

Unveiling Customer Behavior in Retail with Data-Driven Insights

CASE STUDY

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Overview



This case study presents a extensive **Analysis of Customer behavior within retail environment** using a data science–driven strategy. Through the integration of analytical modeling and targeted visual storytelling, the objective was to decode customer patterns, enhance personalization, and uncover meaningful product relationships.

Highlights :

- Understanding varied customer preferences and behavior for effectiveness of marketing initiatives and inventory decisions.
- Retail dataset with detailed records of customer orders and relevant information.
- Turning raw transaction data into meaningful insights to improve personalization and support smarter decisions.

Introduction

Understanding how customers shop is one of the most important parts of running a successful retail business. With the large amount of data collected from customer transactions, there is a great opportunity to study shopping habits, find trends, and make better business decisions. By looking closely at the data, businesses can learn what customers want, when they shop, and which products they are most likely to buy again.

Here we focus on analyzing retail customer behavior using data science which includes steps like exploring the data, finding common product combinations, grouping customers based on their habits, and predicting future purchases to deliver personalized interactions across various touch points.



Problem Statement

- Deciphering customer purchasing behaviors beyond surface-level sales data to uncover patterns.
- Segmenting customers by their behavioral patterns to help enable future hyper-targeted marketing initiatives.
- Identifying high-confidence product associations to guide strategic cross-selling.
- Anticipating reorders likelihood using predictive analytics to improve customer retention.

Methodology

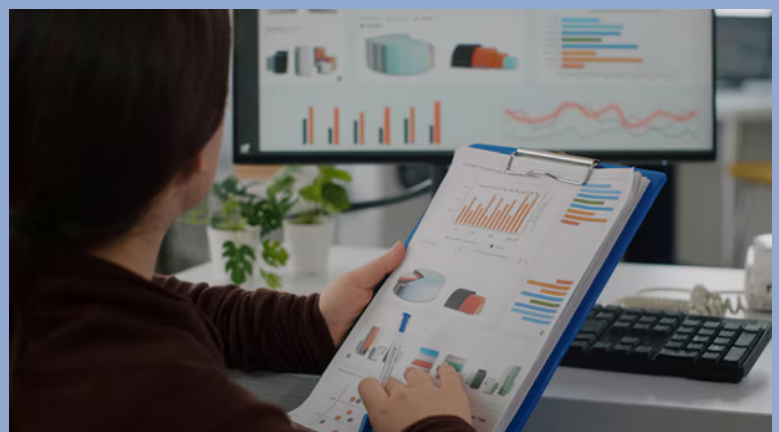
Data Collection and Integration:

- Cleaning: Removed missing values, duplicates, and irrelevant records.
- Feature Engineering: Created new features (e.g., RFM metrics, product categories).
- Transformation: Encoded categorical variables and standardized numerical features.



Exploratory Data Analysis (EDA):

- Statistical Summary: Used descriptive stats and visualizations (histograms, heatmaps) to identify trends.
- Cohort Analysis & Sentiment Analysis: Analyzed user behavior over time and product sentiment.



Methodology

Market Basket Analysis:

- Association Rule Mining: Implemented FP-Growth to find frequent itemsets and generate rules.

Predictive Modeling:

- Modeling: Applied XGBoost, Random Forest, and Neural Networks to predict reorder behavior.
- Class Balancing: Used SMOTE to handle imbalanced classes.

Visualization & Reporting:

- Visualization: Created visualizations using matplotlib, seaborn, and Power BI for insights.
- Presentation: Summarized findings via visualizations.



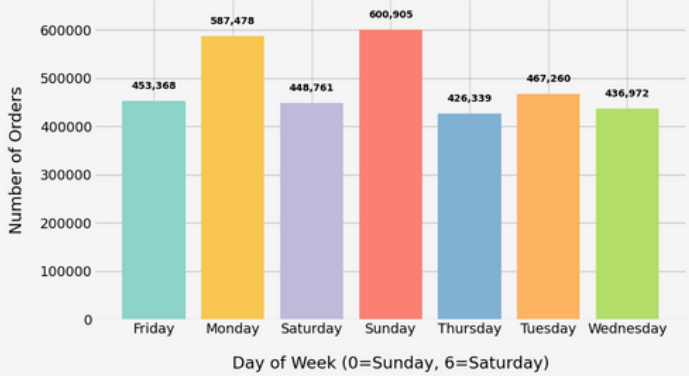
RESULTS:

The analysis uncovered distinct customer groups, such as high-value spenders and loyal buyers, allowing for tailored marketing and promotional campaigns. Market basket analysis identified key product pairings, suggesting opportunities for cross-selling. Predictive models performed with 71% accuracy, with SMOTE enhancing model effectiveness through class balancing. High-demand aisles, such as dairy and snacks, were pinpointed, helping inventory and sales planning. Cohort analysis highlights the need for prompt customer engagement to boost retention

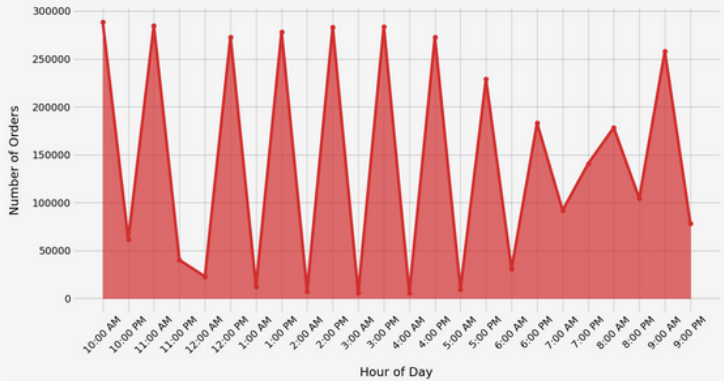


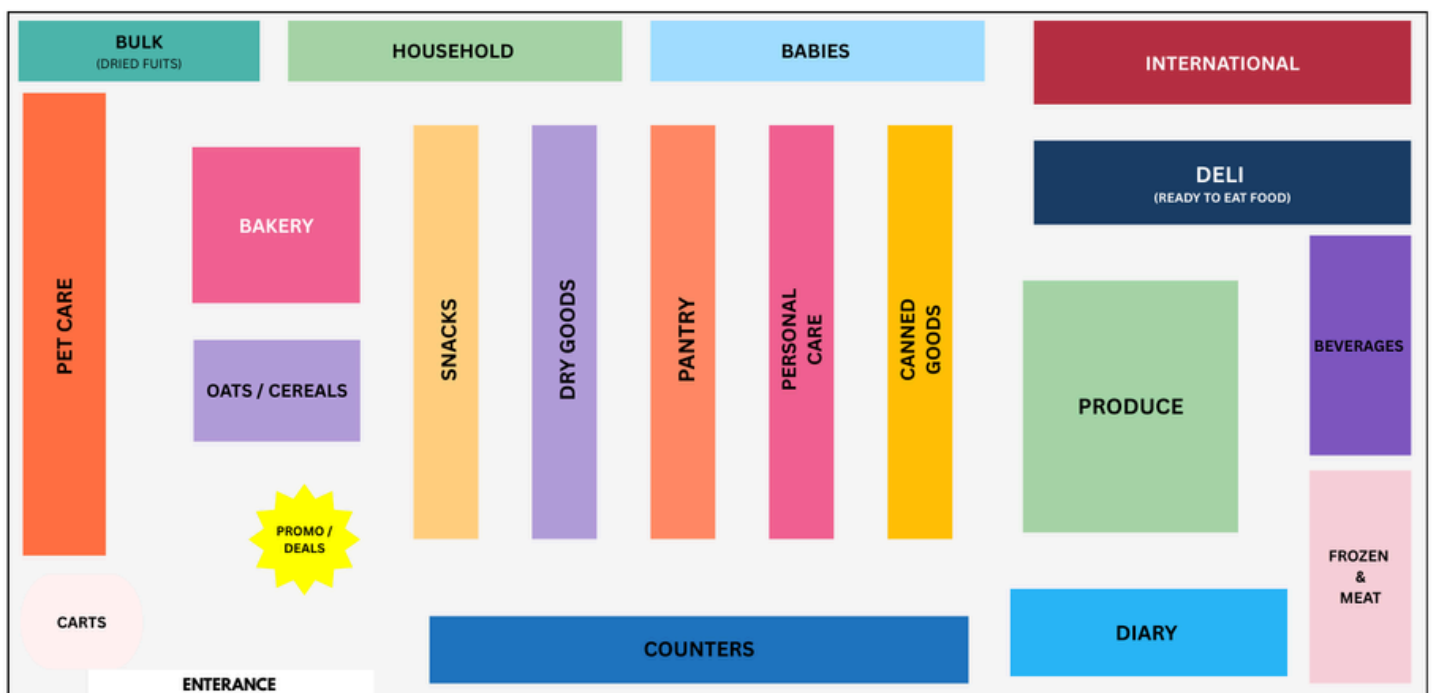
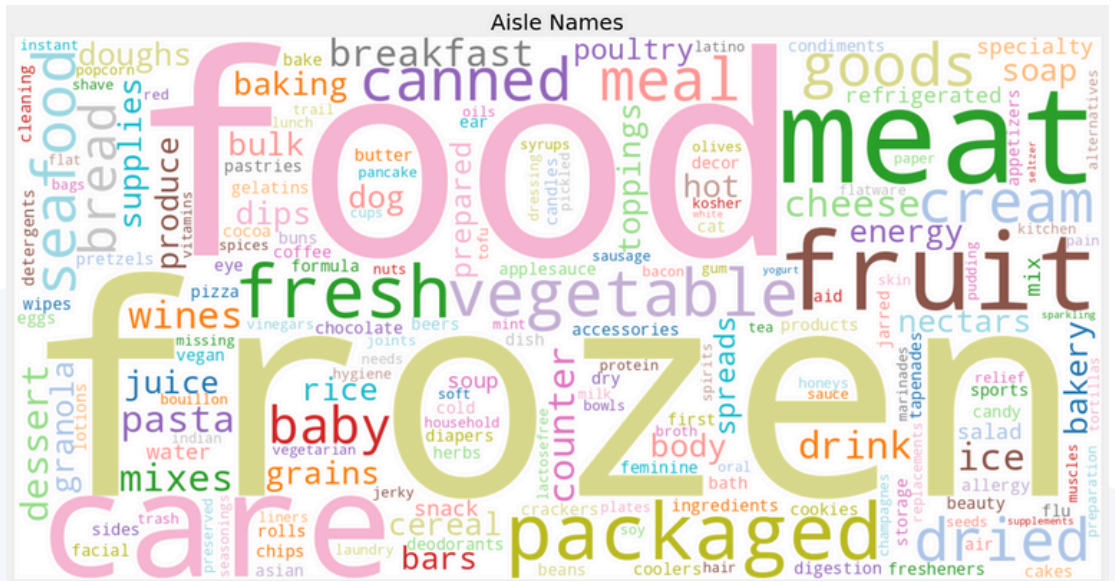
Key Insights

Orders by Day of Week

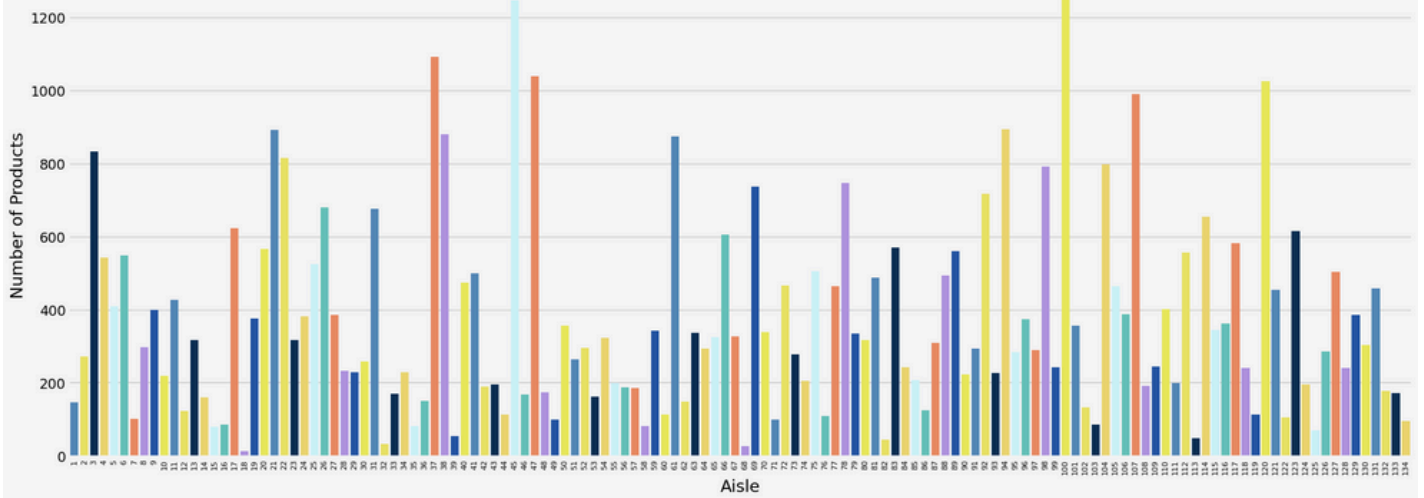


Number of Orders by Hour of Day

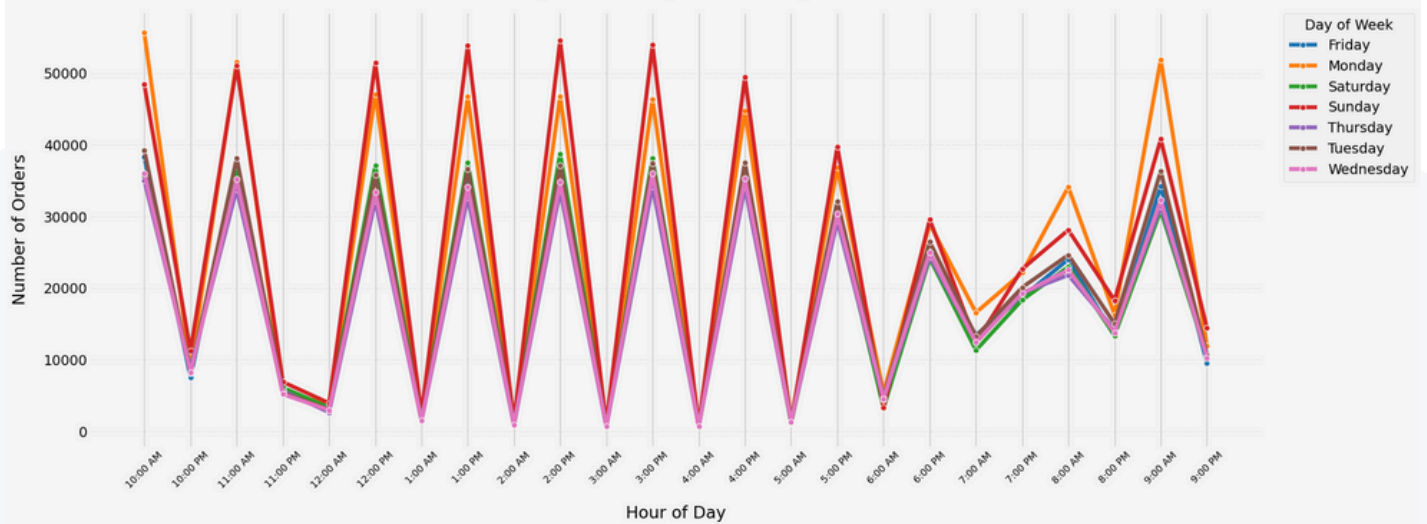




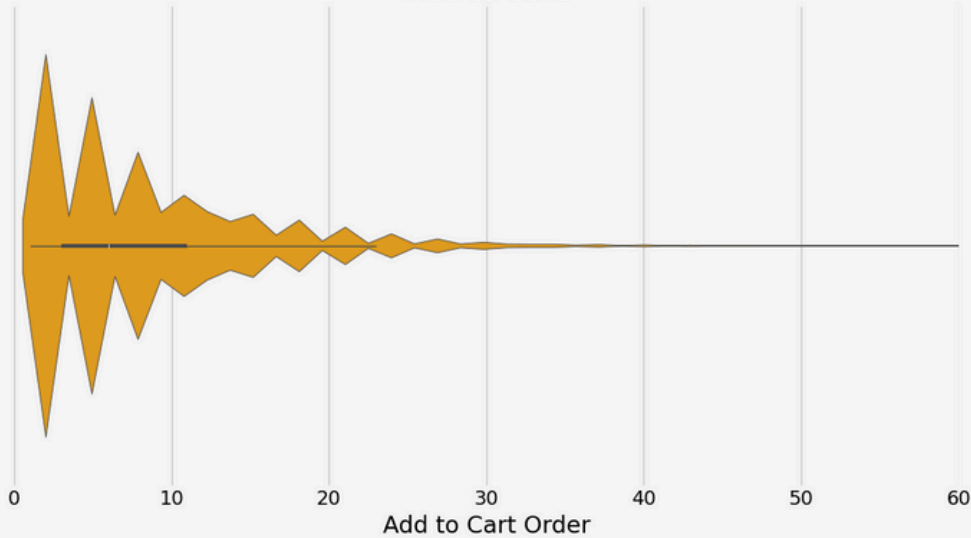
Product Distribution Across Aisles



Orders by Hour of Day for Each Day of Week

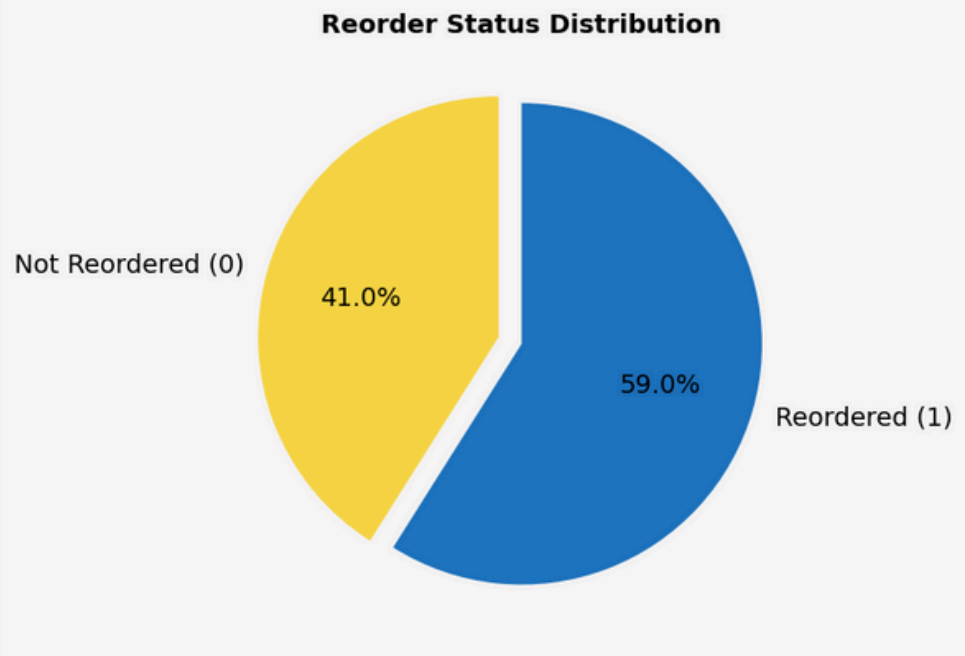
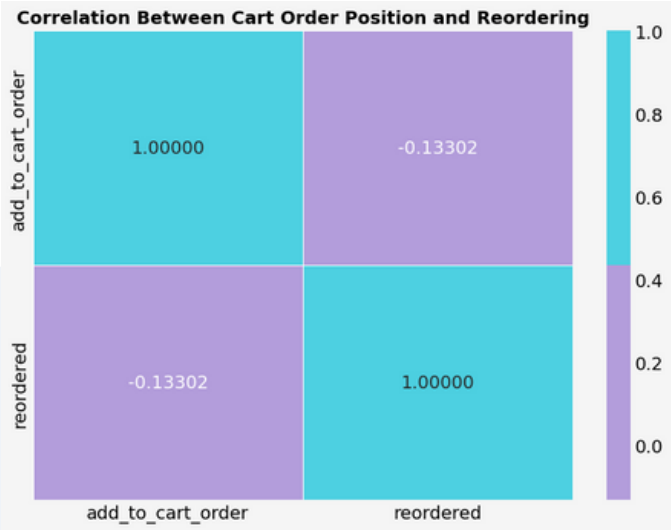
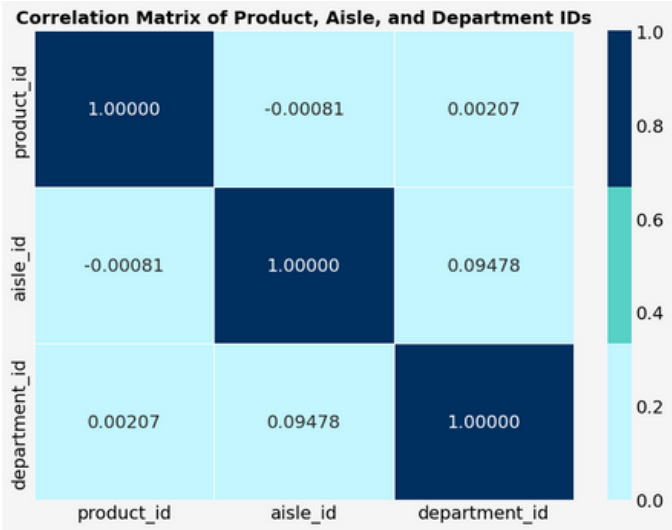


Add to Cart



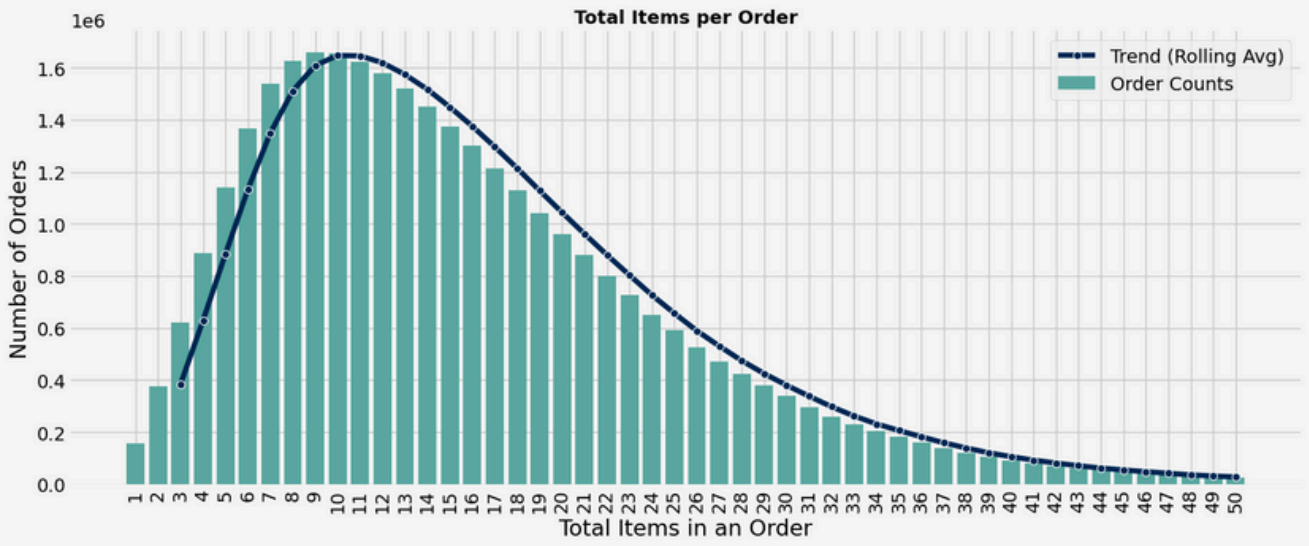
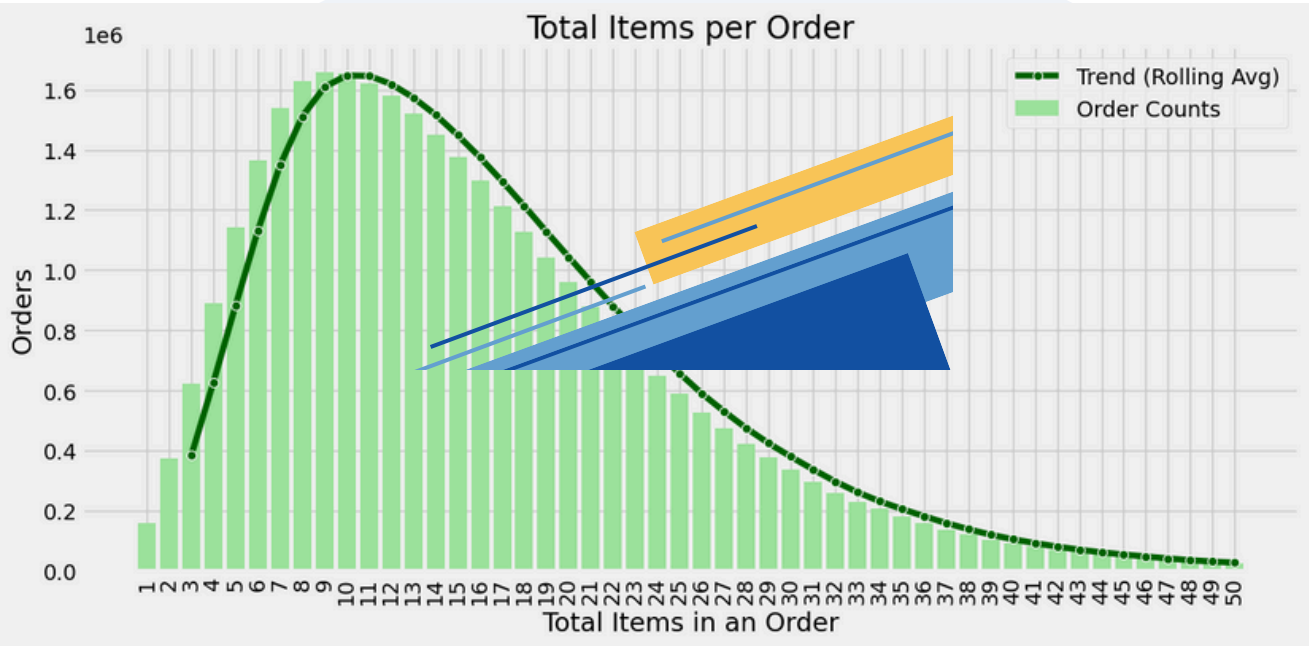
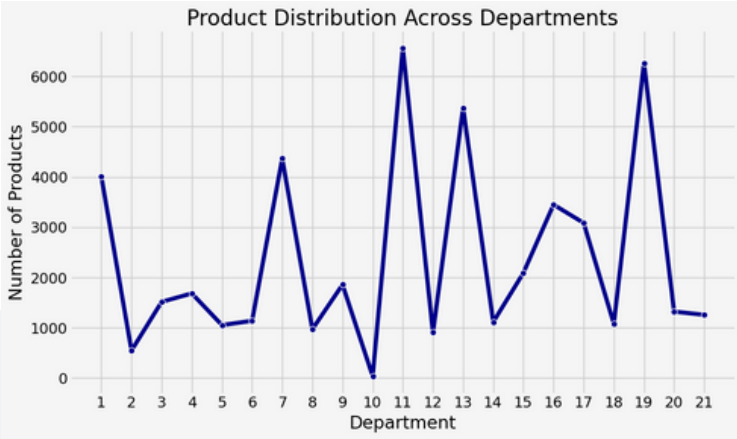
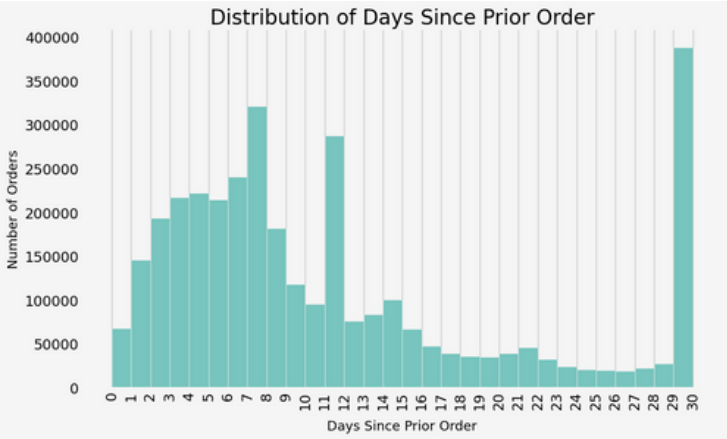
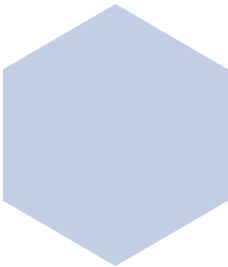


Key Insights



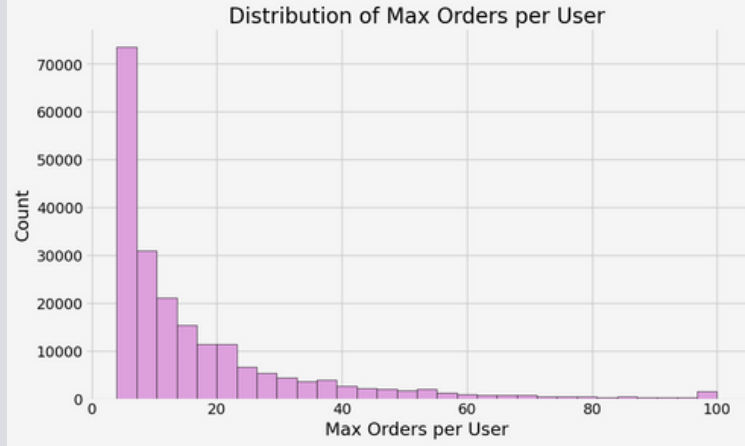
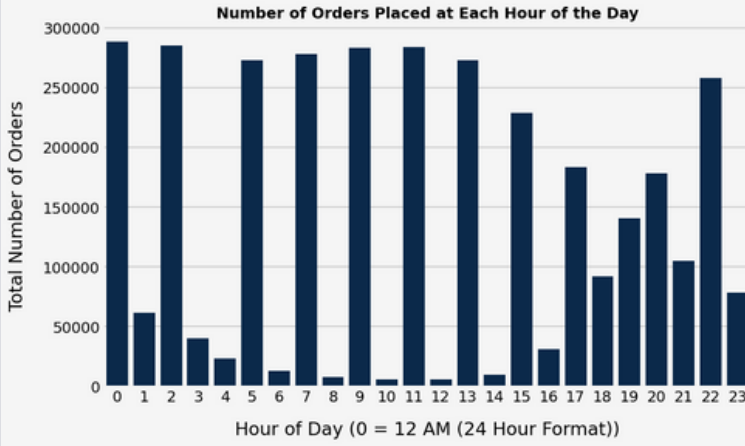
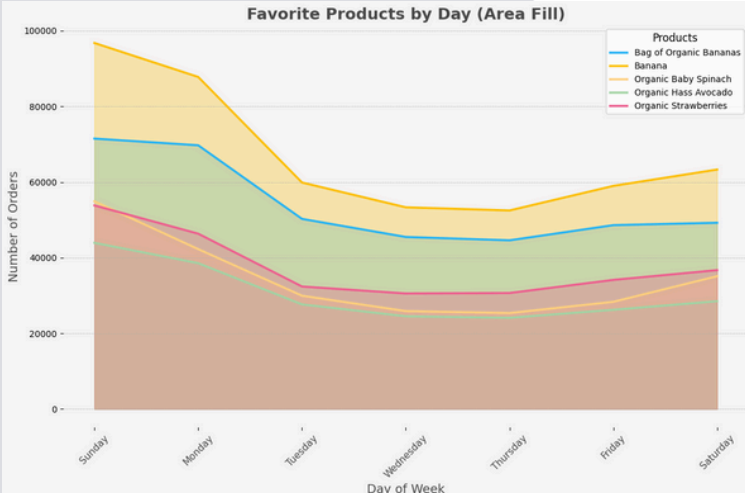
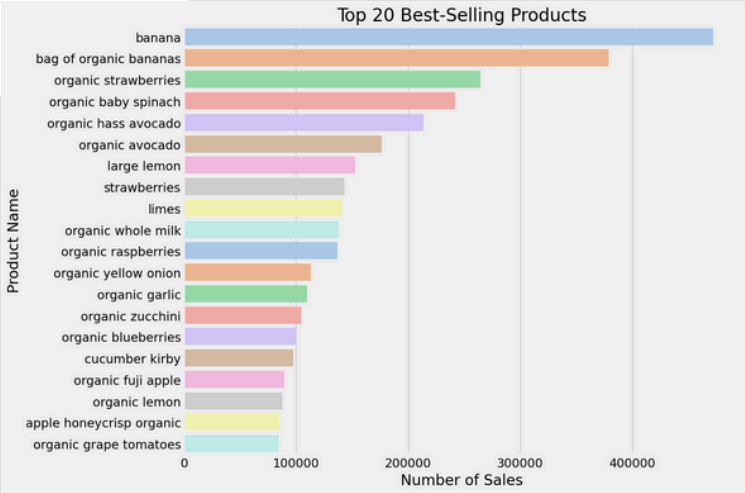
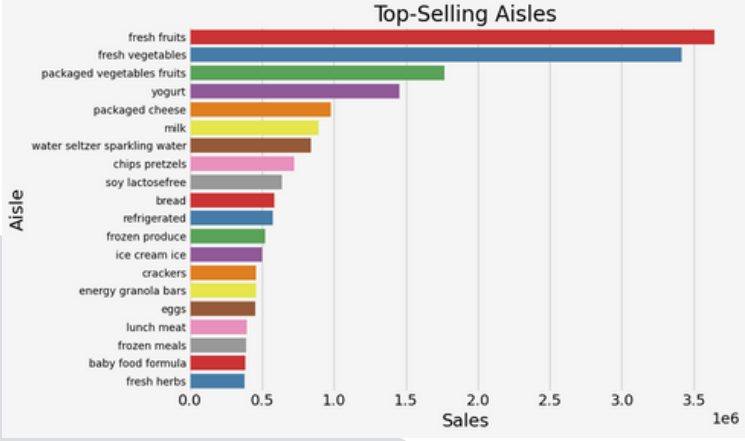
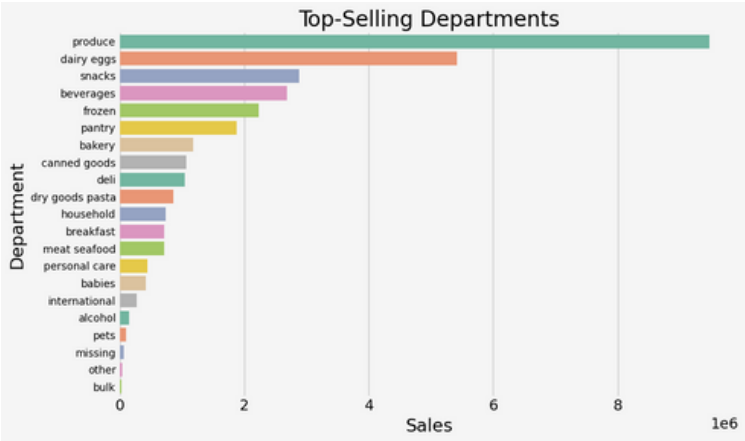


Key Insights



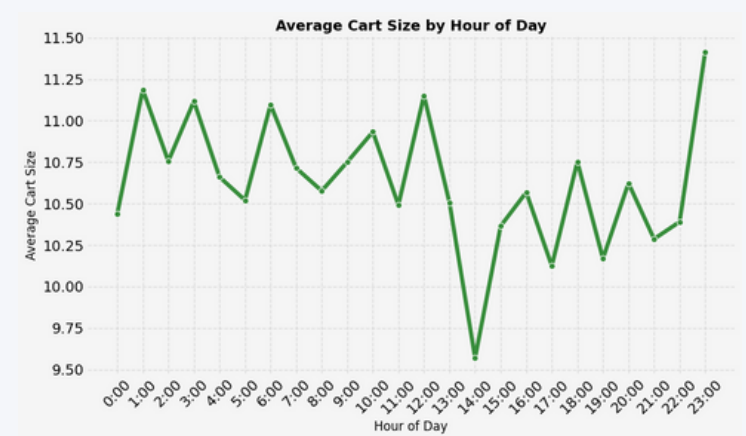
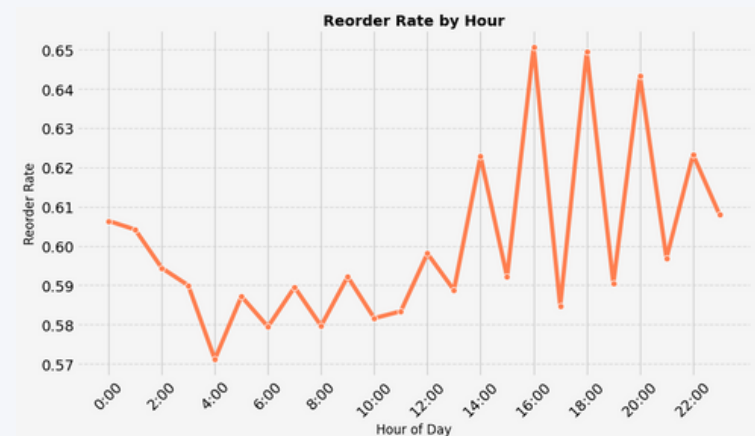
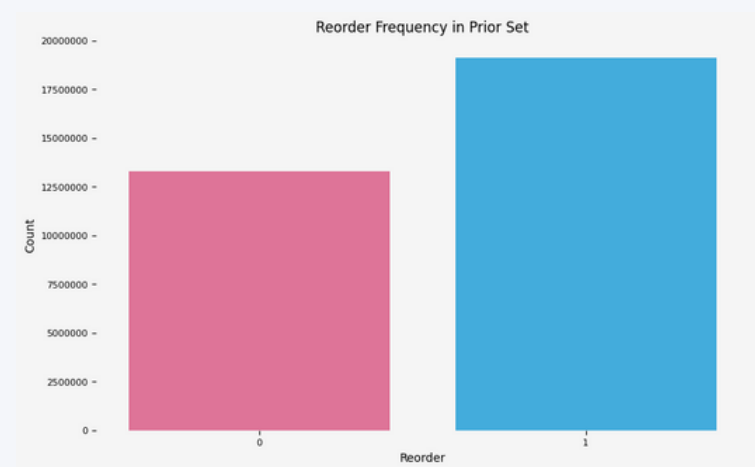
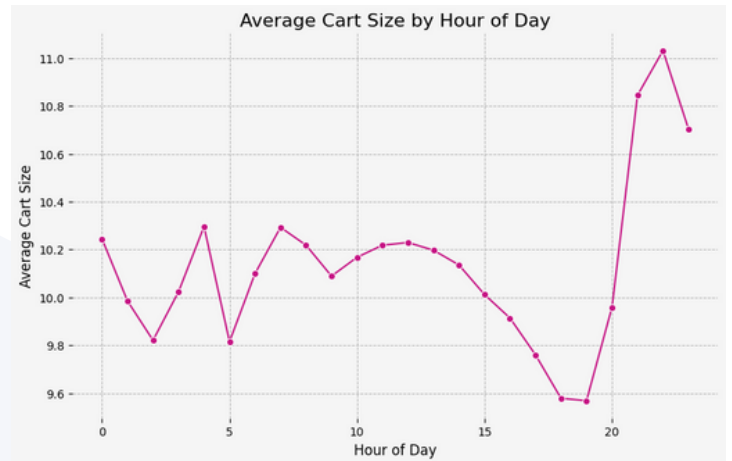
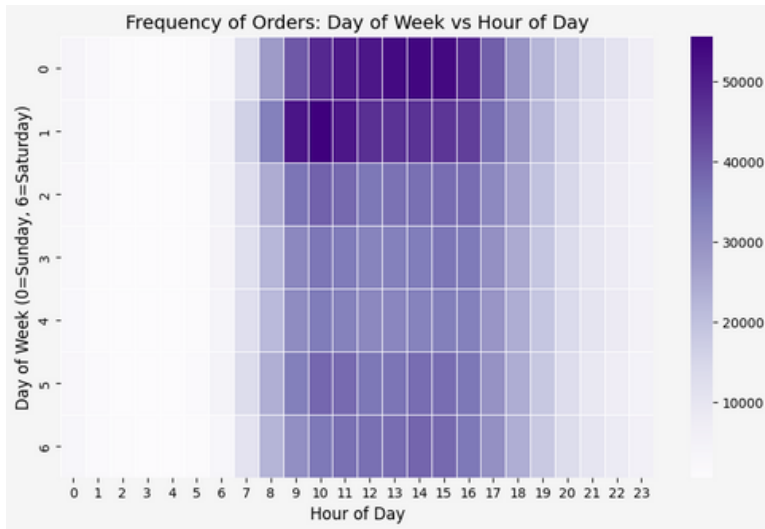


Key Insights



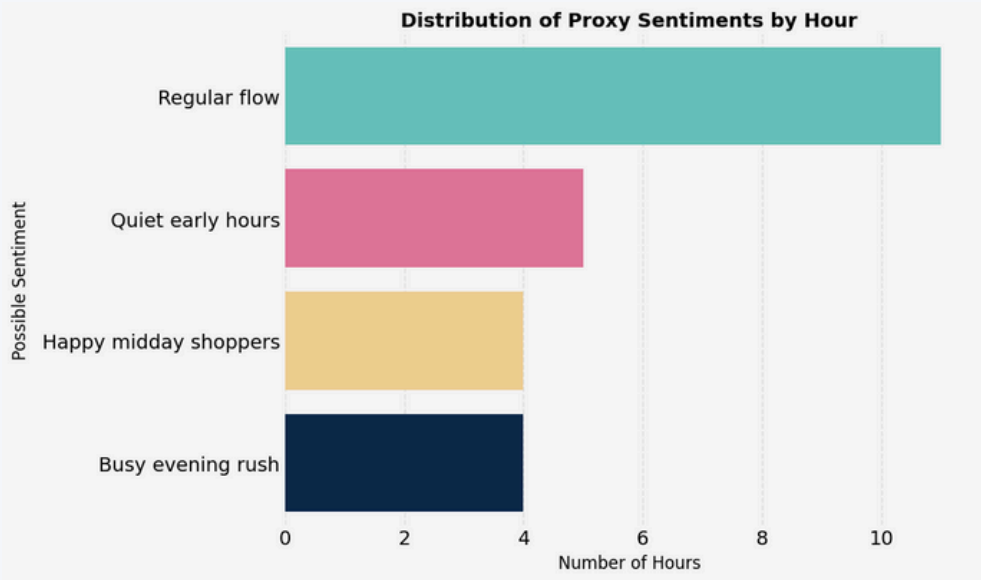
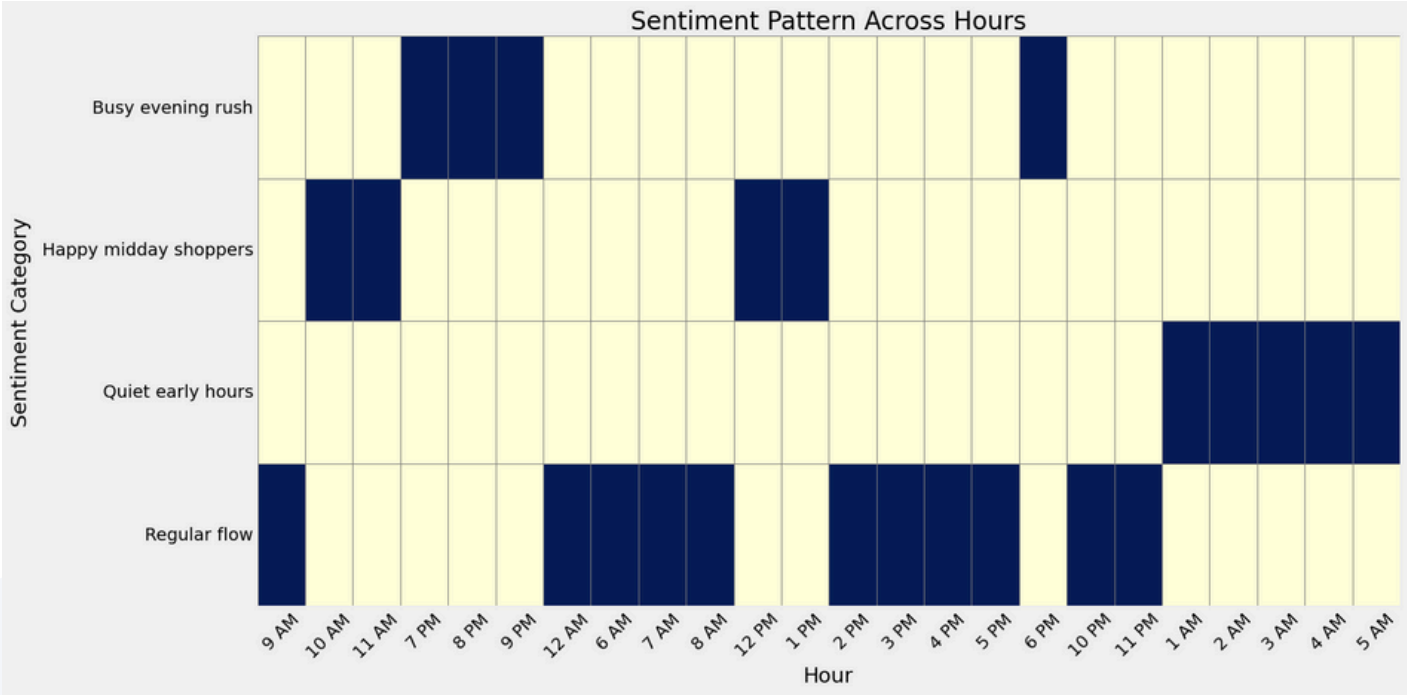


Key Insights



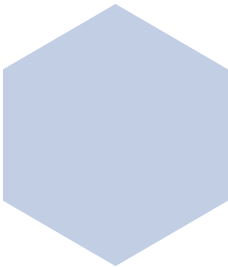


Key Insights

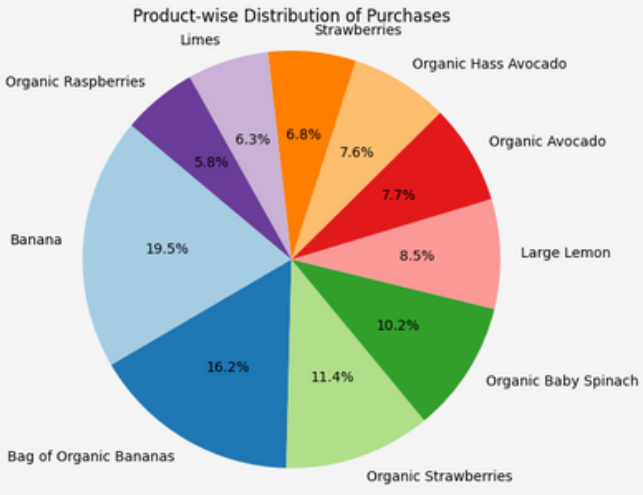
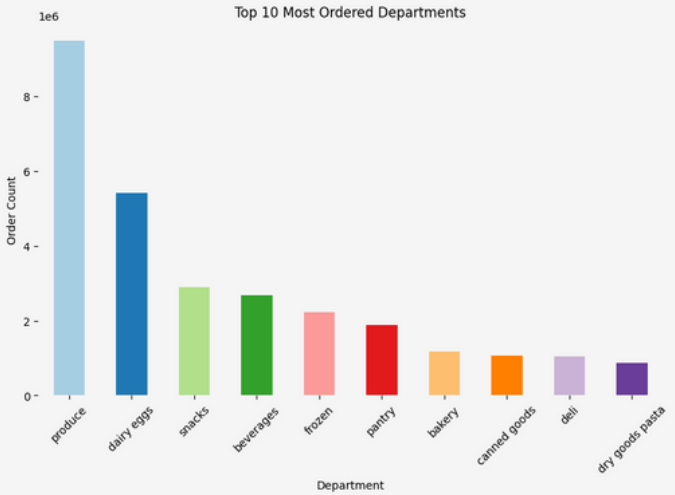
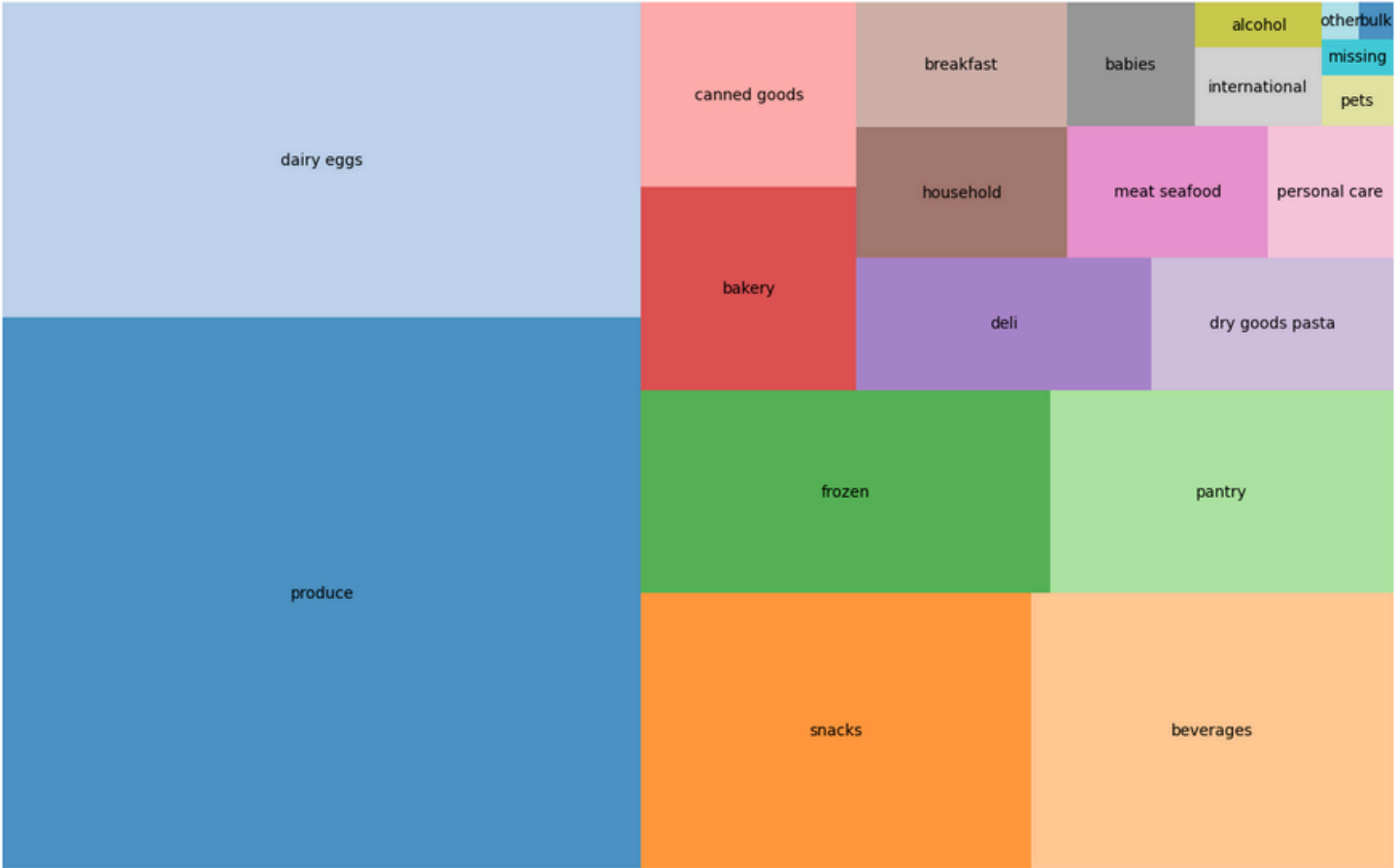




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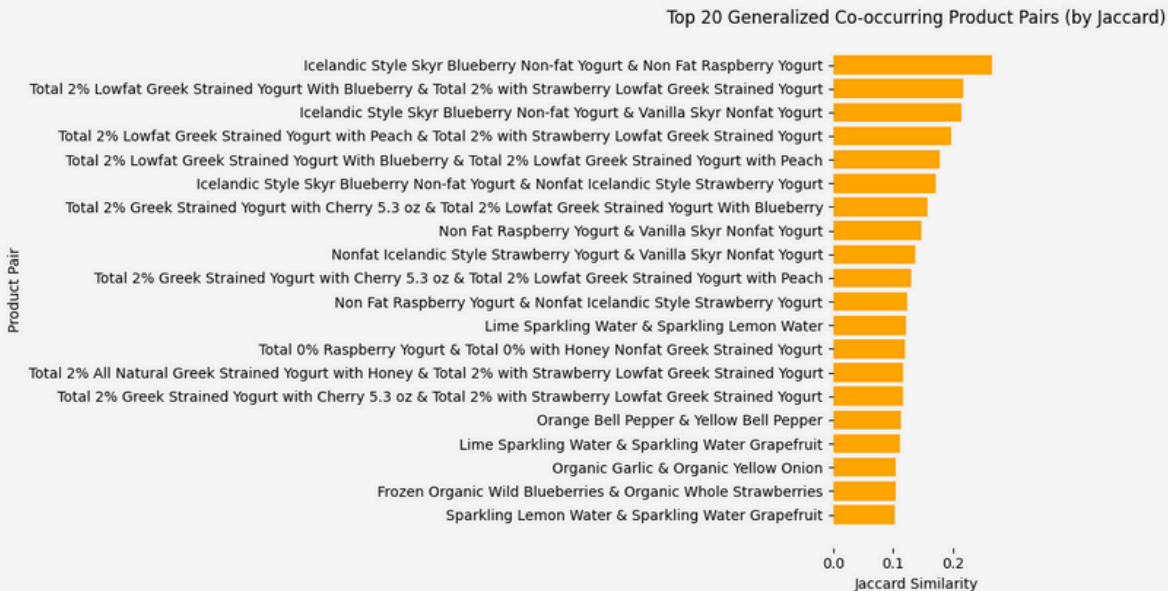
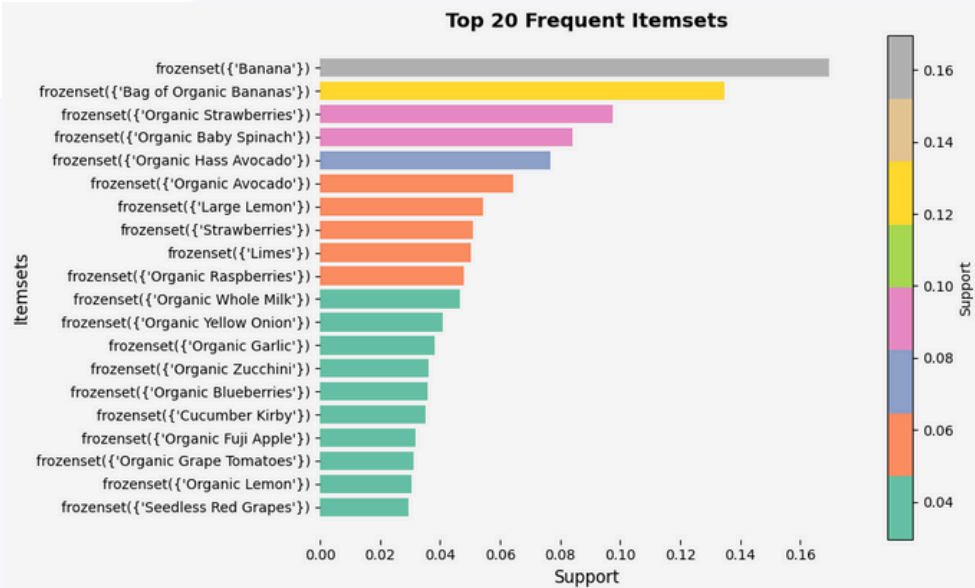
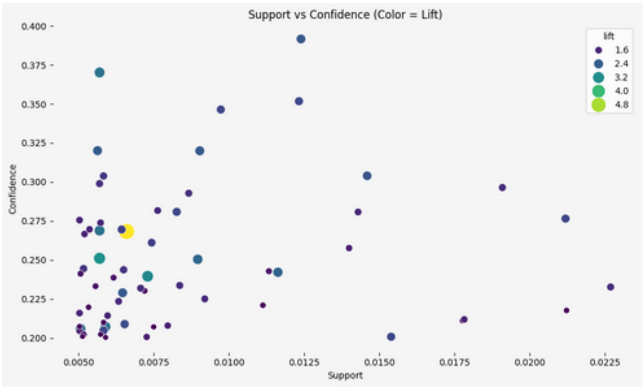
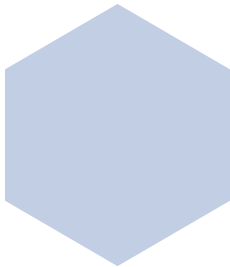


Treemap of Departments by Order Volume



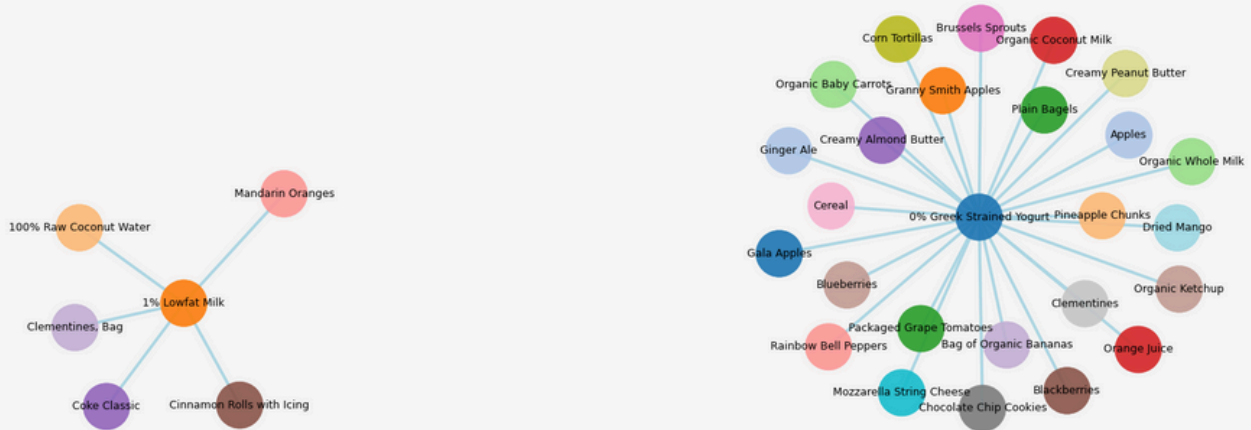


Market Basket Analysis

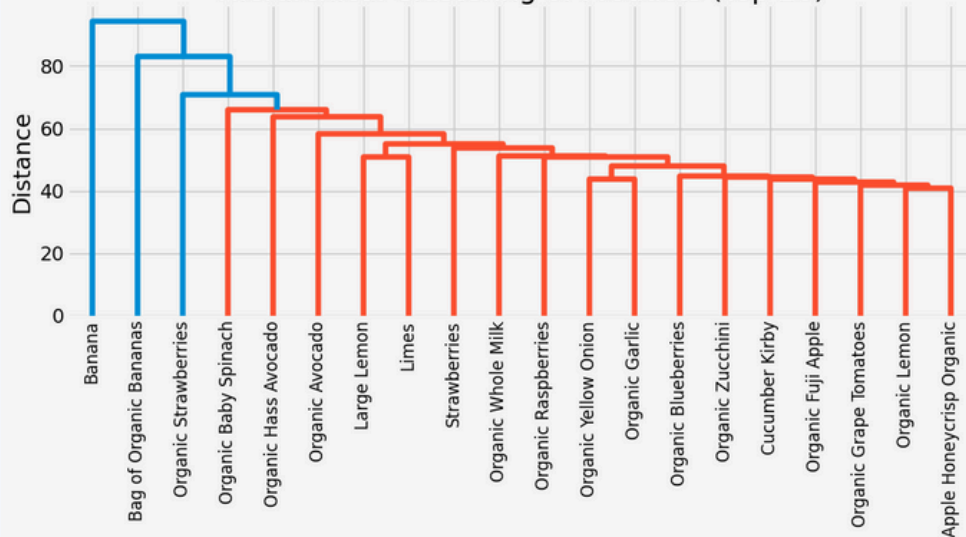




Colorful Product Co-occurrence Network (Top 30 Pairs)

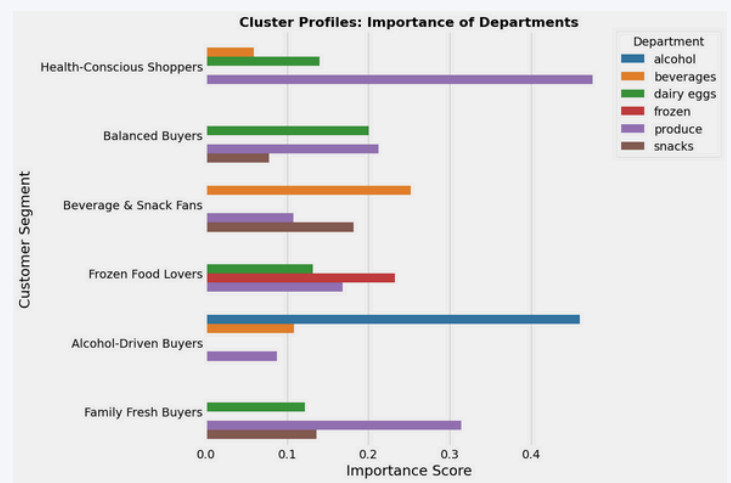
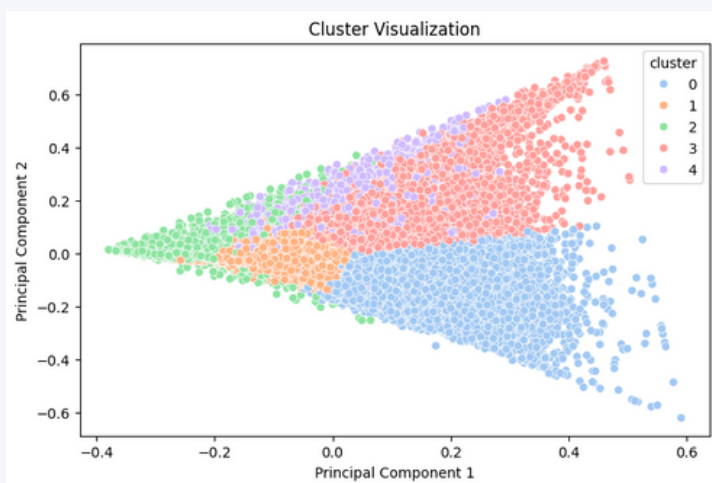
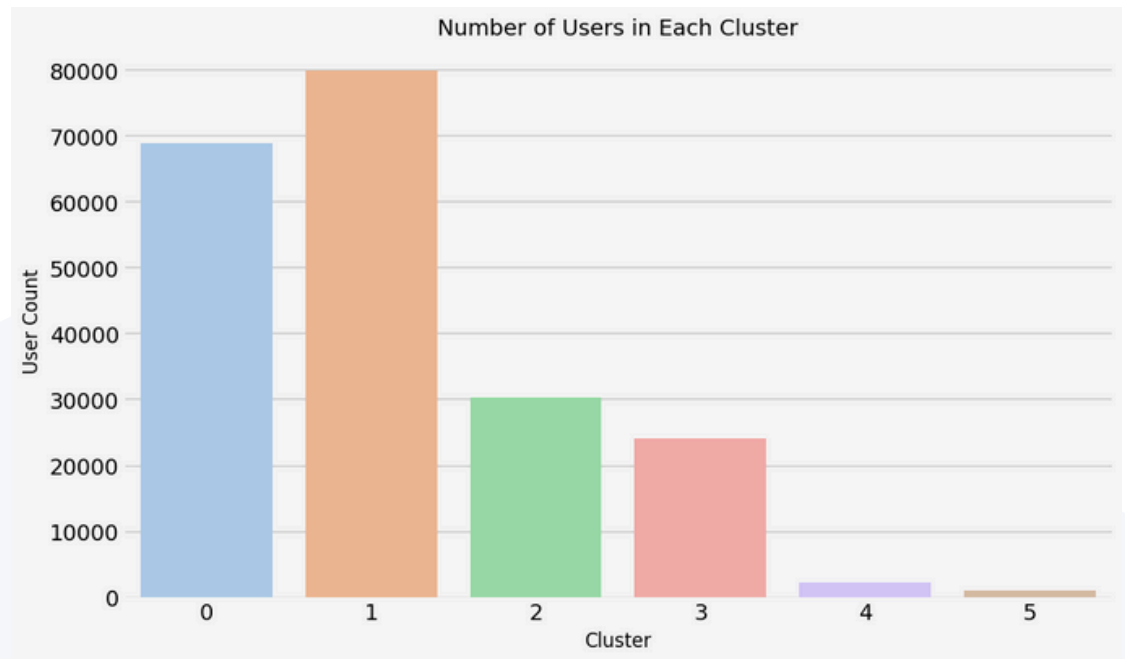
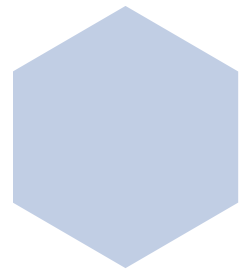


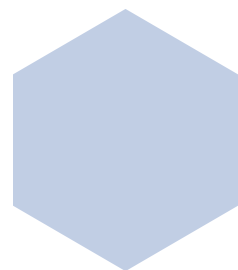
Hierarchical Clustering of Products (Top 20)



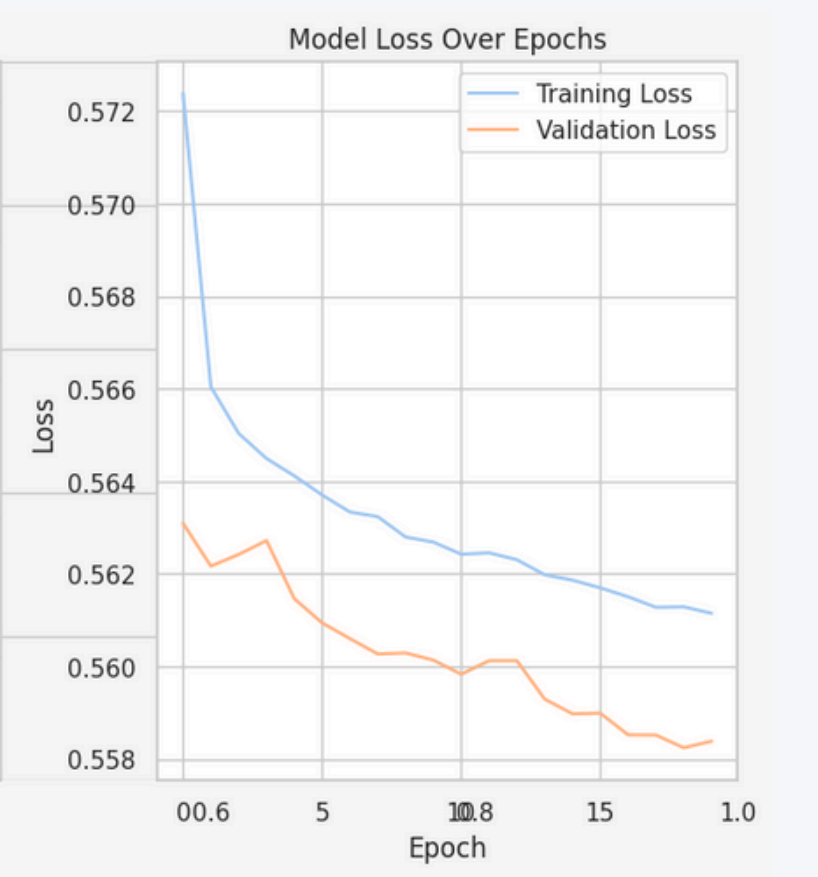
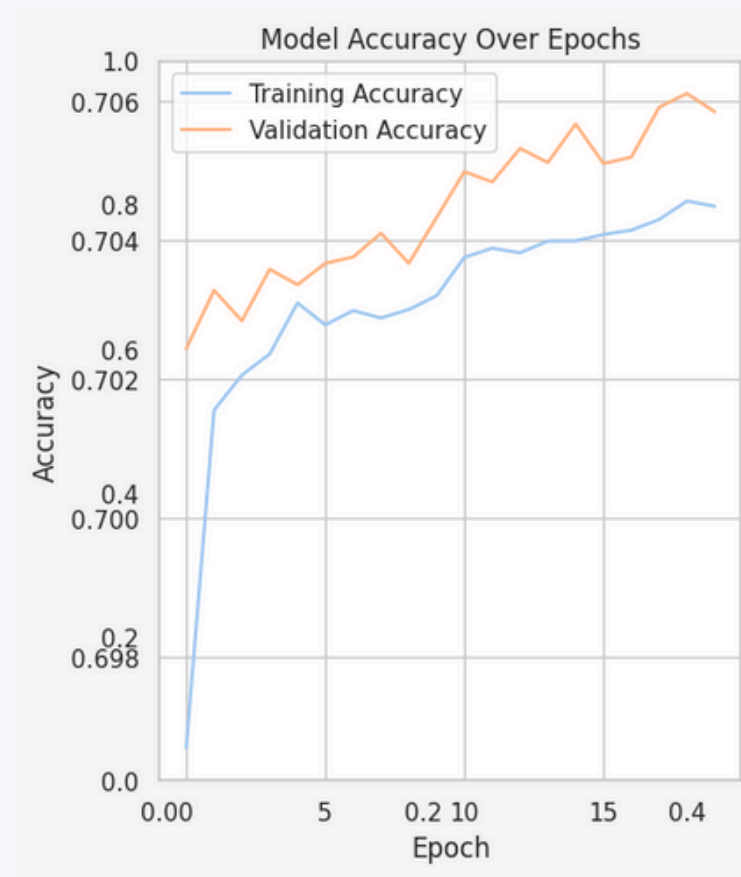
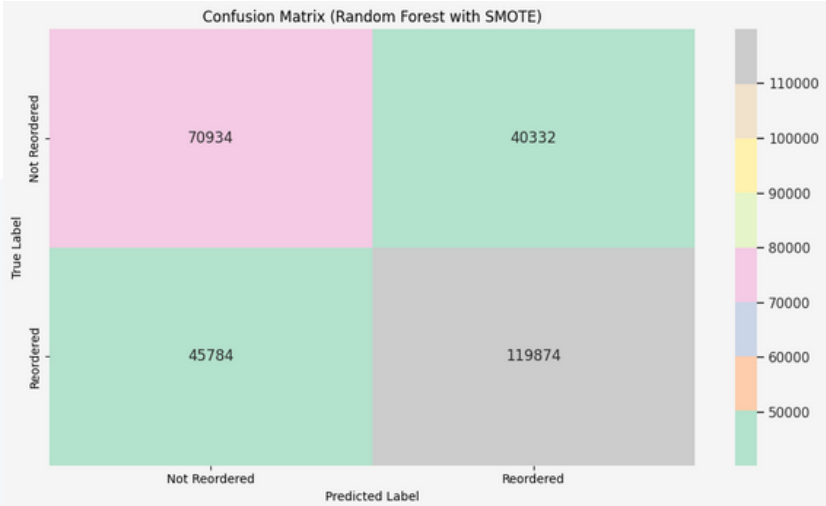
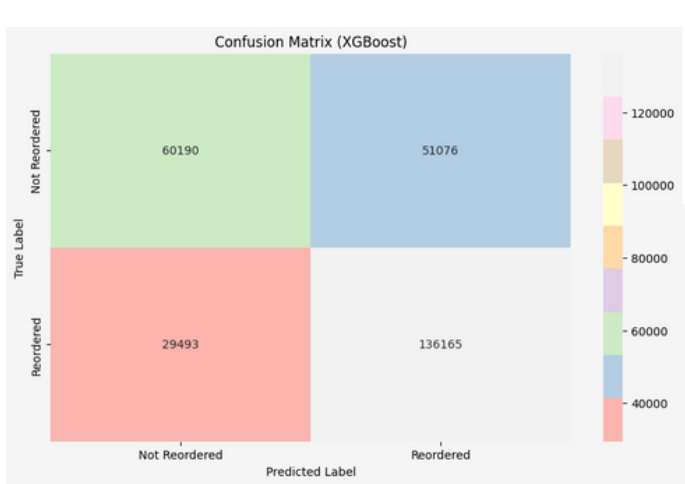


Clustering



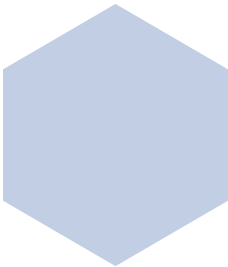


Predictions

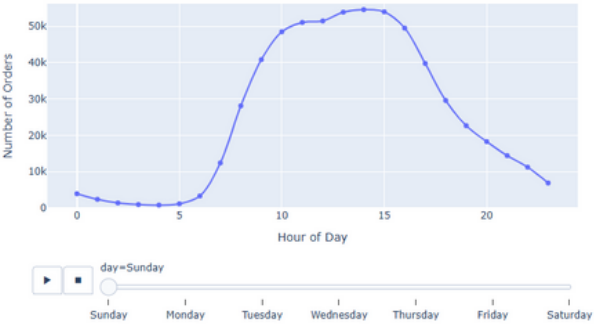




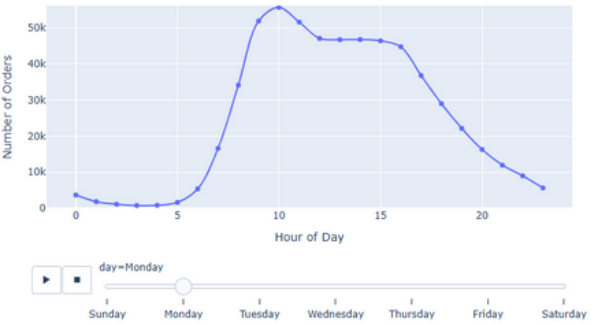
Insights



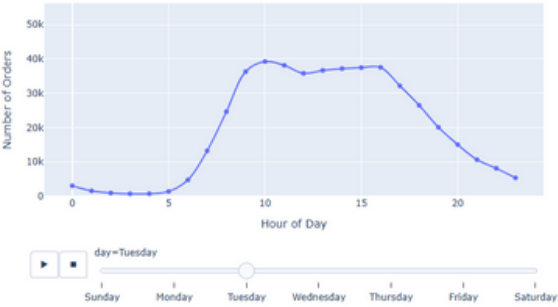
Animated Order Trends by Hour of Day (Daily)



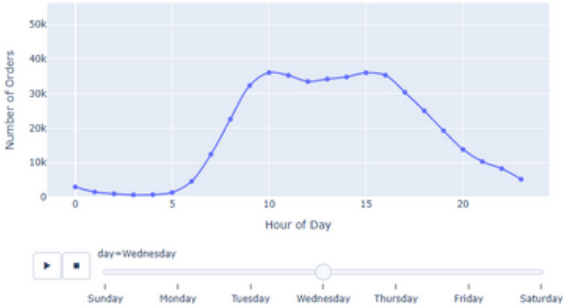
Animated Order Trends by Hour of Day (Daily)



Animated Order Trends by Hour of Day (Daily)



Animated Order Trends by Hour of Day (Daily)



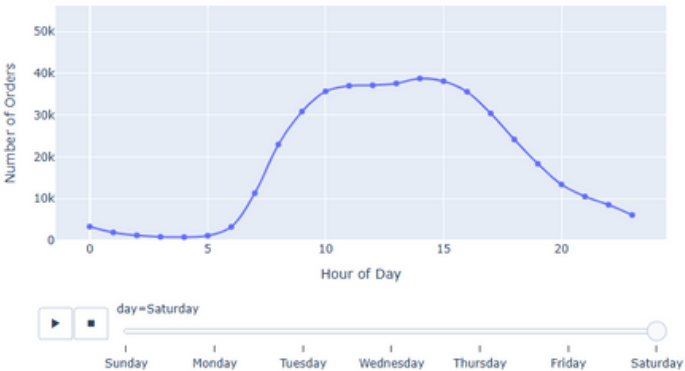
Animated Order Trends by Hour of Day (Daily)



Animated Order Trends by Hour of Day (Daily)



Animated Order Trends by Hour of Day (Daily)



Conclusion

By adopting a distinctive data-driven strategy, we were able to uncover critical insights that informed business growth, strengthened customer relationships, and improve its competitive position within the dynamic retail sector. Through the integration of advanced data science methodologies—including behavioral segmentation, association analysis, and predictive modeling—the business gained the capability to anticipate customer needs with greater precision, customize offerings to individual preferences, and streamline operational processes. These efforts not only elevate the overall customer experience but also provided a scalable framework for continuous improvement.

The case study demonstrates how thoughtful application of data analytics can transform raw data into strategic intelligence, laying the groundwork for long-term success and innovation in a rapidly evolving marketplace.

TRANSFORMING BUSINESSES WITH **ERP SYSTEMS, DATA SCIENCE, AND INTELLIGENCE**

Delivering Data-Driven Insights for Smarter
Decisions and Sustainable Growth

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