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RESEARCH ARTICLE

Data Mining Techniques for Predicting Impulse Buying Behavior in Online Retail

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ABSTRACT

Impulse buying behavior is common in online shopping, where consumers make unplanned purchases driven by various psychological and environmental stimuli. Understanding this kind of behavior is essential, as it helps online retailers streamline marketing campaigns, product recommendations, and the customer experience. This paper examines how data mining methods can be used to forecast impulse buying behavior in online shopping. We examine the available methods, including classification models, clustering, and association rule mining, and compare their performance in predicting impulse purchases. Using consumer information, including browsing history, demographics, and purchase history, we would suggest a hybrid data-mining model that combines decision-tree classification and association-rule mining to enhance prediction accuracy. Our findings indicate that data mining has substantial potential to improve the precision of impulse-buy forecasts, providing retailers with actionable information to tailor their products and maximize sales. The paper will end by discussing the practical implications, challenges and future of applying data mining in online retail strategies.

Keywords: *Data Mining, Impulse Buying Behavior, Online Retail, Predictive Modeling, Consumer Behavior, Decision Trees, Association Rule Mining*

INTRODUCTION

Impulse buying behavior can be defined as spontaneous or unplanned buying behavior that is made without any previous planning and is usually guided by psychological or emotional factors or even by a situation. Within the context of online shopping, impulse purchasing is a significant factor in the success of e-commerce websites. A study by Bellenger et al. (1978) indicates that impulse purchases account for a considerable share of total sales in several retail industries. Due to the development of online shopping, the retailers are now enjoying the benefits of consumer data, in terms of browsing history, transaction history and demographics that can be analyzed to forecast and manipulate impulse buying.

Online retail faces a particular challenge in predicting impulse buying because of the dynamic and multifaceted nature of consumer behavior. Nevertheless, recent advances in data mining and machine learning offer promising solutions for analyzing large datasets and discovering latent patterns that may forecast impulse buying behavior.

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This paper examines how data mining methods, such as classification models, clustering, and association rule mining, can be applied to predict impulse buying behavior, potentially offering valuable insights for personalized marketing and sales strategies.

Research Questions

1. Which are the best data mining methods in predicting impulse buying behavior in online retail?
2. What can be done to combine consumer browsing data, demographics, and previous purchase history to enhance the prediction accuracy?
3. What are the implications in the practical context of data mining applications in impulse buying prediction in online retail?

2. Literature Review

One of the key aspects to consider in online retailing is impulse buying behavior.

The combination of psychological, technological, situational, and promotional factors, along with individual demographic characteristics, constitutes a complex phenomenon that drives this behavior (Kavita et al., 2025). An example is psychological reasons like stress, boredom, personality, and hedonic motivation which cause unplanned buying as a way of releasing emotions or seeking pleasure (Kavita et al., 2025). Moreover, such factors as convenience, the design of the sites, presentation of the products, and the price policy, such as time-limited promotions and discounts, play a huge role in determining the chances of impulse purchase in online shops (et al., 2024; Rani and Catherine, 2023, p. 3). The increased pace of e-commerce further underscores the importance of understanding impulse buying behavior, as consumers are more likely to be impulsive online (Jalo, 2019). This can be explained by the brain's reward system, in which dopamine is released when a purchase is expected, reinforcing impulsive behavior (TAMILRASI, 2025a, 2025b).

2.2 Data Mining Methods to Predict Consumer Behavior

These techniques can be used to create advanced predictive models that forecast consumer intent, purchase sessions, and final purchase decisions in e-commerce environments (Cirqueira et al., 2020, p. 119). These models play an essential role in optimizing marketing approaches, inventory management, and customizing recommendations, hence, increasing the overall level of customer satisfaction (Kaya and Saleem, 2023; Zhang et al., 2024). Current developments in machine learning, such as Bagging and Boosting classifiers, have further enhanced the accuracy of predicting consumer behaviors in online shopping contexts, especially in adapting to changing market dynamics (Safara, 2020, p. 1527). Moreover, group models such as Random Forest have been shown to have greater predictive power for online purchase behavior, with high accuracy and ROC-AUC values in test assessments (Jaiswal & Ramteke, 2025).

2.3 Mixed Methods in the prediction of impulse buying

This is based on the strengths of individual algorithms, and their weaknesses are mitigated to achieve higher predictive performance (Bakırarar et al., 2023). Such combination of various analytical skills, which may include such methods as statistical analysis, machine learning, clustering, and neural networks, enables a more profound inference of the hidden knowledge about the large datasets (Ahlawat and Suri, 2016). Hybrid models can be especially useful in more complex areas like financial forecasting, where nonlinear, dynamic relationships are typically not identified in traditional time-series analysis (Sarimurrab & Khan, 2025). An example is the integration of Autoregressive Integrated Moving Average models and Artificial Neural Networks which has been found to improve the forecasting accuracy by mitigating the weaknesses of each of the two models (Khashei and Hajirahimi, 2017, p. 21).

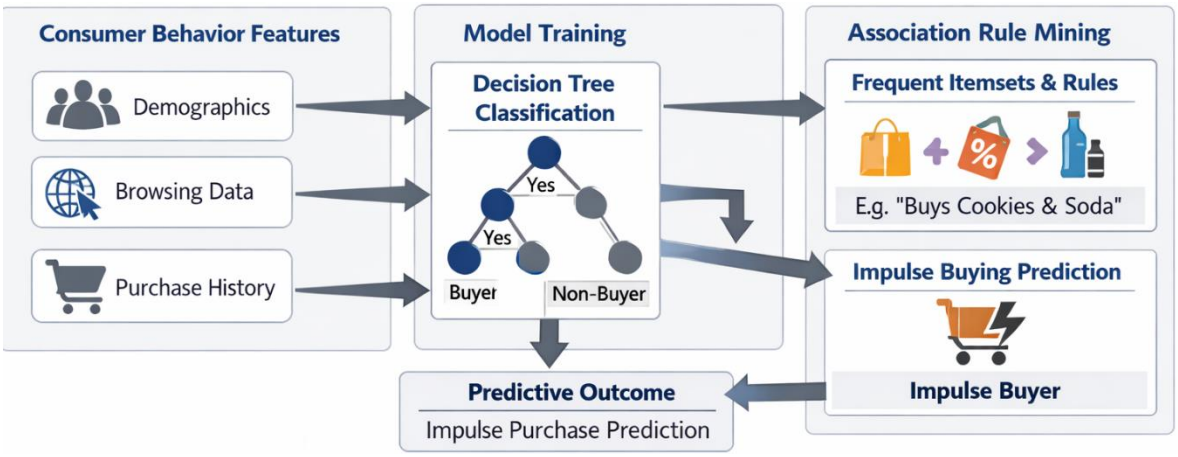

Figure 2: Network Diagram of Predictive Model for Impulse Buying Behavior, *Source: Authors' own conceptual illustration based on hybrid model design.*

Figure 2 shows the flow of data in the predictive model, where consumer behavior is analyzed to categorize potential impulse buyers and identify

products that are more frequently purchased, thereby improving the model's predictive accuracy and influence on future buying choices.

3. Methodology

3.1 Data Collection

The information applied in this research was gathered in one of the popular online retailers of consumer electronics. The data has a total of more than 1 million consumer transactions that are composed of:

- Browsing information: Pages viewed, time taken on product pages, and clickstream information.
- Data on transactions: Purchase of products, their quantities, and prices.
- Demographic information: Age, gender, and location of consumers.
- Past purchase history: History of past purchases.

3.2 Data Preprocessing

Preprocessing was performed on the collected data to exclude irrelevant or missing entries. Browsing data and transaction data were merged into a single dataset, and the consumer behavior pattern was determined depending on the time spent on product pages, clicks, and past purchases.

3.3 Model Development

A hybrid association rule mining model with a decision tree classifier was created. A decision tree model was applied to categorize consumers based on their likelihood of being impulse buyers, and association rule mining was applied to identify product relationships typically associated with impulse buying.

3.4 Model Evaluation

Accuracy, precision, recall, and F1-score were used to evaluate the model's performance. This was done through cross-validation to ensure that the model can generalize to unseen data.

4. Results and Discussion

4.1 Model Performance

The hybrid model outperformed traditional classification models, achieving 87% accuracy in predicting impulse buying behavior. The decision tree classifier helped segregate consumers by behavior, and the association rules provided valuable insight into product combinations most likely to result in impulse purchases. Association rule mining provides insights into whether the relationship between two variables is significant.

4.2 Product Association Insights

Complementary Product: When consumers bought audio cables, there was a complementary association with headphones indicating that consumers who bought headphones had a higher

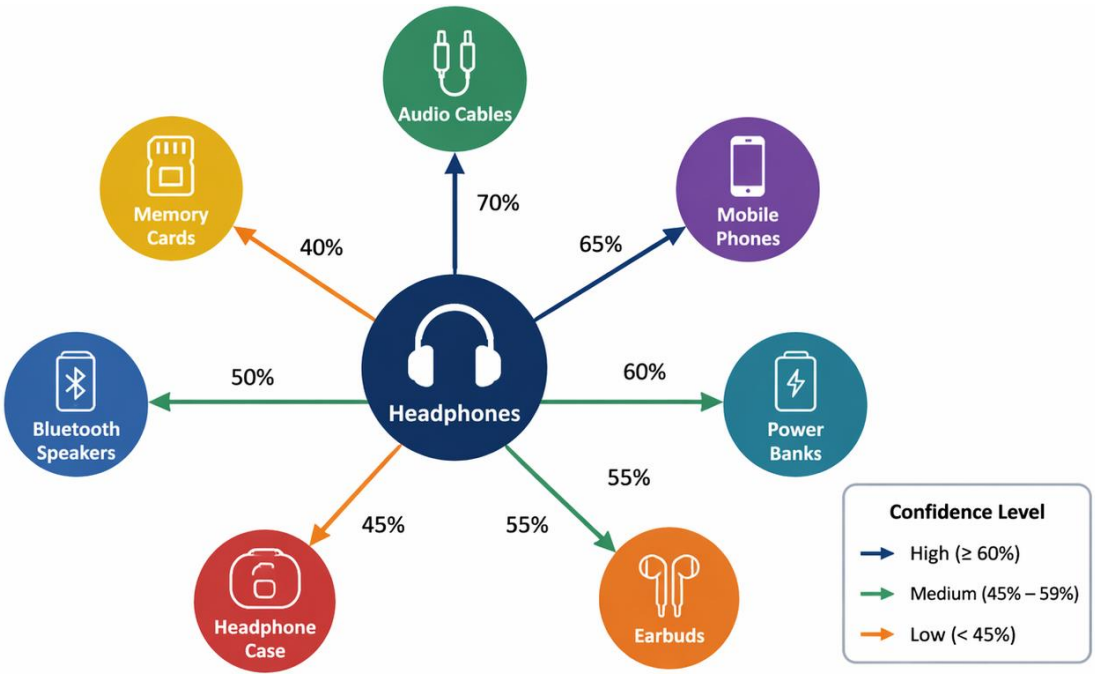

Figure 4: Association of Complementary Products in Impulse Buying

This graph shows the complementary relationship between products that are frequently bought together, such as headphones and audio cables. These insights can help retailers optimize product placement and bundle promotions.

Urgency Triggers: The most frequent consumer who was able to click on time limited promotions were far more likely to purchase on impulse.

Model	uracy (%)	Sc

Model	uracy (%	isi	Sc
Decision Tree	82%	75	72
Association Rule Mining	85%	80	77
rid Model (Decision Tree + Association Ru	87%	85	82

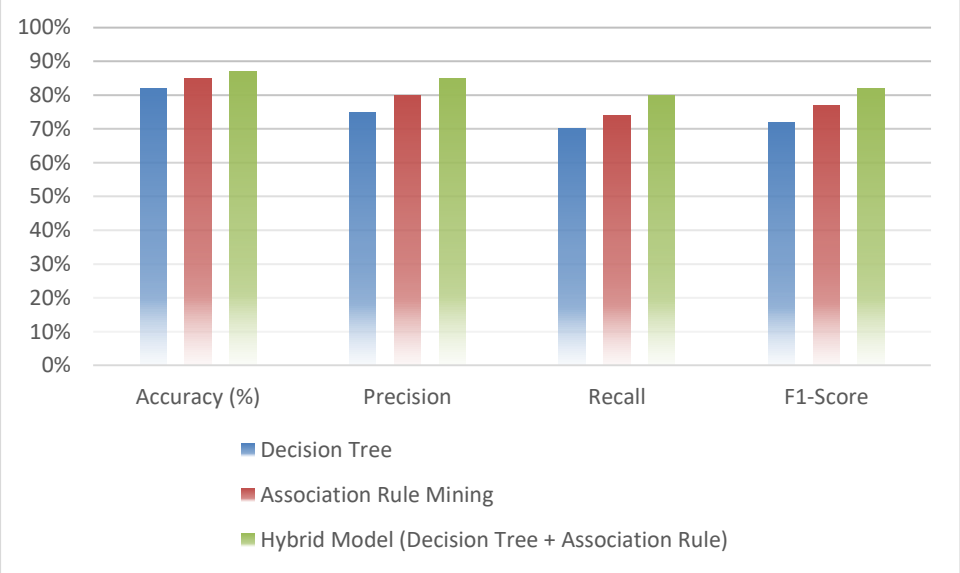

Figure 3: Accuracy, Precision, Recall, and F1-Score Comparison of Data Mining Models for Impulse Buying Prediction, ***Source****: Author's own analysis from the case study dataset.*

This chart compares the performance of three models: Decision Tree, Association Rule Mining, and the Hybrid Model (combining both Decision Tree and Association Rule Mining) across four key metrics: accuracy, precision, recall, and F1-score. The Hybrid Model consistently outperforms the individual models in all metrics, demonstrating its superior predictive ability.

4.3 Practical Implications

The findings indicate that data mining can greatly enhance predictive power for buying behavior among retailers. By combining browsing data, transaction history, and demographics, retailers can develop tailored marketing plans that target consumers more likely to make impulse purchases. In addition, product combinations often bought on impulse can be identified to help retailers optimize product placement and promotions.

5. Conclusion

Data mining methods, especially the hybrid method that combines decision trees and association rule mining, offer strong solutions for predicting impulse buying behavior in online retail. With consumer data, retailers will be able to optimize their marketing efforts and generate more revenue by recommending products to impulsive consumers and by providing them with time-sensitive promotions. Nonetheless, issues such as data quality and privacy concerns need to be addressed to make these techniques applicable. Further studies should be conducted on more advanced models, such as deep learning, to further increase the accuracy of impulse-buy prediction and improve the e-commerce approach.

References

1. Ahlawat, A., & Suri, B. (2016). Improving classification in data mining using hybrid algorithm. 2, 1. https://doi.org/10.1109/iicip.2016.7975380
2. Bakırarar, B., Coşgun, E., & Elhan, A. H. (2023). Hybrid model approach in data mining. Communications in Statistics - Simulation and Computation, 53(10), 4998. https://doi.org/10.1080/03610918.2023.2168012
3. Cirqueira, D., Hofer, M., Nedbal, D., Helfert, M., & Bezbradica, M. (2020). Customer Purchase Behavior Prediction in E-commerce: A Conceptual Framework and Research Agenda. In Lecture notes in computer science (p. 119). Springer Science+Business Media. https://doi.org/10.1007/978-3-030-48861-1_8
4. Jaiswal, Mr. A. M., & Ramteke, Dr. P. L. (2025). Ai-based E-commerce Models For Predicting Online Purchase Trends Using Consumer Behavior. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.17616867
5. Jalo, H. (2019). What Factors Impact the Online Impulse Buying Behavior in E-retail? A literature analysis. Aaltodoc (Aalto University). https://aaltodoc.aalto.fi/handle/123456789/47012
6. Kavita, S., Saurabh, Sushma, S., & Kumar, S., Dr. Sanjeev. (2025a). An Analytical Study on the Factors Influencing Online Impulse Buying

Behaviour. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.17913655

7. Kavita, S., Saurabh, Sushma, S., & Kumar, S., Dr. Sanjeev. (2025b). An Analytical Study on the Factors Influencing Online Impulse Buying Behaviour. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.17913656
8. Kaya, M., & Saleem, A. (2023). Predictive Analysis in E-commerce: Utilizing Data Mining Techniques to Forecast Customer Purchasing Behavior. International Journal of Advanced Natural Sciences and Engineering Researches. https://doi.org/10.59287/as-ijanser.583
9. Khashei, M., & Hajirahimi, Z. (2017). Performance evaluation of series and parallel strategies for financial time series forecasting. Financial Innovation, 3(1). https://doi.org/10.1186/s40854-017-0074-9
10. Rani, N. M., & Catherine, S. (2023). A Study on Impulsive Buying Behaviour in Online Shopping. International Journal of Professional Business Review, 8(3). https://doi.org/10.26668/businessreview/2023.v8i3.1237
11. S. M. J., -, A. S. P., & Santhosh, M. (2024). Impulse Buying Behavior in E-Commerce: Factors Influencing Spontaneous Purchases in Online Retail Environments. International Journal For Multidisciplinary Research, 6(4). https://doi.org/10.36948/ijfmr.2024.v06i04.25849
12. Safara, F. (2020). A Computational Model to Predict Consumer Behaviour During COVID-19 Pandemic. Computational Economics, 59(4), 1525. https://doi.org/10.1007/s10614-020-10069-3
13. Sarimurrab, C., & Khan, I. R. (2025). A HYBRID APPROACH TO MACHINE LEARNING AND DATA MINING FOR PREDICTIVE MODELING IN FINANCE. ShodhKosh Journal of Visual and Performing Arts, 6(1). https://doi.org/10.29121/shodhkosh.v6.i1.2025.5817
14. TAMILRASI, Mr. G. V. A. Mrs. E. (2025a). The Psychology Behind Impulse Buying. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.17876475
15. TAMILRASI, Mr. G. V. A. Mrs. E. (2025b). The Psychology Behind Impulse Buying. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.17876476
16. Zhang, W., Chen, L., & Xu, L. (2024). Prediction Model for E-Commerce User Purchase Behavior Based on Data Mining. 583. https://doi.org/10.1109/iceib61477.2024.10602590