A Study on Application of Predictive Modelling Techniques in New Product Pricing in E-Commerce

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Abstract

Predictive modelling of new product pricing in e-commerce is a crucial application that leverages data-driven insights to optimize pricing strategies and enhance decision-making processes. In this dynamic and competitive online marketplace, accurately determining the right price for a new product can significantly impact a business's success. This abstract highlights key aspects of predictive modelling in the context of e-commerce pricing strategies. It begins by emphasizing the dynamic nature of the e-commerce landscape and the challenges businesses face in setting optimal prices for new products. It introduces the concept of predictive modelling as a powerful tool that utilizes historical data, market trends, and various relevant factors to forecast the most effective pricing strategies.

The research underscores the significance of data-driven decision-making in e-commerce, highlighting how predictive modelling can analyse vast datasets to identify patterns and correlations. By considering factors such as consumer behaviour, market demand, competitor pricing, and economic trends, businesses can gain valuable insights into the potential success of different pricing scenarios.

Furthermore, the research emphasizes the practical implications of predictive modelling in enhancing pricing agility. In the fast-paced e-commerce environment, the ability to quickly adapt pricing strategies based on real-time data becomes a competitive advantage. The abstract suggests that businesses can achieve this by implementing predictive models that

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continuously learn and evolve with new information, allowing for proactive adjustments to pricing strategies.

It highlights the transformative impact of predictive modelling on new product pricing in e-commerce. It stresses the potential for businesses to gain a competitive edge by harnessing the power of data-driven insights to optimize pricing decisions, adapt to market dynamics, and ultimately drive success in the ever-evolving online marketplace.

Key Words *: Pricing strategies, Dynamic marketplace, Market trends, Consumer behaviour, Competitor pricing, Economic trends, Online marketplace.*

Introduction

In the rapidly evolving landscape of e-commerce, where market dynamics shift swiftly and competition is relentless, the strategic pricing of new products stands as a critical determinant of business success. The challenge lies in navigating the complexities of this dynamic marketplace, where consumer behaviour, competitor actions, and economic trends influence purchasing decisions. Consequently, businesses seek innovative solutions to optimize their pricing strategies, and predictive modelling emerges as a powerful tool in this endeavour.

Predictive modelling in new product pricing is a data-driven approach that harnesses historical data, market trends, and various relevant factors to forecast and optimize pricing strategies. This abstract underscores the pivotal role of predictive modelling in addressing the challenges faced by e-commerce businesses in determining the right price for their new products. It emphasizes the dynamic nature of the online marketplace, where traditional pricing methods may fall short in capturing the intricacies of consumer behaviour and responding to real-time changes.

The research highlights the significance of data-driven decision-making in e-commerce and positions predictive modelling as a transformative solution. By analysing vast datasets encompassing consumer behaviour, market demand, competitor pricing, and economic trends, businesses can extract valuable insights to inform their pricing decisions. The abstract emphasizes that predictive modelling enables businesses to proactively identify patterns and correlations, providing a strategic advantage in crafting effective pricing strategies.

Moreover, the abstract stresses the practical implications of predictive modelling in enhancing pricing agility. In a fast-paced e-commerce environment, the ability to adapt pricing strategies swiftly based on real-time data becomes a competitive differentiator. The research suggests that businesses can achieve this by implementing predictive models that continuously learn and evolve with new information, enabling them to make proactive adjustments to pricing strategies.

In summary, this research aims to explore and validate the transformative impact of predictive modelling on new product pricing in e-commerce. By optimizing pricing decisions, adapting to market dynamics, and leveraging data-driven insights, businesses have the potential to gain a competitive edge in the ever-evolving online marketplace. The identified keywords—pricing strategies, dynamic marketplace, market trends, consumer behaviour, competitor pricing, and economic trends—frame the core elements of this research, guiding the exploration of predictive modeling's role in shaping successful pricing strategies in e-commerce.

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Objectives

To evaluate the effectiveness and accuracy of predictive models in anticipating optimal pricing strategies for newly introduced products.

To analyse the use of predictive models to understand customer behavior patterns concerning new product pricing, providing insights into consumer responses and preferences.

Scopes

Investigating the application of predictive modelling techniques in new product pricing in e-commerce. Exploring the challenges and opportunities in utilizing data-driven decision-making for setting optimal prices for new products in the online marketplace. Analysing the implications of predictive modelling for demand forecasting and customer purchase behaviour in the context of e-commerce. It aims to provide a comprehensive understanding of the challenges and opportunities in utilizing predictive modelling techniques for setting optimal prices for new products in the online marketplace. The paper also seeks to offer insights and recommendations for businesses seeking to leverage data-driven insights to optimize their pricing strategies and gain a competitive edge in the ever-evolving e-commerce landscape.

Methodology

This review paper is purely dependent on secondary data which involves collecting and analyzing the research studies which is previously published articles, publications which is related to data analytics in new product pricing in E-commerce. The data analyzing process will be analyzing all the papers and summarizing and identifying the key findings.

Literature review

Title: A Machine Learning Framework For Predicting Purchase By Online Customers Based On Dynamic Pricing

Author: Rajan Gupta* and Chaitanya Pathak

Year:2014

E - commerce online dynamic pricing has emerged as one of the most important forms because of its power to influence the purchasing behaviour of customers. This appropriately linked literature review previews the subject on online pricing transparency and a primary driver to purchases. The paper also discusses in broad with the wide applicability of dynamic pricing in other industries to include retail, automotive, mobile communication among others. Furthermore, the study explores the concept dynamic pricing which bases on factors such as competitor's pricing, supply and demand, and conversion rate. Some of the different models and strategies on dynamic pricing discussed include Segmented Pricing, Peak Use Pricing and Service Time Pricing. The review states that the dynamic pricing is taking a strong place in the e-business industry, where both online and traditional firms in the sector are opting to use this strategy as a means of attracting and maintaining the loyalty of their customers. With the use of machine learning algorithms, data mining and with big data technologies, adaptive or dynamic pricing will make customer purchase decisions the proposed framework. In the research, it focuses on customer segments and aims to improve the price-purchase right, not the cheapest price. Also discussed in the future extension of this study is a possibility on personalisation of adaptive pricing and purchase prediction in the framework. Overall, the literature review allows the

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scenario in which later the relevance and importance of dynamic pricing in online retail are realized and then sets up the framework for its application and evaluation.

Title: Pricing In Consumer Digital Markets: A Dynamic Framework

Author : Richard Reisman

Year : 2019

This literature review examines the evolving landscape of consumer decisions within novel pricing models, responding to the calls for further research (Grewal et al., 2012) and the inquiry into optimal pricing strategies considering customer, competitive, and consumer considerations (Marketing Science Institute, 2014, p. 9). The focus is on participative pricing and, specifically, the unique conceptual framework of Fair Pay. Distinguished by its consumer-empowered pricing decision-making process, Fair Pay stands out by allowing customers to set prices post-consumption, aligning with in-use value. Empirical evidence underscores the reduction of consumer uncertainty and the encouragement of reciprocity, where customer generosity leads to premium offers and perks. Notably, Fair Pay fosters ongoing dialogue between consumers and suppliers, employing a flexible, longitudinal approach to pricing decisions. The framework enables suppliers to set reference prices, guiding consumers while promoting understanding through requests for explanations. Crucially, Fair Pay takes a long-term, cyclical stance on customer relationships, creating a repeated game. By reinforcing fair customer behaviour with favourable offers and ensuring supplier satisfaction through fair payments, the framework establishes a balanced power dynamic. This approach, particularly effective in digital environments, facilitates a granular understanding of Pay What You Want (PWYW) mechanisms longitudinally and with individual customers, emphasizing the importance of trust-building for maximizing long-term value in repeated customer journeys (Greif and Egbert, 2016b).

Title: Modelling And Forecasting Dynamic Factors Of Pricing In Ecommerce

Author : Galyna Chornous , Yaroslava Gorbunova

Year :2020

In the contemporary competitive landscape, e-commerce emerges as a dominant force, presenting numerous advantages over traditional trading. These include the absence of maintenance costs, low market entry costs, low 'menu' costs, flexibility, and the ability to leverage substantial information for forming favourable prices. The information economy, especially in e-commerce, facilitates swift adaptation to market changes and consumer preferences, enabling companies to set optimal prices dynamically. Dynamic pricing, as a form of personalized pricing, offers benefits such as enhanced business profitability and the absence of direct price discrimination, addressing ethical concerns related to customized pricing .This study employs mathematical modelling, focusing on the successful implementation of dynamic pricing on the popular online platform Airbnb. Recognized as a leader in e-commerce, Airbnb's competitive advantages underscore the relevance of studying its successful experiences for increasing competitiveness. The study emphasizes the identification of dynamic factors influencing pricing and proposes the use of Partial Least Squares (PLS) regression as an effective tool for implementing personalized pricing strategies. The advantages of the PLS model lie in its ability to identify hidden predictors among collinear factors and its good performance in processing large information arrays. The study recommends PLS regression for all types of personalized pricing, aligning with the evolving landscape of behavioural characteristics in consumers, positioning it as a valuable tool in the toolkit for personalized pricing support**.**

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Title :A Multi-Series Framework For Demand Forecasts In E-Commerce

Author : Remy Garnier and Arnaud Belletoile

Year: 2019

This article addresses the critical need for accurate sales forecasts in the dynamic realm of E-commerce, where traditional univariate methods often fall short due to the short nature of sales time series. The proposed global model, leveraging Tree Boosting Methods, surpasses state-of-the-art models by exploiting non-linearity and cross-series information. The study introduces a pre-processing framework tailored to address inherent challenges in E-commerce data, including volatility. Notably, the business environment in E-commerce is characterized by complexities such as holiday effects, competitor behaviours, pricing changes, and short time series, necessitating advanced forecasting techniques. The article emphasizes the importance of accurate demand forecasts in the context of modern logistics, where just-in-time resupply is crucial for cost savings. It highlights the unique challenges posed by non-stationary historical data, short time series, and cannibalization effects in demand data. Recognizing natural groupings of products sharing similar properties, the study argues for the necessity of models that share information between time series, contrary to existing methods that typically treat different series independently. The proposed framework aims to improve prediction accuracy by exploiting correlations between series, particularly addressing the challenge of short time series history. The subsequent sections of the study delve into the formal definition of the problem, provide a review of previous work, detail the data pre-processing steps, introduce the boosting model, and present experimental setup and results on a real-world dataset. Overall, this research contributes to advancing the understanding and application of machine learning techniques for demand forecasting in the context of E-commerce.

Title: New Product Demand Forecasting In Retail Applying Machine Learning Techniques To Forecast Demand For New Product Purchasing Decisions.

Author : Aino Henio

Year : 2021

This thesis focuses on creating a robust method for forecasting new product demand in the retail sector, specifically tailored for purchasing decisions. The study evaluates various machine learning models and, after finding that regression methods did not yield feasible results, formulates the demand forecasting problem as a classification task. Five classification models are applied, and the evaluation criteria include prediction accuracy, precision, recall, and F1-score.

The XGBoost model emerges as the best-performing one, achieving an accuracy of 0.73, which is significantly higher than the benchmark model. The classes are derived from average daily sales measured in euros, providing a practical approach to forecasting without the need to predict daily demand fluctuations. The study acknowledges the inherent uncertainty in new product demand forecasts and suggests the implementation of the selected XGBoost model for purchasing decisions.

Despite the small performance differences observed between the tested models, the study considers the method successful in achieving the objective of selecting a forecasting approach with favourable accuracy, specifically tailored for the needs of the purchasing function. The implications of these findings and potential considerations for the case company, including the possibility of overfitting and the importance of ongoing evaluation with larger datasets, are highlighted. Overall, this research provides valuable insights into the application of machine learning models for demand forecasting in the retail context.

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Title : Demand Prediction, Predictive Shipping, And Product Allocation For Large-Scale E-Commerce

Author :Xiaocheng Li,a Yufeng Zheng,b Zhenpeng Zhou,c Zeyu Zhengd

Year : 2018

This paper investigates multiple operational challenges in large-scale e-commerce, utilizing extensive transactional data from Alibaba and Cainiao. The research explores three interconnected problems: multiple-product demand prediction, the introduction of a novel shipping mechanism termed Predictive Shipping, and the optimization of product allocation across multiple warehouses. The study begins with an in-depth exploratory data analysis, examining customer orders, transaction behaviour, inventory records, and fulfilment logistics data. The identified opportunities for improvement lead to the development of a joint demand prediction system, incorporating clustering-based model regularization for enhanced accuracy. A theoretical analysis and formulation of Predictive Shipping demonstrate its potential to lower costs by arranging shipping based on demand predictions before actual orders are placed. The paper also addresses the challenge of optimizing product allocation across warehouses through linear programming, considering the averaged outbound shipping cost.

Furthermore, the authors contribute to the field by designing specialized data visualization tools for large-scale e-commerce platforms, aiding in the identification and illustration of operational problems. The proposed methodologies are supported by real and synthetic data experiments. Overall, this research provides valuable insights into improving various aspects of e-commerce operations, demonstrating the practical implications of predictive analytics in demand forecasting, shipping mechanisms, and warehouse product allocation.

Title : Predictive Model For Customer Satisfaction In E-Commerce

Author :Kotsokechagia Maria

Year : 2021

The transformative impact of the Internet and e-commerce on consumer behaviour is evident in the way individuals seek product information, make purchase decisions, and share their experiences through online reviews. This shift in consumer dynamics presents both challenges and opportunities for businesses. While customers benefit from accessing valuable information, companies can leverage customer reviews to gain insights into satisfaction levels and adapt their strategies accordingly. The ability to offer personalized experiences and adapt quickly to customer needs is crucial in the current competitive landscape.

In this context, managing and deriving meaningful insights from vast amounts of customer data becomes a significant challenge. This paper explores the application of machine learning, specifically supervised learning, to predict customer review ratings. Three predictive models, including binary classification, multi-class classification, and logistic regression, are proposed and evaluated using a dataset of approximately 100,000 orders from e-market Oils shops.

The study reveals that the binary classification approach outperforms the others in terms of precision, recall, and F1-score. However, the investigation also identifies challenges related to imbalanced datasets, prompting suggestions for future research. The imbalance in class distribution within the dataset can be addressed through resampling methods, such as under sampling or oversampling, to enhance the overall performance of the predictive models. This research contributes to the

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understanding of leveraging machine learning for customer review prediction, emphasizing the need for addressing data imbalances to optimize model performance .

Title: E – Commerce Trends And Future Analytics Tools

Author: Premkumar Balaraman and Sabarinathan Chandrasekar

Year:2016

This paper investigates the evolving landscape of E-Commerce, aiming to assess changing trends and explore the pivotal information technologies shaping its future. Adopting a qualitative and descriptive approach, the study relies on secondary sources and content analysis. Findings reveal that information technologies have not only transformed traditional business practices but have also disrupted established value chains. Key shifts in E-Commerce include a focus on customer-centric approaches, collaborative web content, glocalization, and the pervasive impact of big data analytics. Social commerce and ubiquitous (mobile) commerce emerge as influential factors, significantly impacting online purchasing in both B2C and B2B business models. The paper categorizes emerging analytics into data analytics, network analytics, and mobile analytics, noting the flood of innovative products for managing and analysing big data. Successful technology adoption has led to advancements in payment channels, authentication processes, and overall payment system efficiency. The applications of big data analytics extend beyond E-Commerce to areas such as tax evasion prevention, smart transportation, congestion pricing, smart cities, disaster warning systems, smart agro supply chains, e-banking, e-healthcare, and energy conservation. The challenges posed by diverse data formats and communication conventions persist, hindering the realization of E-Commerce's full potential. The global connectedness introduces complexities in managing business processes with varied data exchange formats, vocabularies, and structures. As technology continues to advance, innovations impact electronic business operations and necessitate ongoing efforts for standardization and seamless global integration.

Title: Factors Influencing Consumer Behavior And Prospective Purchase Decisions In A Dynamic Pricing Environment—An Exploratory Factor Analysis Approach

Author :Vijay Victor, ORCID, Jose Joy Thoppan ORCID, Robert Jeyakumar Nathan ORCID and Fekete Farkas Maria ORCID

Year : 2018

This study focuses on understanding the factors influencing consumer behavior in the context of online dynamic pricing environments. Through an exploratory factor analysis, seven key factors are identified: shopping experience, awareness of dynamic pricing, privacy concerns, buying strategy, fair price perceptions, reprisal intentions, and self-protection intentions. The findings emphasize the importance of careful consideration in making dynamic pricing decisions, as they can significantly impact consumer reactions. The study's relevance extends beyond its specific focus on an Indian population, offering implications for global players in the E-commerce sector. With the Indian marketplace gaining critical mass and attracting major global players, understanding customer behaviour becomes crucial. The high growth trajectory of the Indian economy, coupled with a focus on digitalization, makes it an attractive market for global players like Amazon and Walmart. To navigate this dynamic landscape successfully, addressing consumer concerns, improving perceptions of online pricing transparency, and promoting the positive aspects of dynamic pricing are essential. The study underscores the need for a deeper understanding of customer behaviour to mitigate reprisal attitudes and self-protection measures, preventing potential negative consequences such as avoidance of online channels or negative word-of-mouth. Ultimately, fostering a positive consumer experience and addressing privacy concerns will

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contribute to the success and sustainability of E-commerce platforms in rapidly growing markets like India.

Title : Data Mining Model for Predicting Customer Purchase Behavior in E-Commerce Context

Author: Orieb Abu Alghanam, Sumaya N. Al-Khatib, Mohammad O. Hiari

Year : 2022

The paper explores the significance of accurately predicting customer purchase patterns in the dynamic e-commerce market through data mining. With the rapid growth of e-commerce websites and fierce competition, understanding the relationship between customers and merchandise is crucial for staying in business and improving profits. The study proposes a data mining model that utilizes four classifiers (C4.5, J48, CS-MC4, and MLR) and the Apriorism algorithm for association rule mining to enhance prediction accuracy and provide personalized recommendations.

To address the challenges posed by big data in e-commerce, the study employs the K-means clustering algorithm to reduce dataset size, enhancing the runtime efficiency of the proposed model. The testing on the Northwind trader's dataset yields promising results with an accuracy of 95.2% when utilizing eight clusters. The research emphasizes the importance of leveraging machine learning techniques, such as decision trees and clustering algorithms, to extract valuable insights from vast datasets in the e-commerce domain.

The literature review underscores the role of data mining in extracting knowledge from extensive datasets, facilitating one-to-one marketing, personalization, increased sales, and customer retention. As e-commerce businesses aim to gain global advantages, understanding customer sentiments and preferences becomes paramount. The application of machine learning techniques, particularly in predicting customer purchase behaviour, is identified as a critical component for the success of online retail stores. The study addresses the challenges of dealing with big data in e-commerce and highlights the potential of ML algorithms in improving prediction accuracy and providing valuable recommendations for customers.

Findings of the study

Predictive modelling techniques play a crucial role in understanding customer behavior patterns concerning new product pricing in e-commerce.

2. Dynamic pricing in online retail, driven by machine learning algorithms and big data technologies, has the potential to influence consumer purchase decisions and preferences.

3. Data-driven decision-making, facilitated by predictive modelling, enables businesses to optimize pricing strategies and enhance decision-making processes in the dynamic and competitive online marketplace.

4. Understanding customer behaviour and addressing privacy concerns are essential for fostering a positive consumer experience in rapidly growing e-commerce markets like India.

5. Data mining models are instrumental in accurately predicting customer purchase patterns in the dynamic e-commerce market, aiding businesses in staying competitive and improving profits.

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6. The significance of dynamic pricing and the practical implications of predictive modeling are emphasized in enhancing pricing agility and adapting to real-time changes in the fast-paced e-commerce environment.

7. The application of predictive modelling techniques in new product pricing in e-commerce offers opportunities for demand forecasting, personalized pricing, and proactive adjustments to pricing strategies based on real-time data.

8. The study underscores the relevance of predictive modelling beyond its specific focus on the Indian population, offering implications for global players in the e-commerce sector.

9. Leveraging machine learning models for demand forecasting in the retail context can address the needs of the purchasing function and contribute to successful pricing strategies.

10. The evolving landscape of e-commerce, driven by changing trends, information technologies, and big data analytics, presents opportunities and challenges for businesses in optimizing pricing strategies and understanding consumer behaviour.

Example

Amazon:

Amazon is a pioneer in utilizing predictive analytics for its e-commerce operations. The company employs predictive analytics for personalized recommendations to customers based on their browsing and purchase history. This includes suggesting products similar to those a customer has shown interest in or purchased in the past. Predictive analytics also plays a crucial role in Amazon's supply chain management, helping forecast demand for products, optimizing inventory levels, and ensuring timely deliveries through services like Amazon Prime.

Netflix:

While not strictly an e-commerce company, Netflix is an example of a subscription-based service that heavily relies on predictive analytics. Netflix uses predictive analytics to recommend TV shows and movies to its users based on their viewing history, preferences, and behaviour. The recommendation engine analyses vast amounts of data to make personalized content suggestions, keeping users engaged and satisfied. Additionally, Netflix leverages predictive analytics to optimize its content creation strategy, making decisions about which genres and types of content are likely to be popular among its user base.

Importance of study

Enhancing Pricing Strategies: The research emphasizes the significance of predictive modelling techniques in optimizing pricing strategies for new products in the dynamic e-commerce landscape, enabling businesses to adapt to real-time changes and enhance pricing agility.

Data-Driven Decision-Making: The study underscores the importance of data-driven decision-making facilitated by predictive modelling, enabling businesses to gain valuable insights into customer behaviour patterns and preferences, ultimately leading to more informed pricing decisions.

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Competitive Edge: By accurately predicting customer purchase patterns and understanding the relationship between customers and merchandise, businesses can stay competitive in the rapidly growing e-commerce market and improve profits.

Customer Experience: Understanding customer behaviour and addressing privacy concerns are essential for fostering a positive consumer experience in rapidly growing e-commerce markets, such as India, where customer satisfaction and trust are crucial for success.

Practical Implications: The research highlights the practical implications of predictive modelling in the context of new product pricing, demonstrating its potential to influence consumer purchase decisions and preferences, ultimately contributing to the success and sustainability of e-commerce platforms.

Conclusion

The papers reviewed highlight the importance of data analytics and machine learning in the e-commerce industry. With the rapid growth of e-commerce websites and fierce competition, understanding customer behaviour patterns and preferences is crucial for staying in business and improving profits. The studies propose various data mining models and predictive modelling techniques that utilize machine learning algorithms to enhance prediction accuracy and provide personalized recommendations. The use of clustering algorithms and decision trees is identified as a critical component for the success of online retail stores.

The literature review underscores the role of data mining in extracting knowledge from extensive datasets, facilitating one-to-one marketing, personalization, increased sales, and customer retention. The transformative impact of the Internet and e-commerce on consumer behaviour is evident in the way individuals seek product information, make purchase decisions, and share their experiences through online reviews. This shift in consumer dynamics presents both challenges and opportunities for businesses. While customers benefit from accessing valuable information, companies can leverage customer reviews to gain insights into satisfaction levels, improving customer experience and retention.

The papers also highlight the challenges posed by big data in e-commerce, such as dealing with diverse data formats and communication conventions, and the need for addressing data imbalances to optimize model performance. The studies emphasize the potential of dynamic pricing in influencing consumer purchase choices and highlight the practical implications of predictive modelling in enhancing pricing agility and adapting to real-time changes in the fast-paced e-commerce environment.

Overall, the papers provide valuable insights into the transformative impact of data analytics and machine learning on the e-commerce industry, offering businesses the opportunity to optimize pricing strategies, stay competitive, and improve profitability in the ever-evolving online marketplace.

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