

Developing a Comprehensive Machine Learning System for E-Commerce: Integrating Personalized Recommendations with Demand Forecasting

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Enhance e-commerce with
personalized recommendations
and demand forecasting



Benefits of the work:

- Improve user experience.
- Improve product management
and pricing.
- Address issues with cold-start
problems.

Aim & Objectives

Aim:

- Create a Machine Learning system enhancing e-commerce with personalized recommendations and demand forecasting.

Objectives:

- Analyze existing e-commerce systems.
- Evaluate relevant e-commerce datasets for suitability.
- Design and develop a ML-based e-commerce system.
- Ensure seamless integration of models.
- Evaluate system performance.

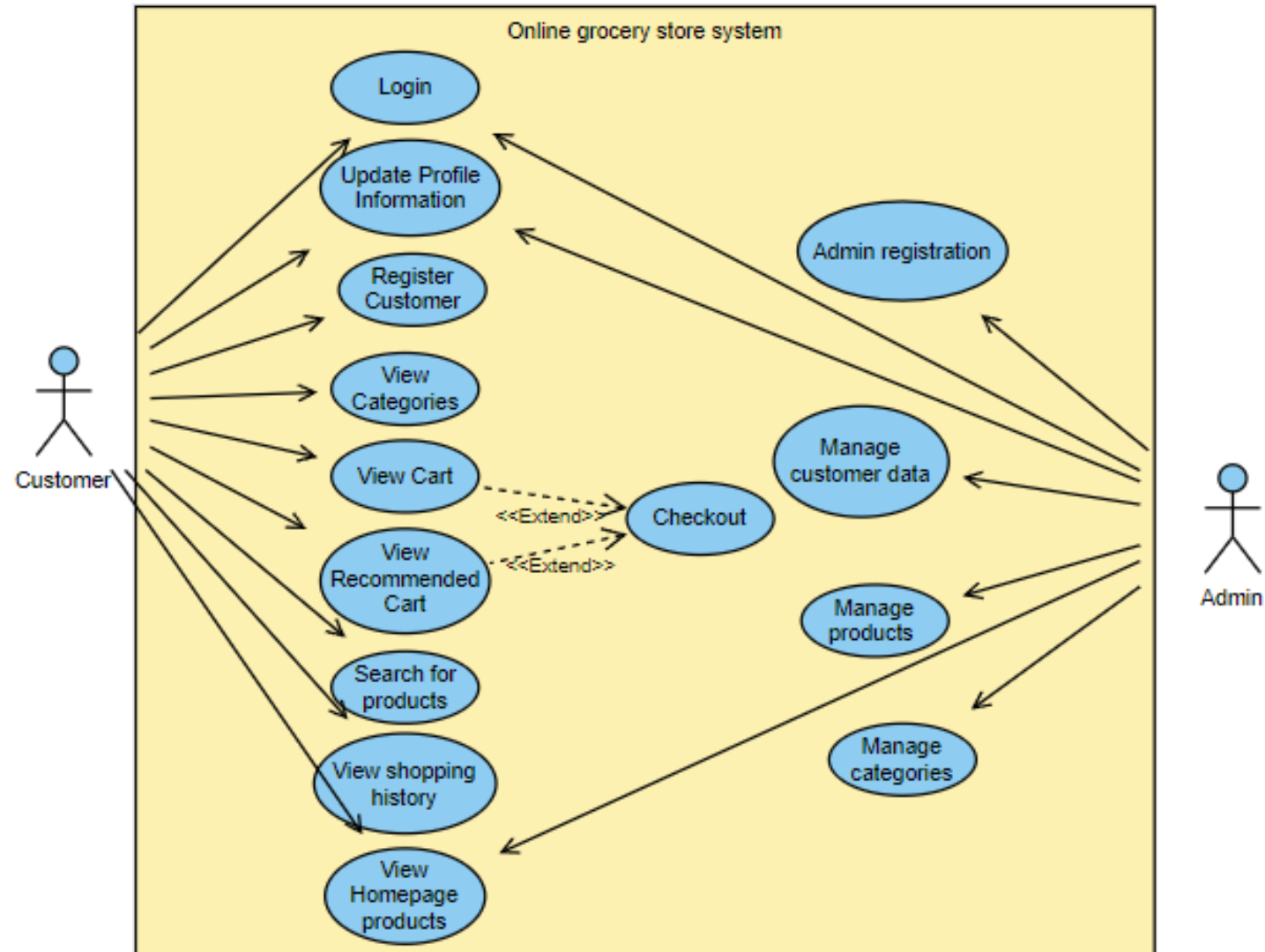
Existing Systems:

- Personalized recommendations
- Demand forecasting

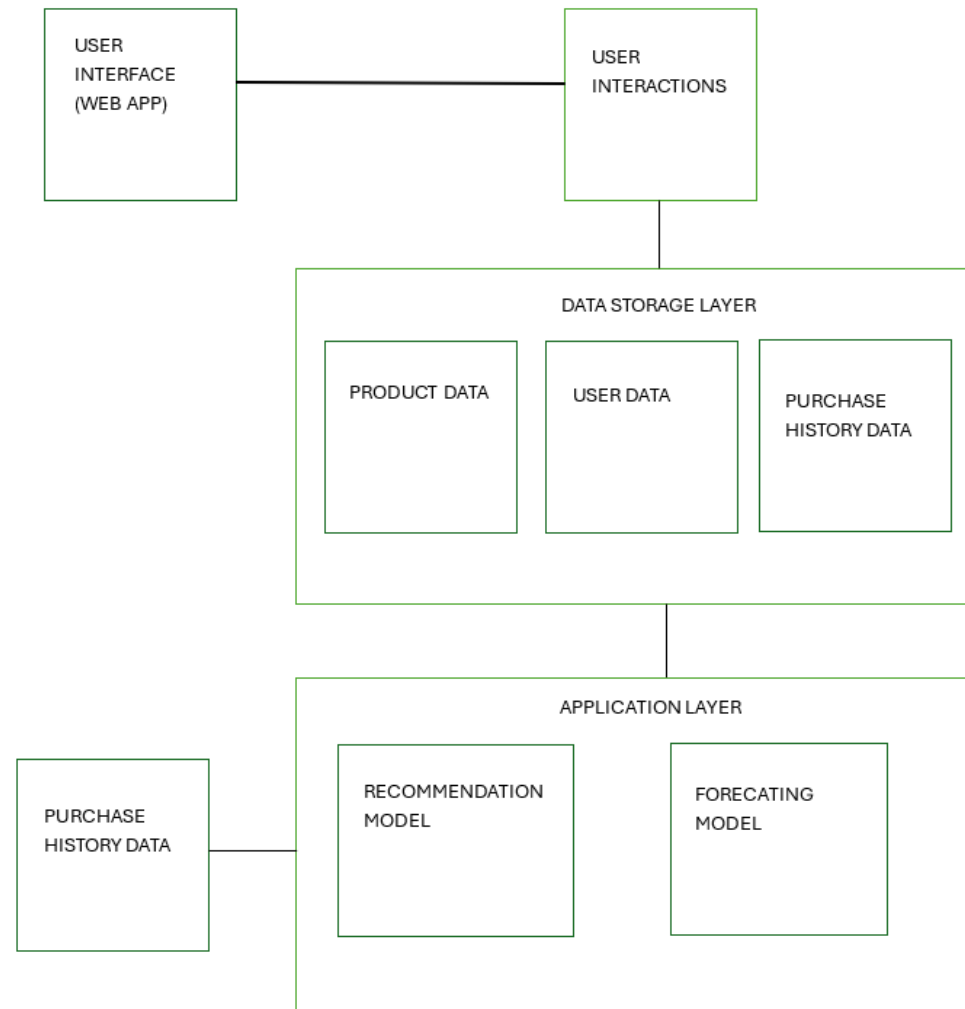
Gaps and Opportunities:

- Integration of both systems
- Addressing cold-start problem

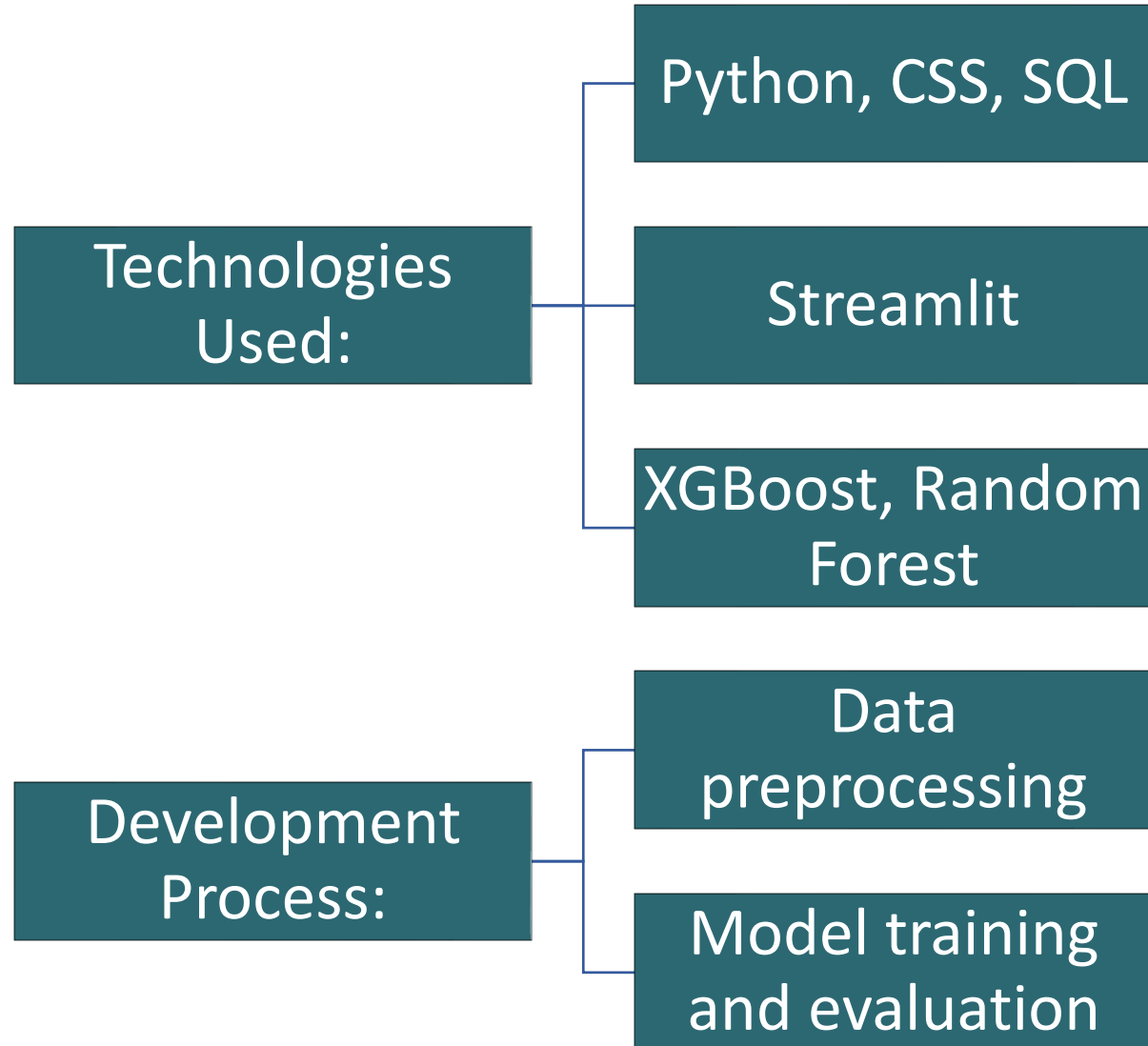
Use case Diagram



System Architecture



Implementation



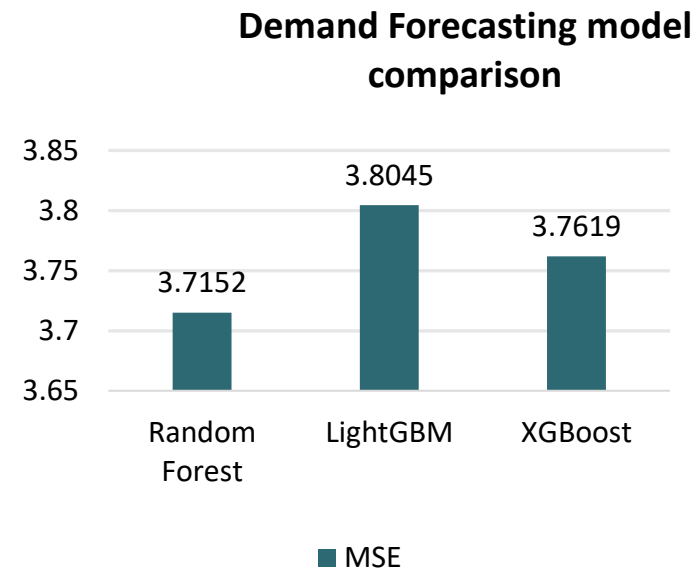
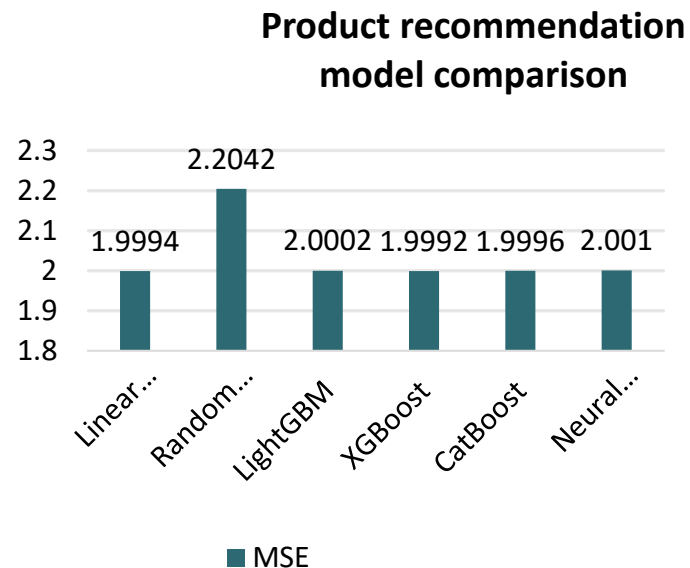
Testing and Results

Evaluation Metrics:

- Mean Squared Error (MSE)
- R-squared (R^2)

Performance:

- Product Recommendation: Best model - XGBoost (MSE: 1.9992)
- Demand Forecasting: Best model – Random Forest(MSE: 3.7152)



Products Recommendation System

Objective:

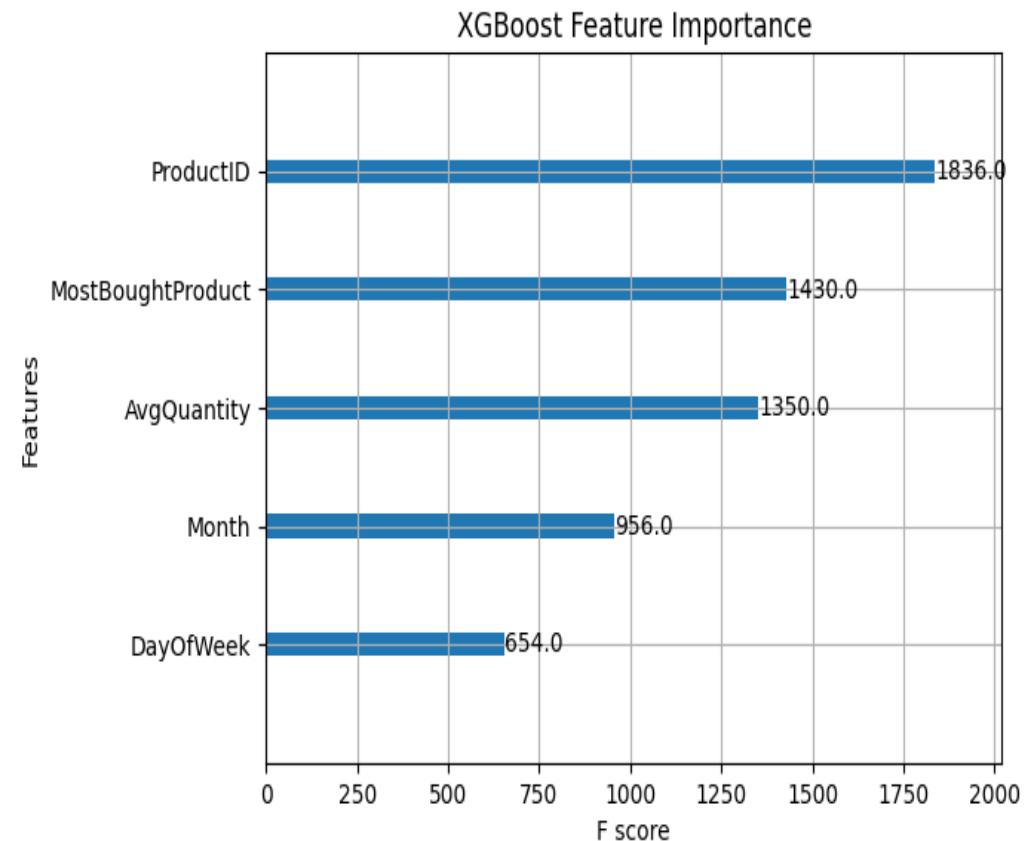
- Enhance user experience with personalized recommendations.

Approach:

- XGBoost

Features:

- Engineering features: Total orders, average quantity, most bought product



Demand Forecasting System

Objective:

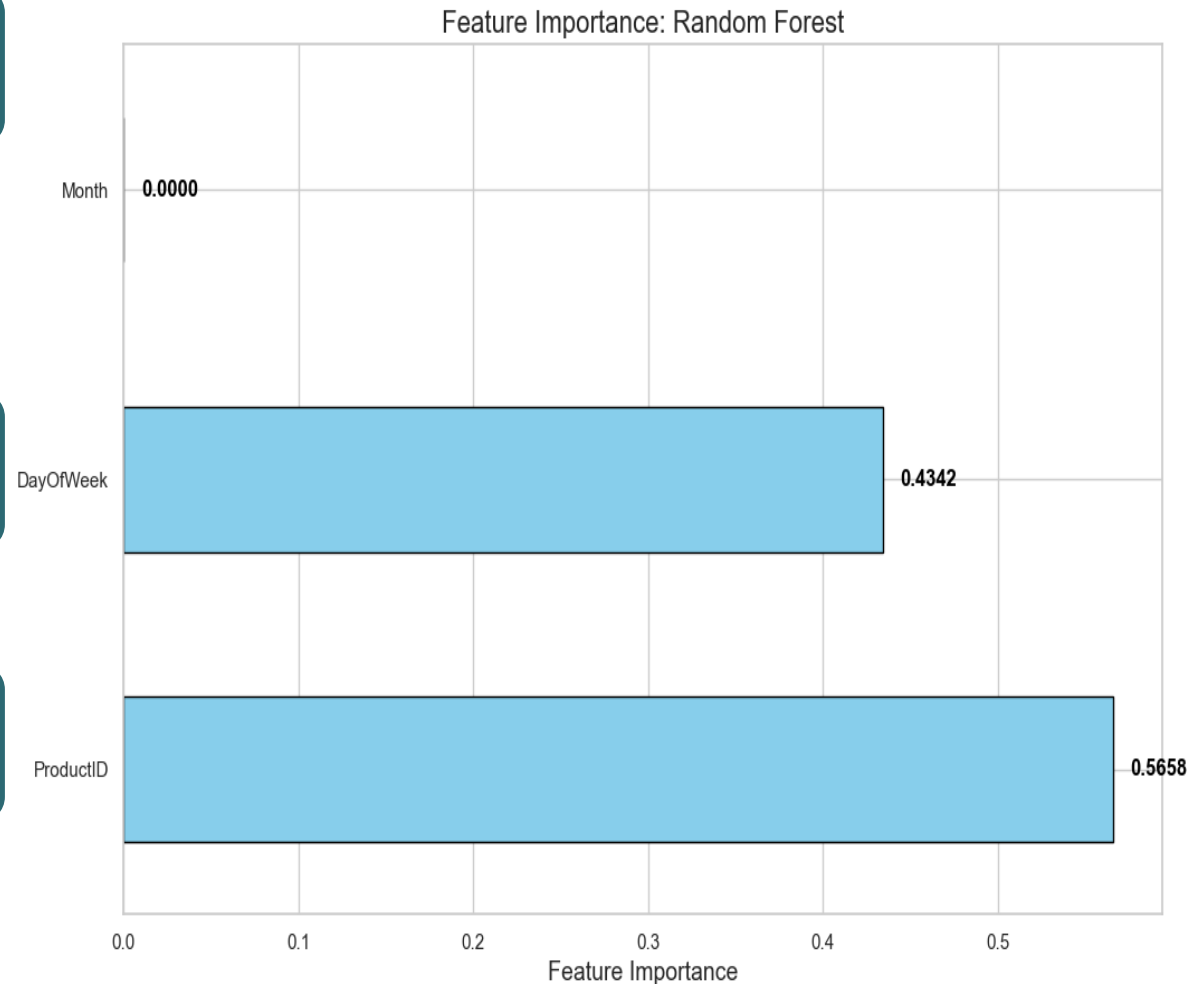
- Predict future product demand to optimize product inventory and pricing.

Approach:

- Random Forest

Features:

- Engineering features: DayOfWeek, Month



Challenges and Future Work

Current Limitations:

- Cold-start problem

Future Enhancements:

- Hybrid recommendation systems
- Real-time Forecasting

Conclusion

After conducting a comprehensive analysis of existing system such as Yusp, Beeketing for Shopify, and WooCommerce, we manage to achieve insightful finding such how their model work. This includes simple collaborative filtering and upselling and cross-selling features with need for algorithms.

The datasets, including purchase histories and product details, were suitable for developing machine learning models, but the quality and completeness of historical data are crucial. Enhancing accuracy could be achieved by incorporating external data sources such as location information.

The e-commerce system successfully used machine learning models like XGBoost and Random Forest for personalized recommendations and demand forecasting, leveraging historical purchase data effectively. However, further improvement is necessary to address the cold start problem and integrate various data sources through hybrid models.

The system's architecture supported the integration of recommendation and forecasting models, providing a personalized yet efficient user experience. While it can handle increasing data volumes, further optimizations are needed to improve real-time processing capabilities.

Test results indicated success with machine learning techniques with product recommendation accuracy and demand forecasting. Continuous model fine-tuning and combining data sources will help maintain and improve performance and reliability.

Thank you