Demand Forecasting Application for Hyperpure

Overview

Hyperpure, operating with a farm-to-fork model, delivers perishable goods (like fruits, vegetables, and frozen foods) to hotels, restaurants, and catering businesses. Managing inventory accurately is crucial to avoid spoilage and shortages due to the perishable nature of these products. This project aims to develop a demand forecasting application that helps clients order optimal quantities based on trends, seasonality, and other factors.

Objectives

1. **Forecast Demand**: Predict the amount of each product needed over a set period, such as a week.
2. **Minimize Waste and Shortages**: Help clients maintain appropriate stock levels by forecasting accurately.
3. **User-friendly Application**: Enable restaurants, hotels, and vendors to input relevant information (such as expected guests or historical orders) and receive demand forecasts.

Approach

1. **Data Collection and Analysis**
   - **Simulated Data**: We generated a dataset representing historical sales data, including fields for product categories, sales quantities, dates, and relevant conditions (e.g., holidays).
   - **Key Features**: We selected important features like month, year, day of the week, and product category. These factors help the model identify patterns in demand over time.
2. **Data Preprocessing**
   - **Feature Extraction**: Extracted useful information from the date, such as month and year, to capture seasonality.
   - **One-Hot Encoding**: Converted categorical data (like product names and day of the week) into numeric format using one-hot encoding. This makes the data model-ready.
   - **Data Splitting**: Divided the data into training and testing sets to evaluate model accuracy and avoid overfitting.
3. **Model Development**
   - **Algorithm Choice**: We used Linear Regression, a reliable choice for predicting continuous values, such as sales quantities.

o **Training**: Trained the model on historical data to learn demand patterns over time.
4. **Application Design**
   o **User Inputs**: Designed a script where users can enter details, such as the type of product, season, and expected conditions, to receive a demand forecast.
   o **Alerts**: The application also includes an alert feature to help users prevent overstock or understock scenarios based on predictions.
5. **Evaluation Metric**
   o **Mean Absolute Error (MAE)**: Chose MAE to measure model accuracy. MAE is easy to interpret and helps indicate average prediction errors, making it suitable for demand forecasting.

Results

The model provides a reasonably accurate forecast of product demand, helping users keep the right stock levels for various perishable items. Although the model may not capture all possible variables, it offers a reliable starting point to improve stock management for Hyperpure clients.

Conclusion

This demand forecasting application supports Hyperpure's goal of minimizing waste and preventing shortages by providing accurate predictions of product demand. It combines a user-friendly design with effective data-driven insights, helping clients make better purchasing decisions. Future improvements could include adding more detailed data (such as regional demand trends or product-specific shelf-life) to further refine predictions.