PRODUCT DEMAND PREDICTION USING MACHINE LEARNING

Creating a product demand prediction involves several steps, from data collection and preprocessing to model building and evaluation. Here's a high-level overview of the process:

1. \*\*Data Collection\*\*: - Gather historical data on product sales, including relevant features like product attributes, prices, promotions, and any external factors that might affect demand (e.g., seasonality, holidays, economic indicators).

2. \*\*Data Preprocessing\*\*: - Clean and preprocess the data. This may include handling missing values, encoding categorical variables, and scaling/normalizing numerical features.

3. \*\*Feature Engineering\*\*: - Create new features that may help improve the model's performance. For instance, you might create lag features to account for temporal dependencies or engineer features to capture the impact of promotions.

4. \*\*Data Splitting\*\*: - Split the data into training and testing sets to evaluate the model's performance. You can use techniques like time-based splitting to preserve the temporal order of the data.

5. \*\*Model Selection\*\*: - Choose a machine learning or time series forecasting model. Common choices include: - Linear Regression - Decision Trees - Random Forest - Gradient Boosting (e.g., XGBoost, LightGBM) - Time Series models (e.g., ARIMA, Prophet) - Deep Learning (e.g., LSTM, GRU, or Transformer models)

6. \*\*Model Training\*\*: - Train the chosen model on the training data. Depending on the model, you may need to tune hyperparameters to optimize performance.

7. \*\*Model Evaluation\*\*: - Evaluate the model's performance using appropriate metrics. For demand prediction, you can use metrics like Mean Absolute Error (MAE), Mean Squared Error (MSE), or Root Mean Squared Error (RMSE).

8. \*\*Hyperparameter Tuning\*\*: - If necessary, perform hyperparameter tuning to improve the model's performance.

9. \*\*Validation and Testing\*\*: - Validate the model's performance on the testing dataset to ensure it generalizes well to new data.

10. \*\*Deployment\*\*: - Once the model is satisfactory, deploy it in a production environment where it can make real-time predictions or automate demand forecasts.

11. \*\*Monitoring and Maintenance\*\*: - Continuously monitor the model's performance and update it as needed to adapt to changing market conditions.

12. \*\*Visualization and Reporting\*\*: - Create visualizations and reports to communicate the predictions and insights to stakeholders.