PRODUCT DEMAND PREDICTION WITH MACHINE LEARNING

PROJECT TITLE: PRODUCT DEMAND ANALYSIS

PROBLEM STATEMENT:

Create a machine learning model that forecasts product demand based on historical sales and external factors, helping businesses optimize inventory management and production planning to meet customer needs efficiently.

AIM:

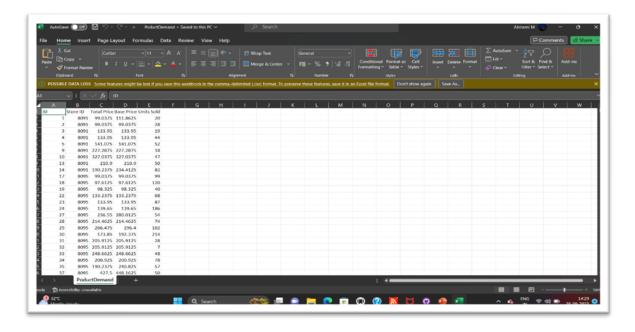
The project aims to build a machine learning model that forecasts product demand based on historical sales data and external factors. The primary goal is to assist businesses in optimizing inventory management and production planning to efficiently meet customer needs. The project encompasses data collection, data preprocessing, feature engineering, model selection, training, and evaluation.

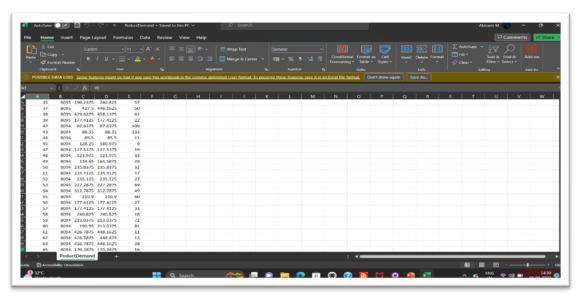
DATASET: Product demand dataset

link: https://www.kaggle.com/datasets/chakradharmattapal

li/product-demand-prediction-with-machine-learning

some of the screenshot of product demand Exel sheet of dataset are:





Project steps:

- 1.problem definition
- 2.Design Thinking

Step-1: Problem definition:

The problem is to create a machine learning model that forecasts product demand based on historical sales data and external factors. The goal is to help businesses optimize inventory management and production planning to efficiently meet customer needs. This project involves data collection, data preprocessing, feature engineering, model selection, training, and evaluation.

Step-2: Design Thinking:

(1).Data Collection:

Data collection is a systematic process of gathering observations or measurements. Whether you are performing research for business, governmental or academic purposes, data collection allows you to gain first-hand knowledge and original insights into your <u>research problem</u>.

While methods and aims may differ between fields, the overall process of data collection remains largely the same. Before you begin collecting data, you need to consider:

The aim of the research

The type of data that you will collect

The methods and procedures you will use to collect, store, and process the data.

(2).Data Preprocessing:

Data preprocessing is an important step in the data mining process. It refers to the cleaning, transforming and integration of data in order tp make it ready for analysis. The goal of data preprocessing is to improve the quality of the data and to make it more suitable for the specific data mining task.

Some common steps in data preprocessing are:

- (a). Data cleaning
- (b).Data Integration

- (c). Data Transformation
- (d).Data Reduction
- (e). Data Discretization
- (f).Data Normalization

(3). Feature Engineering:

Feature engineering involves creating relevant features from the raw data. For instance:

- Lag features: Include past sales data (e.g., sales from the previous week or month) as features.
- Date-related features: Extract features like day of the week, month, quarter, or year.
- External factors: Incorporate external data such as holidays, economic indicators, or weather forecasts.

(4). Model Selection:

Choose an appropriate machine learning algorithm for your demand forecasting task. Time series models like ARIMA or machine learning models like Random Forest, XGBoost, or LSTM (if you have a significant amount of data) are common choices.

For this example, we'll use a Random Forest regressor.

from sklearn.ensemble import RandomForestRegressor

model = RandomForestRegressor(n_estimators=100, random state=42)

(5). Model Training:

Data Splitting: Split the dataset into training, validation, and test sets.

Model Training: Train the selected regression model using the preprocessed training data.

Example:

model.fit(X_train, y_train)

(6).Evaluation:

Evaluate your model's performance on the testing dataset using appropriate metrics such as Mean Absolute Error (MAE), Root Mean Square Error (RMSE), or Mean Absolute Percentage Error (MAPE).

Example:

from sklearn.metrics import mean absolute error

```
y_pred = model.predict(X_test)
mae = mean_absolute_error(y_test, y_pred)
print(f"Mean Absolute Error: {mae}")
```

Conclusion:

This document outlines the project's objectives, design thinking considerations, and the workflow for building a demand forecasting machine learning model. By following these steps, we aim to empower businesses with the ability to make data-driven decisions regarding inventory management and production planning, ultimately enhancing operational efficiency and customer experience.