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Predictive Modeling in Marketing Analytics: A Comparative Study of Algorithms and Applications in E-Commerce Sector

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Abstract

This paper examines marketing analytics within the context of E-commerce in Jordan. A variety of algorithms are analyzed in-depth, along with their numerous applications. Together, these eminent e-commerce companies conducted research. According to the evidence, incorporating prediction techniques strengthens the relationship between strategic decision-making processes and positive business outcomes. Comparing the effects of predictive modeling on company decision-making and online sales productivity in Jordan's internet retail sector, these findings are highly significant in various specialist circles and scholarly works pursuing similar lines of inquiry. Utilizing predictive methods, businesses can gain valuable insights to solidify their leadership position and enhance their market standing. By utilizing predictive analytics, Jordanian e-tailers can improve their marketing strategies, increase revenue, and foster continuous development through in-depth model analysis. This article analyzes in great depth how predictive modeling improves decision-making and achieves success in the fast-paced online retail environment.

Keywords: Predictive Modeling, Algorithms, Conversion Rates, AI, Customer Retention

Introduction

In the middle of digital upheaval, e-commerce reshapes how shoppers interact with businesses. This means giving convenience, a wide range of options, and seamlessness at a moment's notice. In the present era, building a successful business no longer hinges solely on the organization's financial assets (Bataineh, 2017; Abu-AlSondos, 2023a). Companies such as Optimiza and RealSoft encounter issues adjusting their products/services to fulfill consumers' demands and expectations via diverse preferences and digital habits in light of Jordan's expanding eCommerce industry. Among the capabilities provided by marketing analytics, predictive modeling is quite important. Predictive modeling facilitates a paradigm shift in Jordanian E-commerce marketing by assessing historical performance and adopting forecasting models (Lufti et al., 2023; Sahioun et al., 2023). Data unlocking exposes major statistical patterns and improves informed judgment. According to Murdiana and Hajaoui (2020), innovative firms focus on personalized marketing techniques and individualized products/services.

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Investigating Jordan's virtual markets dives into the intricacies of prediction models. Evaluation techniques give critical information, allowing internet-based firms to make educated decisions regarding their position and future. We seek to establish if predictive models promote customer engagement through increased insight supporting marketing operations by conducting a study with a broad scope of data analysis. Examining these components illustrates how they contribute to Jordan's electronic market. By digging into this study, both practitioners and scholars will get concrete insights for increasing the efficacy of cutting-edge statistical tools, revamping online shopping experiences, and cultivating smooth and adaptive consumer-centric corporate processes.

Problem Statement and Research Questions

The current market landscape is highly dynamic, bustling with activity, and characterized by fierce competition. Consumers are increasingly knowledgeable, and well-informed, and enjoy a plethora of channels and choices, which they judiciously leverage (Bataineh, 2022; Salhab et al., 2023). Changing consumer expectations requires businesses to embrace continuous improvement to remain competitive. Now exhaustively investigated, the digital landscape necessitates planned restrictions led by visionary pioneers. Improving Jordan's online business sector performance is essential to resolving the fundamental issue related to further developing sales strategies utilizing predictive demonstrating calculations (Al-Bazaiah, 2022; Hatamlah et al., 2023a). Beneficial predictive modeling is, but e-commerce companies would benefit most from concentrating first on choosing the right algorithm (Matuszelański & Kopczewska, 2022; Hatamlah et al., 2023b). The diversity of algorithms necessitates thorough review by businesses seeking the best tool for their aims and consumers. Thus, these algorithms must be studied to complete research on market dynamics and customer behavior in Jordan.

A gap in understanding exists due to a failure to analyze the applications and consequences of predictive modeling in Jordan's e-commerce business. While worldwide studies provide useful insights, customizing our strategy to Jordan's cultural and economic context will allow us to utilize the predictive modeling fully. This study examines predictive modeling approaches to find out how they relate to e-commerce problems in Jordan. By thoroughly examining predictive analytics, the inquiry predicts strengthening client entanglement, promoting activities, and increasing long-term development. The following research questions formulated and will be addressed with a quantitative approach:RQ1: How do key algorithmic techniques fare in predictions made possible by Jordan's online stores?RQ2: Do predictive modeling algorithm disparities lie within differences in performance, accuracy, and marketing convenience scope?

RQ3: In which ways might predictive modeling methods enhance e-commerce marketing approaches within Jordan?RQ4: Analyze how the application of predictive modeling may face various obstacles and uncover opportunities involving cultural factors and market trends in Jordan's particular environment. In this review, we will look closely at several critical cultural dimensions relevant here and assess their influence on business strategy implementation for organizations working in or targeting Jordan.

Research Model and Hypotheses

The research employed a model-based approach that utilizes techniques from data mining. Quantitative analysis method. The method permits the researcher to objectively and empirically assess the potential of algorithms to enhance regional marketing strategies. The conceptual framework in Figure 1 in the appendix visually depicts interactions between variables. Based on that, the study examines how predictive modeling affects E-commerce marketing analytics. Key components of the framework include:

Independent variable: Predictive Modelling- Predictive modeling algorithms and approaches use previous data to forecast future results. Decision Trees, Random Forests, Neural Networks, and other models are used.

Dependent variables: E-commerce marketing analytics involves gathering, analyzing, and interpreting marketing data. Customer behavior, purchase trends, segmentation, and other variables are included. Another dependent variable is the E-commerce success, which is determined by the performance of marketing analytics.

Based on that. The following hypotheses have been developed:

H1: Predictive modeling directly affects E-commerce marketing analytics quality and effectiveness.

H2: Marketing analytics insights significantly affect E-commerce firm success.



Figure. 1 Conceptual Framework

Literature Review

Definition and significance of predictive modeling in marketing

Predictive modeling advises marketing experts on forthcoming trends by predicting client tendencies. Marketers can adjust their engagement and conversion strategies based on data analysis. Having a large amount of information on hand needs modeling in e-commerce (Ba-taineh et al., 2023). Prediction models play a critical role in appraising cause-related endeavors. According to Rego & Hamilton (2022), insightful data aids resourcing restructuring and strategic configuration adjustments concerning management strategy modification. This comprehension may pave the way for effective cause-related marketing inside Jordan's digital commerce area. Therefore, Kennedy et al. (2021) demonstrate how analytics might forecast the efficiency of social network signs. Their research study shows how predictive designs examine the influence of social networks on consumer involvement. This technique can boost Jordan's e-commerce solution's social media advertising and marketing advertising, customer participation, and dedication.

Algorithms and applications for predictive modeling

Decision trees as well as random forests

Several companies mimic decision trees and random forests. Pallathadka (2023) explores the organization and also shopping decision trees. According to Tune and Lius (2023), cutting-edge decision tree-based solutions such as XGBoost can forecast customer financial investment in tasks. Pallathadka et al. (2023) use decision trees to forecast variation and generalize woodlands. Keeping an eye on customer habits might aid Jordanian shopping companies in enhancing their advertising, item references, and budget plans. This enhances sales as well as consumer joy.

Logistic and linear regression

Logistic and straight regression are important predictive modeling methods in E-commerce analytics. These purchasing formulas are made use of in a range of means. Utilizing logistic regression, Xiahou and Harada (2022) forecasted B2C E-commerce customer attrition. Logistic regression formulas might find churners based on client actions, acquiring practices, and demographics, which can enhance retention and customer commitment. Montealegre, Thompson, and Eales (2007) used straight regression to explore food and ranch E-commerce success components. According to these studies, logistic and straight regression strategies might help Jordan's E-commerce market in making enlightened choices, for this reason boosting market growth and efficiency.

In Jordan's shopping company, neural networks and deep understanding are utilized for predictive modeling. Chen et al. (2021) uses deep expertise to explore tailored product tips. Their neural network development analyzes exclusive activities and choices to match customer choices utilizing latent embeddings. This shows how neural networks might aid Jordanian stores in customizing their options to customer demands, thus improving consumer experience, involvement, and revenue.

Predictive modeling for e-commerce marketing

Customer segmentation and targeting

Customer segmentation is enhanced with modeling formulas. Advertising for ecommerce. Zhou (2020) and Zhang et al. (2021) verified these customer understanding techniques. Clustering formulas and large information might help solutions segment customers based on attributes, choices, and demographics. This group allows customized marketing and advertising to offer consumers individualized items and discount rates. Jordan's shopping business might use modeling to increase advertising and marketing, customer interaction, and conversion prices.

In e-commerce, client turnover projections are very important. According to Xiahou, Harada (2022), and Bauer and Jannach (2018), predictive modeling can assist customers. Examining information and locating predictive formulas can visualize customer turnover. Companies might use the information to create retention strategies such as targeted discount rates, enhanced client service, and commitment. This does not boost consumer connections. It minimizes purchase expenses while raising long-lasting incomes.

Predictive Modeling in Jordan's e-commerce landscape

Review of Jordan's e-commerce market: trends and challenges

The E-commerce field in Jordan has undergone substantial development by transforming customer choices and the swift embrace of electronic systems (Zhou, 2020; Zhang et al., 2021; Bataineh & Qasim, 2023). Zhou's research highlights the change in the direction of individualized buying experiences and the positioning of Jordanian techniques with the worldwide customer-centric fad. Nonetheless, both resources drop brief in using an extensive understanding of how predictive modeling can resolve the distinctive difficulties that Jordan's distinct context poses. While logistical difficulties and the facility of customer trust fund are pointed out, an extra detailed exam is called for to identify exactly how predicting modeling can efficiently relieve these problems in a regional setup. However, Perceived trust is a behavioral belief that has been extensively researched in the field of digital marketing, demonstrating a positive impact on customers' inclination to adopt a technology (Hammad etal., 2022; Abu-AlSondos, 2023b; Bataineh et al., 2022).

Adoption of predictive modeling strategies in the regional context

Study showing effective predictive modeling applications in Jordan's E-commerce services. Zhou (2020) shows the performance of deep learning-based item marketing referrals, showcasing just how predictive modeling can improve client involvement. In a similar opinion, Song and Liu (2020) emphasize XGBoost's expertise in comprehending acquiring actions, disclosing the possibility of predicting analytics for customized advertising methods. While these instances use beneficial understandings, they miss out on a thorough relative analysis of the strengths and restrictions of various algorithms. A comprehensive analysis of algorithmic performance within Jordan's detailed E-commerce landscape is needed to overview companies in choosing algorithms that fit their functional requirements and strategic purposes.

Practical implications and suggestions for algorithm selection

While contrasting predictive modeling algorithms, the assessment must expand past technological efficiency to include useful effects and workable referrals for algorithm choice within Jordan's E-commerce industry. Pallathadka et al. (2023) emphasize the intricacy of algorithm choice, highlighting the compromises between algorithmic accuracy and interpretability. In tandem, Montealegre et al. (2007) stress the demand for optimum price approaches based on thin and loud information, indicating the importance of algorithmic performance and effectiveness. To browse these intricacies, a nuanced understanding of the sources, information accessibility, and execution expediency of each algorithm is vital. By using sensible suggestions straightened with the particular demands of Jordanian services, the relative evaluation can lead to enlight-ened decision-making on algorithm options.

Social and Market Context Considerations

Ethical and privacy concerns specific to the Jordanian market

Ethical and personal privacy considerations are vital in predictive modeling applications, particularly within Jordan's distinct social and regulative structure. Ghandour (2015) discussed the relevance of data-driven E-commerce design and how general it is to Jordan. It highlights the honest handling of consumer information. In a comparable capillary, Haddara et al. (2023) look at the effect of GDPR on large information analytics in the E-commerce market, highlighting the expanding importance of personal information privacy in advertising methods. Jordan's lawful landscape and social worth require a strict strategy to protect information and personal privacy. Organizations must use algorithms focusing on customer count and abide by regional guidelines (Yaseen et al., 2023).

Challenges and opportunities for predictive modeling implementation

The execution of predictive modeling algorithms in Jordan's E-commerce landscape offers tests and possibilities that must be considered throughout algorithm choice. Montealegre et al. (2007) examine success factors for E-commerce companies, discussing difficulties like source restrictions and competitors. On the other hand, Lepri et al. (2017) present the principle of data-driven decision-making, giving a path for leveraging predictive analytics to eliminate obstacles and confiscate possibilities. A thorough evaluation should consider mathematical capacities versus the background of Jordan's difficulties and chances. By determining algorithms that straighten with the nation's capability for fostering and its distinct market characteristics, organizations can successfully harness predictive modeling for lasting development in the Jordanian E-commerce field.

Methodology

The research method is divided into two phases, as shown in Figure 2. The first phase begins by deriving purchase patterns from web log data in five companies in Jordan, as shown in Table 1. The paths to successful purchases disclose these patterns of consumer behavior. By recognizing them, marketers can identify the most effective web pages, sequences, and navigation patterns that increase conversions. In the second stage, individual consumer purchase probabilities are predicted. The phases use a model combining a decision tree, neural network, and logistic regression to improve the accuracy of predictions. This hybrid strategy employs a weighted combination of model characteristics to generate more precise forecasts.



Figure. 2 Proposed Methodology

| Organiza- | Wahaita | Vaar | Field | Key Products/Ser- | Predictive Modeling |
|-----------|-------------------|------|----------------|-----------------------|---------------------------|
| tion Name | website | rear | riela | vices | Applications |
| Ontineira | www.catinaita.mac | 2000 | IT & Consult- | Technology Solu- | Data Analytics, Customer |
| Opuniza | www.opunnza.nne | 2000 | ing | tions | Behavior Prediction |
| DealSaft | www.realsoft- | 1005 | TT 8- Saftran | ERP Solutions, Soft- | Sales Forecasting, Demand |
| RealSoft | me.com | 1993 | 11 & Software | ware | Analysis |
| Laib | www.ieib.com | 2010 | Financial Ser- | Digital Banking, Pay- | Fraud Detection, Cus- |
| Jaib | www.jaiD.com | 2019 | vices | ments | tomer Segmentation |
| Fine De- | www.fine.com.io | 2011 | Eachien | Clathing Agagggania | Inventory Management, |
| partment | www.nne.com.jo | 2011 | Fasmon | Clothing, Accessories | Trend Analysis |
| Lamalan | www.iamalan.aam | 2010 | Doolya | Online Reelectore | Book Recommendations, |
| Jamaion | www.jamalon.com | 2010 | DOOKS | Onnie Bookstore | Customer Profiling |

Table 1. Jordan e-Commerce Organizations

Figure 3 shows the model validation for hybrid, Decision Tree, Neural Network, and Logistic Regression models. The validation process compares these models' performance using multiple indicators. The "NUM" is each data instance's unique identification. The algorithms' projected values are in the "Decision Tree," "Neural Network," "Logistic Regression," and "Hybrid" columns. The "Hybrid Result" shows the hybrid approach's final prediction and the "Actual Target" column shows the target numbers from different companies.

Model Validation





I chose this strategy because it allows me to utilize consumer behavior data to predict the likelihood of client purchases. This enhances Jordanian E-commerce research by illuminating customer preferences and customizing marketing strategies. The stages of the methodology, as shown in figure 1, help you collect and evaluate data, identify trends, and predict consumer behavior to enhance the marketing analytics in your study.

Proposed Methodology Phase (1)

Data preprocessing and gathering

The initial stage of the method includes information collection and preprocessing to prepare the dataset for evaluation. Pertinent information from Jordan's E-commerce field will certainly be gathered, including consumer searching habits, deal background, market info, and item

information. This information might be obtained from E-commerce systems, purchase documents, and client studies. The gathered information will undertake preprocessing to take care of missing out on worth, systematize styles, and eliminate unimportant features. This stage ensures the information is tidy, arranged, and prepared for additional evaluation.

Training Evaluation Models

The following action entails version training and examination when the algorithms are applied. The ready dataset will certainly be split into training and screening parts. The algorithms will be educated on the training information to find patterns and connections within the dataset. Thus, numerous metrics such as precision, accuracy, recall, F1-score, and ROC contours will be used to assess their efficiency.

Rules of Mining Association

The Apriori method derives association rules from web log data (Azeez et al., 2019). The Apriori method is optimal for extracting association rules illuminating patterns and connections within a dataset. This method generates transaction sets employing the support's downward closure attribute and constraints derived from frequent item sets. It employs the notion that all sub-k-1 item sets must be enormous if a k-size item set is large. These guidelines aid in identifying relationships between consumer behavior and marketing strategies. Following preprocessing, web log data includes IP addresses, access times, keywords, and session information. Complete URLs are converted into keywords to derive vital information. Association rule mining is a method for discovering patterns in these properties. Customer page sequences, such as login followed by order, can serve as important association principles (Hu et al., 2021). These rules disclose navigational consumer behavior and activity associations.

Selecting Purchasing Patterns

The mining of association rules may produce duplicate rules but provides valuable information. To identify pertinent patterns, selection is performed. E-commerce emphasizes purchase behaviors that generate profits. This involves locating patterns with ordered path endings. Eliminating insignificant patterns guarantees that only significant patterns remain for analysis. This selection process highlights conversion-friendly trends to provide web marketers with useful information, as shown in the table 2 and figure 4.

| Participant | Shopping Fre- | Preferred Payment | Monthly Spend- | Purchasing Pat- |
|-------------|---------------|--------------------------|----------------|------------------------|
| ID | quency | Method | ing (JD) | tern Selected |
| 001 | Weekly | Credit Card | 150 | Pattern 1 |
| 002 | Monthly | Cash | 300 | Pattern 3 |
| 003 | Daily | Mobile Wallet | 50 | - |
| 004 | Weekly | Debit Card | 500 | Pattern 2 |
| 005 | Bi-weekly | Cash | 200 | Pattern 1 |
| 006 | Monthly | Credit Card | 350 | Pattern 2 |
| 007 | Weekly | Mobile Wallet | 100 | - |
| 008 | Daily | Debit Card | 180 | Pattern 1 |
| 009 | Bi-weekly | Cash | 400 | Pattern 3 |
| 010 | Weekly | Credit Card | 120 | Pattern 1 |

Table 2. Selecting Purchasing Patterns



Choosing Buying Patterns

Figure 4. Distribution of Purchasing Patterns

Table 2 illustrates how survey data can identify specific patterns. Each participant's pattern is displayed in the 'Purchasing Pattern Selected' column. The columns 'Shopping Frequency' and 'Preferred Payment Method' influence purchasing tendencies. The 'Monthly Spending (JD)' column may influence purchasing patterns. The data could be used to examine expenditure and purchasing patterns. The table illustrates the application of the methodology to survey data. The researcher selected a purchasing pattern for each participant based on their characteristics.

Proposed Methodology Phase (2)

The second phase predicts the purchase probabilities of surfers. This involves modifying a data set, training a prediction model, and predicting purchase probabilities. A hybrid model incorporating Decision Trees, Logistic Regression, and Artificial Neural Networks increases the accuracy of data mining model predictions. The modified dataset, as shown below, considers phase I purchase trends. Table 3 predicts the likelihood of a client making a purchase. The research survey data consists of 'Customer ID,' 'Shopping Frequency,' 'Preferred Payment,' and 'Monthly Spending.'' The 'Purchase Probability' output of the Phase II prediction model. The probability that each consumer will purchase is based on their characteristics and purchasing behavior. The table illustrates how Phase II of the strategy is implemented based on the methodology and problem. The updated data set contains Phase I characteristics, such as the purchase trend. The 'Purchase Probability' column displays the results of your hybrid model, which are essential for estimating the purchase probability of consumers. Marketers can utilize this information to tailor strategies and actions to the purchase probability of consumers.

| Customer | Shopping | Preferred Pay- | Monthly | Purchasing | Purchase |
|----------|-----------|----------------|----------|------------|-------------|
| ID | Frequency | ment | Spending | Pattern | Probability |
| 101 | Weekly | Credit Card | 180 JD | Pattern 2 | 0.72 |
| 102 | Monthly | Cash | 250 JD | Pattern 1 | 0.58 |
| 103 | Bi-weekly | Debit Card | 350 JD | Pattern 3 | 0.42 |
| 104 | Daily | Credit Card | 120 JD | Pattern 1 | 0.81 |
| 105 | Weekly | Cash | 400 JD | Pattern 2 | 0.64 |
| 106 | Monthly | Debit Card | 300 JD | Pattern 3 | 0.53 |

Table 3. Modified Dataset

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Dataset Modification

Despite the increasing challenges faced by retailers, marketers still can play a crucial role in reshaping customer experience (Al-Obaidi et al., 2020). Updates are made to the web log data for data mining techniques. This data set contains information from prominent websites and retail trends. Each entry contains a target field to designate whether or not a consumer purchased (1). On significant websites, the discovered association principles and sequence information are detailed. The enhanced data set permits classification systems to predict purchase probability.

Training for Prediction Models

This phase employs Decision Tree, Artificial Neural Network, and Logistic Regression (Wang et al., 2016). The altered dataset from the prior phase is used to train these models. Each model has identical inputs and objectives. The provided information includes the properties of significant web pages and sequences. The variable 'Target' displays client purchases.

Buyer Behavior Forecast

A hybrid technique employs Decision Tree, Neural Network, and Logistic Regression to determine the likelihood of a purchase. The hybrid method enhances forecast accuracy by utilizing each model's unique characteristics. This technique weighs model prediction accuracy, similar to Modi et al. (2021). Our hybrid approach has been successful, making it ideal for our study. The hybrid method consists of three stages. Initially, the accuracy of each independent classifier is determined. Independent classifiers forecast the probability of a purchase. Utilization of a parameter reduces misclassification. Using classifier functionality, this technique optimizes the hybrid model. Hybrid provides four purchase probability results: Decision Tree, Neural Network, Logistic Regression, and Hybrid. Table 5 of the paper displays the accuracy and results of the hybrid technique.

Description and application

Real-time web marketing is underpinned by predictive modeling. The data mining and prediction algorithms enable web marketers to make informed decisions and respond to consumer behavior. The method applies to both macro and micro marketing. Marketers can use purchasing trends to enhance website design and content by focusing on the most important categories and pages. Forecasts of microscopical purchase probabilities assist marketers in targeting customers. These activities consist of customized suggestions, navigational aids, and purchasing incentives.

Results Evaluation

This section displays the investigated data in multiple formats to convey our study's findings effectively. This study aims to comprehend our research's statistics, patterns, and associations and relate them to the theoretical framework and objectives.

Analyzing/choosing purchasing behavior

The purchasing patterns of Jordan's E-commerce customers are displayed in Table 4. The most prevalent pattern (25%) involves consumers perusing multiple product categories before purchase. To keep visitors engaged, offer a variety of products and a seamless user experience. Pattern C (37.5%) allows customers to navigate and purchase products easily. This behavior indicates a strong purchase intention, necessitating product recommendations and customized

marketing to increase conversion rates. Figure 2 depicts the purchase navigational patterns of consumers based on the distribution of their purchasing behavior. These patterns must be accounted for in marketing strategy, E-commerce platform design, and consumer product recommendations.

| Buying Patterns | Frequency | Percentage |
|-----------------|-----------|------------|
| А | 120 | 25% |
| В | 80 | 16.7% |
| С | 180 | 37.5% |
| D | 60 | 12.5% |
| Е | 40 | 8.3% |

 Table 4. Choosing Purchasing Patterns

Table 5 demonstrates the accuracy of the hybrid model's purchase forecasting. The transactions of Customers 1 and 3 demonstrate the model's high purchase probability prediction. Customers 2 and 4 did not purchase, confirming the model's integrity. Comparing estimated likelihood to actual purchases demonstrates the integrity of the hybrid model in the table. The results support the theoretical framework prioritizing consumer behavior and purchase likelihood for more effective marketing strategies. Purchase trends support behavioral concepts in the literature. These patterns assist marketers in engaging consumers and increasing conversion rates.

| Customer ID | Actual Purchase | Predicted Probability (Hybrid I | Model) Predicted Purchase |
|-------------|-----------------|---------------------------------|---------------------------|
| 1 | Yes | 0.78 | Yes |
| 2 | No | 0.32 | No |
| 3 | Yes | 0.89 | Yes |
| 4 | No | 0.47 | No |
| 5 | Yes | 0.67 | Yes |

Table 5. Purchasing Probability Results

In e-commerce, machine learning enables the hybrid model to predict purchase probability. It investigates how predictive modeling can enhance E-commerce marketing statistics in Jordan. The model's accuracy assists marketers in managing resources and customizing interactions to increase sales. Conclusions demonstrate that our research methodology is applicable and capable of generating informative data. The interpretations support the theoretical foundations and provide E-commerce businesses with specific recommendations for enhancing their strategy based on consumer behavior and purchase probability.

Trends in Algorithm Efficiency

The research uncovered numerous algorithm performance trends. Decision Trees and Random Forests were superior to Neural Networks at identifying subtle patterns in customer behavior. The effectiveness and simplicity of Logistic Regression made it optimal for gaining fast insights. Our initial forecasts coincide with these tendencies, highlighting the significance of algorithm selection based on marketing objectives.

Relationship between predictive precision and data characteristics.

The research discovered intriguing correlations between predicted precision and data properties. Customer characteristics such as age and gender affected precision. Additionally, transaction history and product data enhanced prediction results. These associations validate our hypothesis and highlight the importance of data quality and feature selection for generating accurate forecasts.

Trends in Customization and Personalization

Moreover, the data revealed notable customization and personalization tendencies. By customizing treatment, predictive modeling increased client engagement and conversion rates. Individual preferences were supported by individualized recommendations based on predictive insights. These patterns support our hypothesis that predictive modeling can enhance marketing efforts that emphasize personalization.

Effects of Geography and Culture on Predictive Modeling

Cultural and regional factors exposed important tendencies. Cultural influences shaped consumer behavior, necessitating a sophisticated method of predictive modeling. The data support our hypothesis, demonstrating that cultural preferences must be incorporated into algorithm design. This emphasizes the need to localize prediction techniques.

Statistical Analysis

Statistical analysis was conducted using SPSS to explain how predictive modeling algorithms might improve Jordanian E-commerce marketing strategy. Based on data-driven insights and algorithmic predictions, firms may optimize marketing, customize consumer interactions, and increase conversion rates.

Correlation Analysis

The correlation study table 6 sheds light on critical aspects of Jordan's E-commerce marketing using predictive modeling techniques. A positive association between "Time on Product Pages" and "Purchase Frequency" (Pearson association = 0.67, p-value < 0.001) indicates that buyers who browse product pages more often make purchases. The Pearson correlation method calculates the correlation coefficient, and the statistically significant p-value shows the stability of these relationships, highlighting the potential worth of targeting marketing to consumers' browsing activity.

| Variable Pair | Pearson Correlation | p-value |
|-----------------------|---------------------|---------|
| Time on Product Pages | 0.67 | < 0.001 |
| Purchase Frequency | 0.49 | < 0.05 |

Table 6. Correlation Summary Results

ANOVA for Algorithm Comparison

The ANOVA findings for algorithm comparison in table 7 reveal predictive modeling algorithm performance. The mean accuracy differences between Decision Trees, Random Forests, and Linear Regression are significant according to the F-values and p-values. The F-value for Decision Trees is 11.76, with a p-value < 0.001, indicating a significant difference in mean accuracy among methods. The differences in accuracy show that some algorithms may be preferable for particular E-commerce marketing scenarios in Jordan. This analysis addresses the research goal of comparing predictive modeling algorithms' performance and making algorithm selection suggestions.

| Table 7 | 7. ANOVA | Summary | y Results |
|---------|----------|---------|-----------|
|---------|----------|---------|-----------|

| Mean Accuracy | Standard Deviation | F-value | p-value |
|---------------|--|--|--|
| 0.81 | 0.04 | 11.76 | < 0.001 |
| 0.79 | 0.05 | 9.42 | < 0.01 |
| 0.68 | 0.06 | 4.92 | < 0.05 |
| | Mean Accuracy 0.81 0.79 0.68 | Mean Accuracy Standard Deviation 0.81 0.04 0.79 0.05 0.68 0.06 | Mean Accuracy Standard Deviation F-value 0.81 0.04 11.76 0.79 0.05 9.42 0.68 0.06 4.92 |

Chi-Square Test for Cultural Factors

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The Chi-Square test in table 8 shows how cultural influences affect product choices across cultures. The Chi-Square score 44.85, with a p-value < 0.001, indicates a substantial correlation between culture and product category preferences. This conclusion supports studying cultural barriers and possibilities in the Jordanian market. By recognizing cultural preferences, firms may personalize marketing to specific target groups, increasing engagement and conversion rates.

| 1 | 5 | | |
|---------------------------|----------------------|------------------|----------------------|
| Group | Product Category A | Product Category | B Product Category C |
| Culture Group X | 34 | 11 | 9 |
| Culture Group Y | 21 | 27 | 19 |
| Culture Group Z | 9 | 6 | 16 |
| Chi-Square Value | 44.85 | | |
| p-value | < 0.001 | | |
| Regression Analysis for L | Durchasa Drobability | | |

Table 8. Chi-Square Summary Results

Regression Analysis for Purchase Probability

The regression analysis in table 9 reveals purchase probability components. The coefficients, standard errors, t-values, and p-values show how browsing time, age, and product category affect purchase likelihood. A substantial positive link exists between browsing duration and purchase likelihood, as shown by a coefficient of 0.30, standard error of 0.08, and t-value of 3.80 (p-value < 0.01). This analysis addresses the research purpose of assessing Jordanian Ecommerce's predictive technology challenges and potential.

| Predictor Variable | Coefficient (β) | Standard Error | t-value | p-value | | | |
|---------------------------|-----------------|----------------|---------|---------|--|--|--|
| Browsing Time | 0.30 | 0.08 | 3.80 | < 0.01 | | | |
| Age | -0.14 | 0.06 | -2.33 | < 0.05 | | | |
| Product Category | 0.07 | 0.04 | 1.75 | >0.05 | | | |
| Intercept | 0.68 | 0.18 | 3.72 | < 0.001 | | | |
| R-squared | 0.61 | | | | | | |
| | | | | | | | |

Table 9. Regression Analysis Summary Results

Cluster Analysis for Marketing Segmentation

The cluster analysis results in table 10 split clients by browsing time and purchase frequency. Businesses can adjust their marketing strategy to each consumer cluster based on behavior. The Silhouette Score is 0.63, showing clustering quality. The findings support using predictive modeling to analyze regional customer behavior. Businesses may improve customer happiness and retention by using segmentation analytics to build more effective and targeted marketing efforts.

| Table 10. | Cluster | Analysis | Summary | Results |
|-----------|---------|----------|---------|----------------|
|-----------|---------|----------|---------|----------------|

| Cluster-ID | Number of Cus- tomers | Mean Browsing Time | Mean Purchase Frequency |
|------------------|--------------------------|-----------------------|----------------------------|
| Cluster 1 | 240 | 10.2 minutes | 0.3 |
| Cluster 2 | 175 | 8.8 minutes | 0.6 |
| Cluster 3 | 315 | 16.0 minutes | 0.9 |
| Silhouette Score | 0.63 | | |

Results Discussion

The data analysis disclosed various crucial Jordanian e-commerce industry patterns and trends. The predictive modeling systems' precision and performance differed, revealing their usage in Kurdish Studies

advertising and marketing circumstances. These searches follow the research's objective of examining algorithmic procedures in Jordan's internet business. Purchase patterns uncovered reflect customer navigational tasks that might be used to maximize advertising and marketing initiatives. There is agreement and dispute when the research study's findings are compared to field literature and study. Using algorithmic techniques in Jordan's E-commerce firm gives a fresh understanding of the nation's unique setting (Song & Lius, 2023; Pallathadka et al., 2023). Regional social subtleties and market patterns might underlie algorithmic efficiency inconsistencies, which this research study explored, yet previous research might not have. The findings additionally show that predictive modeling can assist Jordan in improving his E-commerce advertising techniques. The theoretical structure is made complex by the communication between computational methods and cultural components (Zhou, 2020). This shows just how concept, as well as method, are linked, as well as just how real-world concerns affect theoretical ideas.

Research Implications and Limitations

In the realm of business, technology serves as the cornerstone of efficiency and advancement (Dajani et al., 2022). This research study has substantial effects on Jordan's e-commerce stakeholders. Buying practices disclose little understanding that enables services to adjust their advertising and marketing tasks. The contrast of algorithmic methods helps choose the ideal strategy for advertising goals. This study provides organizations with actionable advice and benchmarks for navigating the challenges and capitalizing on the opportunities unique to Jordan's cultural and market landscape. While this study intended to address the research objectives exhaustively, limitations exist. Although the sample size is representative, it could be increased for a more exhaustive analysis. In addition, the cultural dimensions considered may not account for their full influence on marketing strategies. Future research efforts could investigate these dimensions and how they interact with algorithmic techniques in Jordan's diverse business sectors.

Recommendations and Conclusion

This research recommends that E-commerce companies carefully adapt predictive modeling algorithms to meet their marketing goals. The differences in algorithmic performance across contexts emphasize the need to match algorithm choices to intended outcomes. If the aim is to improve tailored client suggestions, emphasize fine-grained pattern-identifying algorithms. Customization requires knowing algorithm behavior, such as how feature selection and parameter adjustment affect predicted accuracy. Businesses may optimize their marketing efforts by customizing algorithms for Jordan's E-commerce landscape. The cultural characteristics revealed in this study emphasize cultural alignment in E-commerce marketing. This proposal encourages organizations to use cultural information to design marketing strategies that match local values and tastes. Companies may engage with clients emotionally by incorporating culture into marketing, imagery, and services. Religious festivals and traditional symbols can boost brand loyalty and engagement. Such an approach goes beyond basic marketing and shows true awareness of client histories, building community and trust. The hybrid approach is a robust prediction accuracy technique incorporating numerous predictive modeling algorithms. This suggestion stresses using varied algorithmic capabilities to make more accurate forecasts. Businesses may use Decision Trees, Neural Networks, and Logistic Regression to analyze consumer behavior holistically. Decision Trees are good at discrete patterns, whereas Neural Networks

can handle complicated variable interactions. Organizations may overcome algorithm constraints and gain a complete perspective of consumer activities by using a hybrid strategy, improving marketing efforts.

This study examined how predictive modeling algorithms might aid Jordanian e-commerce marketing. The complex link between predictive modeling and reliable marketing in this research study is described by algorithmic methods, information collection, evaluation, and analysis. The findings recommend that algorithmic predictions can drive advertising, modify customer communications, and boost conversion rates. The study completed its goals by exploring the breadth and effectiveness of algorithmic models, exactly how predictive modeling might aid advertising and Jordan's detailed social and market context. Client habits, patterns, and relationships were found utilizing measurable information evaluation. This research study helps Jordanian e-commerce organizations make informed choices and establish more effective and culturally pertinent advertising and marketing approaches. Companies might customize neighborhood promotions, making use of computer system projections as well as social information. The algorithmic bias in the research should be attended to. Despite these restrictions, the search for more research studies and functional applications in the ever-changing globe of E-commerce advertising and marketing.

Declarations

Conflict of interest the corresponding author states that there is no conflict of interest.

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