Project Overview

The Inventory Demand Forecasting project aims to predict stock requirements for vendors selling everyday items to minimize stockouts and ensure customer satisfaction. The machine learning models used in this project include Linear Regression, XGBoost Regressor, Lasso Regression, and Ridge Regression, evaluated on training and validation datasets.

Model Evaluation and Key Insights

Model Comparison:

Linear Regression: A simple baseline model with a training error of 20.90 and validation error of 20.97. This suggests decent performance but with room for improvement, as it does not handle complex relationships or outliers well.

XGBoost Regressor: The most effective model, achieving a training error of 6.90 and validation error of 6.92. This gradient-boosting model is powerful for capturing non-linear patterns and interactions, making it suitable for this problem.

Lasso Regression: Similar to Linear Regression, with slightly higher errors (training: 21.02, validation: 21.07). This suggests that regularization (used by Lasso to prevent overfitting) may not add significant value in this context.

Ridge Regression: Performed identically to Linear Regression, indicating that regularization strength (as used by Ridge) does not improve performance for this dataset.

Best Performing Model:

The XGBoost Regressor is the best model for the validation dataset. Its significantly lower error values indicate that it captures the underlying patterns of the data more effectively than the linear models.

Regularisation Observations:

Lasso and Ridge showed similar or slightly worse performance compared to Linear Regression. This suggests that the dataset may not have high multicollinearity or noise that these techniques typically handle well.

General Observations:

The gap between training and validation errors across all models is minimal, indicating that the models are not overfitting and generalize well to unseen data.

XGBoost’s superior performance suggests that non-linear interactions and relationships among features significantly impact the accuracy of inventory predictions.

Portfolio/Presentation Summary

Objective: To build a machine learning model that predicts inventory demand accurately to minimize stockouts for vendors.

Approach: Experimented with multiple regression techniques (Linear, Lasso, Ridge) and advanced tree-based methods (XGBoost).

Result: The XGBoost Regressor outperformed other models, reducing validation error to 6.92, a significant improvement over the baseline (Linear Regression: 20.97).

Conclusion: The results demonstrate the importance of advanced machine learning techniques like XGBoost in capturing complex patterns in demand forecasting.