

Customer Behaviour Analysis Using Data Mining Techniques With AI Driven Recommendations

E. Raj Kumar

(M.Tech Artificial Intelligence)

Aurora's Scientific and Technological Institute, Telangana, India

Dr.M. Sridhar

Head Of The Department Computer Science and Engineering

Aurora's Scientific and Technological Institute, Telangana, India

Email: msridhar.msr@gmail.com

I. Ravi Kumar

Aurora's Scientific and Technological Institute, Telangana, India

Email: himaja.ravikumar1919@gmail.com

ABSTRACT

The rapid growth of digital transactions and online platforms has generated vast amounts of customer data, creating opportunities to analyze and understand consumer behavior more effectively. The project titled “Customer Behaviour Analysis Using Data Mining Techniques with AI Driven Recommendations” focuses on leveraging data mining and artificial intelligence to extract meaningful insights from customer data and provide personalized recommendations. By applying techniques such as clustering, classification, and association rule mining, the system identifies patterns in customer preferences, purchasing habits, and interaction behavior, enabling businesses to make informed decisions. The proposed system integrates AI-driven recommendation mechanisms to deliver customized product suggestions based on user behavior and historical data. It enhances customer engagement, improves satisfaction, and increases business profitability by targeting the right audience with relevant offerings. Additionally, the system supports real-time analysis and adaptive learning, allowing recommendations to evolve with changing user preferences. Overall, this project demonstrates how the combination of data mining and AI can transform raw data into actionable insights, leading to smarter marketing strategies and improved customer relationship management.

Keywords: Customer Behaviour Analysis, Data Mining, Artificial Intelligence (AI), Recommendation Systems, Machine Learning, Predictive Analytics, Customer Segmentation, Association Rule Mining, Classification Techniques, Clustering Algorithms, Personalized Recommendations, Big Data Analytics, Consumer Insights, Decision Support Systems, Market Basket Analysis.

I. INTRODUCTION

The rapid expansion of digital technologies and e-commerce platforms has led to the generation of vast amounts of customer data, providing valuable opportunities for businesses to understand consumer behavior. Analyzing this data effectively has become essential for organizations aiming to enhance customer satisfaction, improve marketing strategies, and increase profitability. Techniques from Data Mining play a crucial role in extracting meaningful patterns, trends, and relationships from large datasets, enabling businesses to gain deeper insights into customer preferences and purchasing behavior.

The project titled “Customer Behaviour Analysis Using Data Mining Techniques with AI Driven Recommendations” focuses on leveraging advanced analytical methods and artificial intelligence to transform raw customer data into actionable insights. By applying techniques such as clustering, classification, and association rule mining, the system identifies customer segments and predicts future behavior. Furthermore, the integration of AI-driven recommendation systems allows the platform to provide personalized product suggestions based on user interests and historical data. This approach not only enhances user experience but also supports data-driven decision-making, making it a powerful tool for modern businesses in a competitive environment.

II. LITERATURE SURVEY

Title:

“Customer Behaviour Analysis Using Data Mining Techniques”

Abstract:

This study explores the use of data mining techniques to analyze customer purchasing behavior and identify meaningful patterns from large transactional datasets. The research focuses on association rule mining and clustering methods to discover relationships between products and

customer segments. The results demonstrate that these techniques can effectively identify buying trends, enabling businesses to optimize marketing strategies and improve customer satisfaction. The study highlights the importance of data-driven decision-making in understanding consumer behavior.

Title:

“AI-Based Recommendation Systems for Personalized Marketing”

Abstract:

This paper presents an overview of recommendation systems powered by Artificial Intelligence for delivering personalized user experiences. It discusses collaborative filtering and content-based filtering techniques used to generate recommendations based on user preferences and historical data. The study shows that AI-driven recommendation systems significantly enhance customer engagement and retention by providing relevant product suggestions. It also emphasizes the role of machine learning in improving recommendation accuracy and scalability.

Title:

“Market Basket Analysis Using Association Rule Mining”

Abstract:

This research focuses on market basket analysis using association rule mining to identify relationships between items purchased together. The study applies algorithms such as Apriori to extract frequent itemsets and generate association rules from retail transaction data. The findings reveal valuable insights into customer buying patterns, helping businesses design effective cross-selling and up-selling strategies. The paper concludes that data mining techniques play a crucial role in enhancing business intelligence and decision-making processes.

III.EXISTING SYSTEM

The existing systems for customer behaviour analysis primarily rely on traditional data analysis and basic data mining techniques to understand customer preferences and purchasing patterns. These systems typically use historical data stored in databases and apply methods such as clustering, classification, and simple statistical analysis to segment customers and identify trends. While these approaches provide useful insights, they often require manual intervention for data preprocessing, feature selection, and model tuning, making the process time-consuming and less efficient. Additionally, many existing systems generate static reports that do not adapt to real-time changes in customer behavior.

Furthermore, traditional systems lack advanced intelligence and personalization capabilities. Although some platforms incorporate recommendation systems, they are often limited to rule-based or basic collaborative filtering methods, which may not capture complex customer preferences accurately. These systems also struggle to handle large-scale data and dynamic environments, leading to reduced performance and scalability issues. As a result, there is a need for an advanced solution that integrates Artificial Intelligence with data mining techniques to provide real-time, accurate, and personalized customer behaviour analysis and recommendations.

IV.PROPOSED SYSTEM

The proposed system, titled “Customer Behaviour Analysis Using Data Mining Techniques with AI Driven Recommendations,” introduces an intelligent and data-driven approach to understanding customer behavior and providing personalized recommendations. The system utilizes advanced techniques from Data Mining to extract meaningful patterns from large volumes of customer data, including transaction history, browsing behavior, and user interactions. By applying methods such as clustering, classification,

and association rule mining, the system identifies customer segments, predicts future behavior, and uncovers relationships between products.

In addition, the system integrates Artificial Intelligence to enhance recommendation capabilities by generating personalized suggestions tailored to individual user preferences. It employs machine learning algorithms and recommendation models such as collaborative filtering and hybrid approaches to improve accuracy and adaptability. The system also supports real-time data processing, allowing it to continuously learn and update recommendations based on changing customer behavior. Overall, the proposed system provides a scalable, efficient, and intelligent solution that improves customer engagement, supports decision-making, and enhances business performance through data-driven insights.

V.SYSTEM ARCHITECTURE

The system architecture of “Customer Behavior Analysis Using Data Mining Techniques with AI Driven Recommendations” is designed as a multi-layered framework that integrates data collection, processing, analysis, and intelligent recommendation generation. The architecture consists of four major components: Customer Data Sources, Data Preprocessing & Storage Layer, Data Mining Module, and AI Recommendation Engine, all working together to deliver personalized insights and recommendations.

The first layer, Customer Data Sources, collects data from multiple channels such as transaction records, browsing history, and user profiles. This raw data is then passed to the Data Preprocessing & Storage Layer, where it is cleaned, transformed, and stored in a structured format. Techniques such as data cleaning, normalization, and feature extraction are applied to ensure data quality and consistency. This step is crucial as it directly impacts the accuracy of further analysis.

The processed data is then handled by the Data Mining Module, which applies techniques from Data Mining such as clustering, classification, and association rule mining. These techniques help in identifying customer segments, predicting behavior, and discovering relationships between products and users. The insights generated at this stage form the foundation for intelligent decision-making.

Finally, the AI Recommendation Engine uses machine learning algorithms and recommendation models such as collaborative filtering and hybrid approaches to generate personalized suggestions for users. This layer continuously learns from user interactions and updates recommendations in real time. Additionally, the system includes analytics and reporting modules that provide business insights and performance metrics. Overall, the architecture ensures a seamless flow from data collection to actionable recommendations, enabling efficient and intelligent customer behavior analysis.

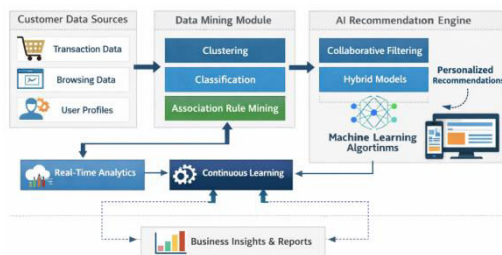


Fig 5.1: Structure of the Proposed System

IV.IMPLEMENTATION



Fig 6.1: Dashboard



Fig 6.2: overview Page

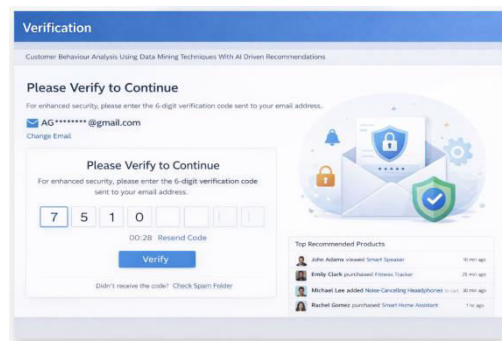


Fig 6.3: Verification page



Fig 6.4: Result Page

IV.CONCLUSION

The project “Customer Behavior Analysis Using Data Mining Techniques with AI Driven Recommendations” successfully demonstrates how advanced analytical methods can be used to extract meaningful insights from large volumes of customer data. By leveraging techniques from Data Mining such as clustering, classification, and association rule mining, the system effectively identifies customer patterns, segments users, and predicts purchasing

behavior. This enables businesses to better understand their customers and make informed, data-driven decisions.

Furthermore, the integration of Artificial Intelligence enhances the system by providing personalized recommendations based on user preferences and historical data. The system not only improves customer engagement and satisfaction but also increases business efficiency and profitability. With its ability to perform real-time analysis and adapt to changing user behavior, the proposed solution proves to be scalable, efficient, and highly effective. Overall, the project highlights the importance of combining data mining and AI techniques to build intelligent systems that support modern business needs and competitive strategies.

III.V.FUTURE SCOPE

The project focuses on enhancing intelligence, scalability, and real-time adaptability. The system can be further improved by integrating advanced machine learning and deep learning models to achieve more accurate predictions and deeper behavioral insights. Techniques such as reinforcement learning and neural networks can be used to refine recommendation accuracy and adapt dynamically to changing customer preferences. Additionally, incorporating real-time data streaming and big data technologies can enable the system to process large-scale data efficiently and provide instant recommendations.

Moreover, the system can be extended to support cross-platform integration, including mobile applications and cloud-based deployment, making it more accessible and scalable. Advanced features such as sentiment analysis from social media, voice-based interactions, and personalized marketing automation can be incorporated to enhance user experience. Strengthening security measures, including data encryption and

privacy-preserving techniques, will ensure safe handling of customer data. In the future, the system can evolve into a fully intelligent business solution capable of end-to-end customer lifecycle management, helping organizations achieve higher efficiency, improved customer satisfaction, and competitive advantage.

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