in demand reduces the need for shelves

Hao Fu et al. [2008] With game theory as research tool, this paper investigates deeply on price competition behavior between mobile commerce retailers (MCR) and web site retailers (WSR) in m-commerce era, elicits 2 kinds of market structures. Furthermore, it gives out perfect equilibrium prices as well as market scale under each condition of market structure. On this basis, two related propositions and two related conclusions are pointed out. First, it gets MCR's and WSR's critical prices. Secondly, as the penetrate rate of m-commerce increasing, two kinds retailers' perfect prices will decrease, and there exists a stable relationship between the ratios of speed declining.

Zhou et al. [2018] With the rapid development of the Internet and data-processing technologies, Internet sentiment analysis can be used to explore many possibilities, from Internet news about products or the influence of product price to the influence of sale behaviour and important brand strategies. In this paper, we analyse news affecting the price of

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products, and establish a new model for price prediction. The results show that significant news events have an impact on the sale prices of electronic products, and can improve the accuracy of price forecasts. Thus, the contribution of this paper is to propose a new forecasting model for the price of e-commerce products.

Xiaoli et al. [2008] With loss aversion and game theory as research tools, this paper investigates deeply on price competition behaviour between mobile commerce retailers (MCR) and traditional off-line retailers (TOR) in m-commerce era, elicits 2 kinds of market structures. Furthermore, it gives out perfect equilibrium prices as well as market scale under each condition of market structure. On this basis, two related propositions are pointed out. First, it gets MCR's and TOR's perfect prices in competition, further analysis can find that in the competition between MCR and TOR when these two kinds of retailers coexist, two exterior factors and three inner factors decide the price difference. Second, as the penetrate rate of m-commerce increasing, perfect prices of two kinds of retailers will change, and the ratio of their change speed will be stable. Therefore, this research not only analyses price competition behaviour between MCR and TOR in m-commerce era, but also provides basic theoretical foundation for further behavioural research on m-commerce pricing.

Yael_Perlman et al. [2022] This paper studies a duopolistic market consisting of a conventional offline retailer and an online retailer, each of whom offers a competing benefit (attribute): Specifically, the conventional retailer is superior in terms of social aspects of the shopping experience, such as helpfulness of salespeople, whereas the online retailer offers the possibility of rapid and convenient procurement. Importantly, customers are assumed to be heterogeneous in the extent to which they value each attribute. We first study a scenario of a fully-covered market, in which consumers' valuations of the attributes are high enough that every consumer purchases a product from one of the channels. In this case, we derive closed-form expressions for the retailers' pricing strategies, their expected profits, and their market shares. We find that, surprisingly, under some conditions, the online retailer's price is higher than the conventional retailer's, despite the lower costs incurred by the former.

Maria Cristina et al. [2021] Dynamic pricing is a long-term pricing model that can increase the conversion rates of your e-commerce store. You can use A.I applications to offer different prices for the same product to different customers,

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depending on unique personal factors. Advanced applications should take into account many other factors, such as the prices charged by competitors that buyers have previously sponsored, the current demand for the product, cross-price elasticity, halo ratios, and so on. Some AI-based dynamic pricing models can also implement in-depth learning capabilities to deduce the prices that each customer will be willing to pay for a product or service at some point.

Anupama Namburuet al. [2022] E-commerce platforms have been around for over two decades now, and their popularity among buyers and sellers alike has been increasing. With the COVID-19 pandemic, there has been a boom in online shopping, with many sellers moving their businesses towards e-commerce platforms. Product pricing is quite difficult at this increased scale of online shopping, considering the number of products being sold online. For instance, the strong seasonal pricing trends in clothes—where Brand names seem to sway the prices heavily.

H. W. Ahmad et al. [2016] This research predicts the start of day and current prices of a specific product at every outlet in a given city using four vector autoregression models that incorporate the historical retail prices of the product at a target outlet and at competing outlets. The models also include the estimated wholesale price of the product. Three ways of identifying local competitors are considered. The wholesale supplier is that with similar pricing patterns to a target outlet. The proposed models outperform a simple autoregression approach that does not include local competitors or wholesale prices in experiments carried out using data obtained from outlets in five North American cities.

Ludvig Lundström et al. [2021] The development of e-commerce has seen a considerable rise in the last decade, with many companies starting online stores. While there is research regarding e-commerce, the concept of dynamic pricing within the e-commerce ecosystem still has a gap. This study seeks to explore and present how a dynamic pricing system can be delivered within an ecommerce setting. With insights from DynamicX, an intelligent dynamic pricing system organization, and through thematic analysis, the result is presented through four themes regarding e-commerce and dynamic pricing. The findings presented in the discussion related to the past, the present, and the future of dynamic pricing systems in e-commerce with a focus on context, technologies, and practices.

Jeevan et al. [2018] Stock Market has started to attract more people from

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academics and business point of view which has increased. So, this paper is mostly based on the approach of predicting the share price using Long Short-Term Memory (LSTM) and Recurrent Neural Networks (RNN) to predict the stock price on NSE data using various factors such as current market price, price-earnings ratio, base value and some miscellaneous events. We use a numerical data and recommended data for a company selected from collaborative and content-based recommendation system. So, this paper is all about selecting the company based on the recommendation system using collaborative and content based on selecting a company for the machine learning model based on the LSTM and RNN method

Kunal Pahwaet al. [2019] Stock market or Share market is one of the most complicated and sophisticated way to do business. Small ownerships, brokerage corporations, banking sector, all depend on this very body to make revenue and divide risks; a very complicated model. However, this paper proposes to use machine learning algorithm to predict the future stock price for exchange by using open-source libraries and preexisting algorithms to help make this unpredictable format of business a little more predictable. We shall see how this simple implementation will bring acceptable results. The outcome is completely based on numbers and assumes a lot of axioms that may or may not follow in the real world so as the time of prediction.

Harsh Valechaet al. [2018] In the ultramodern age of technology, anticipation of market trend is very important to observe consumer behaviour in this competitive world as trends are volatile. Building on developments in machine learning and prior work in the science of behaviour prediction, we construct a model designed to predict the behaviour of Consumer. The aim of this research paper is to examine the relation between consumer behaviour parameters and willingness to buy. First, we investigate to find relationship between consumer behaviour to buy products on changing parameters such as environmental factor, organizational factor, individual factor and interpersonal factor. Thus, this paper proposes time-evolving random forest classifier that leverages unique feature engineering to predict the behaviour of consumer that affect the choice of purchasing the product significantly. Results of random forest classifier are more accurate than other machine learning algorithm.

III. RESEARCH PROBLEM

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Categorizing whether a web shop session will end in a purchase or not, is a relevant use case in the context of predictions in e-commerce. This categorization followed by the display of gift cards to non-purchasing customers, to convince them of a purchase nonetheless, has proven to increase turnover of a large German clothing retailer. A variety of possible prediction models as well as different data sources exist to carry out such predictions. This paper aims at retrieving well-suited prediction models and comparing their performances across different data types, such as static and dynamic data, to establish how customers can be best classified as buying or no buying.

IV. CONCLUSION

Pricing research is a research method that aims to discover customers' willingness to pay for a product or a service. The goal of pricing research is to measure the impact of change in prices on the demand of any offering as well as to determine the optimal price for new products. The most important pricing objective is to maximize the profitability of your business, either in the short or long-term (but preferably both). This paper provided the brief survey on the price competition behaviour between mobile commerce retailers and traditional off-line retailer using various machine learning models.

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