PRODUCT DEMAND PREDICTION WITH MACHINE LEARNING

PROJECT TITLE: PRODUCT DEMAND ANALYSIS

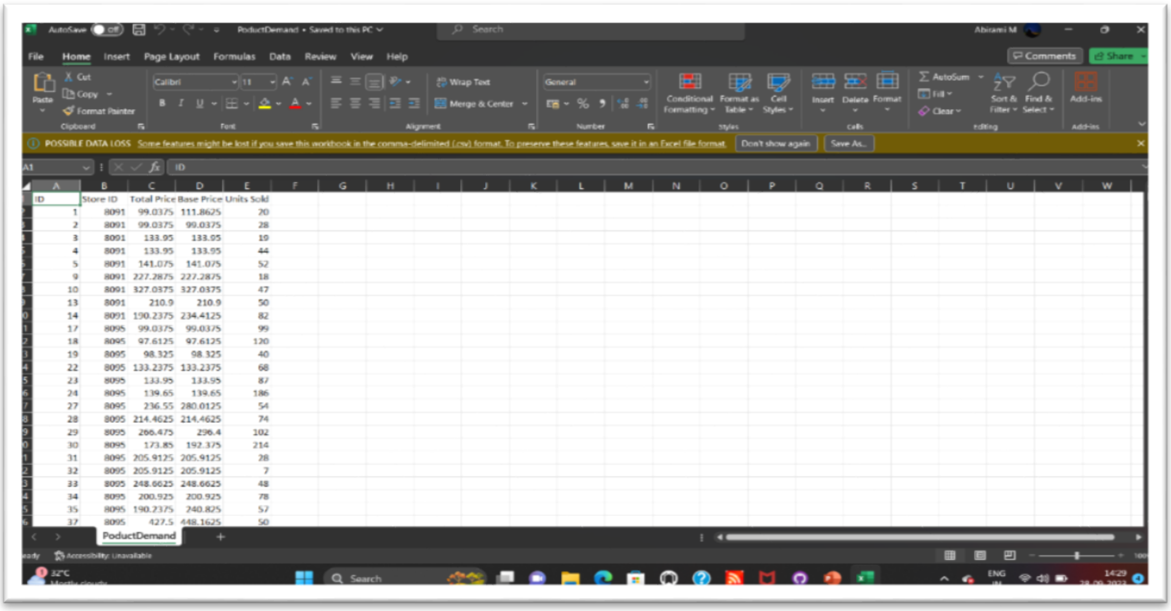
PROBLEM STATEMENT:

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.

DATASET: Product demand dataset

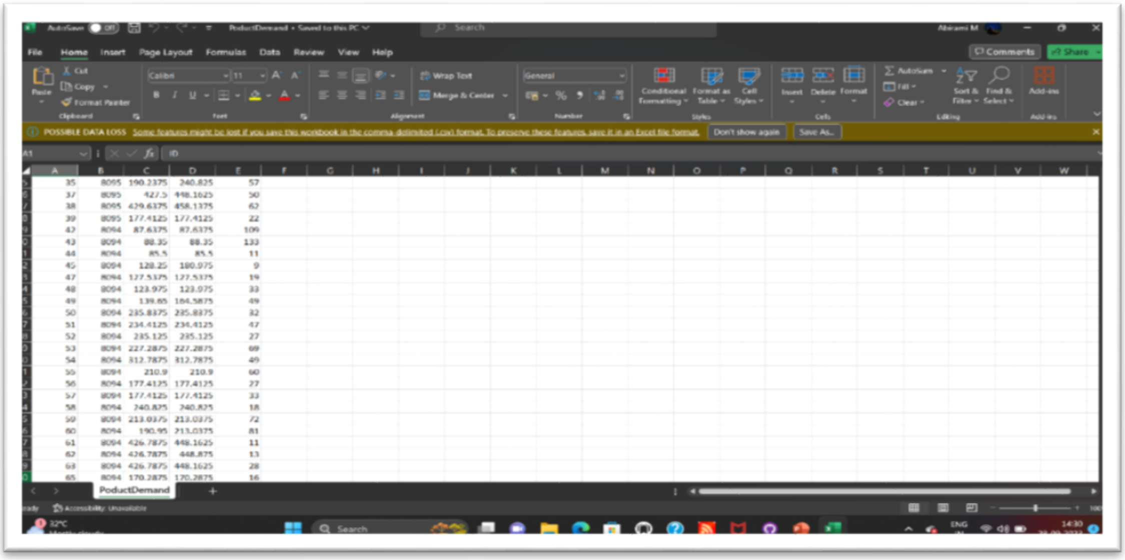
link:https://www.kaggle.com/datasets/chakradharmattapalli/product-demand-prediction-with-machine-learning

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

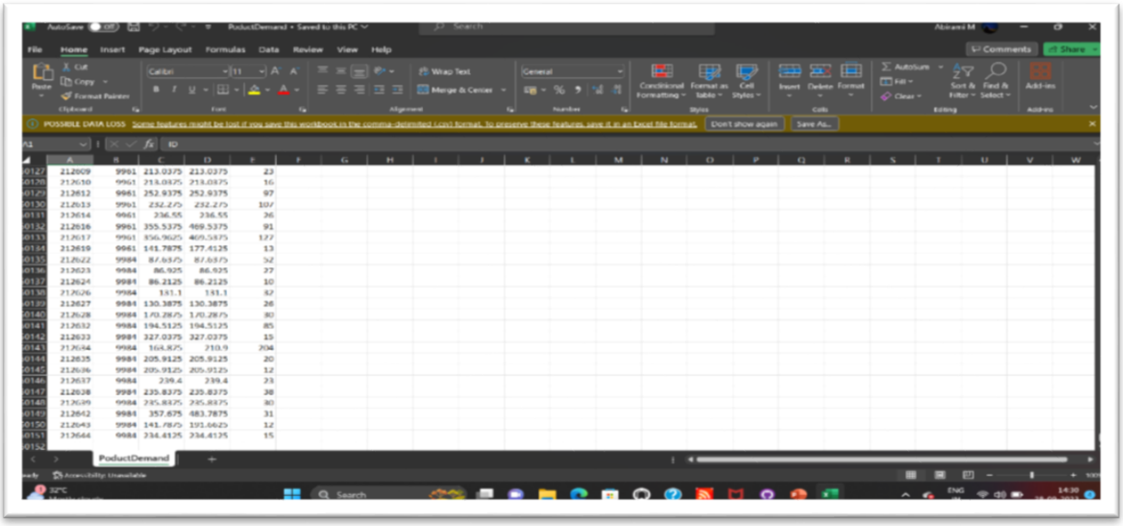


Some features might be lost if you save this workbook in the comma-delimited (.csv) format. To preserve these features, save it in an Excel file format.

ID	Store ID	Total Price	Base Price	Units Sold
1	8091	99.0375	111.8625	20
2	8091	99.0375	99.0375	28
3	8091	133.95	133.95	19
4	8091	133.95	133.95	44
5	8091	141.075	141.075	52
9	8091	227.2875	227.2875	18
10	8091	327.0375	327.0375	47
13	8091	210.9	210.9	50
14	8091	190.2375	234.4125	82
17	8095	99.0375	99.0375	99
18	8095	97.6125	97.6125	120
19	8095	98.325	98.325	40
22	8095	133.2375	133.2375	68
23	8095	133.95	133.95	87
24	8095	139.65	139.65	186
27	8095	236.55	280.0125	54
28	8095	214.4625	214.4625	74
29	8095	266.475	296.4	102
30	8095	173.85	192.375	214
31	8095	205.9125	205.9125	28
32	8095	205.9125	205.9125	7
33	8095	248.6625	248.6625	48
34	8095	200.925	200.925	78
35	8095	190.2375	240.825	57
37	8095	427.5	448.1625	50



A	B	C	D	E
35	8095	190.2375	240.825	57
37	8095	427.5	498.1625	50
38	8095	429.6375	458.1375	62
39	8095	177.4125	177.4125	22
42	8094	87.6375	87.6375	109
43	8094	88.35	88.35	133
44	8094	85.5	85.5	11
45	8094	128.25	180.975	9
47	8094	127.5375	127.5375	19
48	8094	123.975	123.975	33
49	8094	139.65	164.5875	49
50	8094	235.8375	235.8375	32
51	8094	234.4125	234.4125	47
52	8094	235.125	235.125	27
53	8094	227.2875	227.2875	69
54	8094	312.7875	312.7875	49
55	8094	210.9	210.9	60
56	8094	177.4125	177.4125	27
57	8094	177.4125	177.4125	33
58	8094	240.825	240.825	18
59	8094	213.0375	213.0375	72
60	8094	190.95	213.0375	81
61	8094	426.7875	448.1625	11
62	8094	426.7875	448.875	13
63	8094	426.7875	448.1625	28
65	8094	170.2875	170.2875	16



A	B	C	D	E
212609	9961	213.0375	213.0375	23
212610	9961	213.0375	213.0375	16
212612	9961	252.9375	252.9375	97
212613	9961	232.275	232.275	107
212614	9961	236.55	236.55	26
212616	9961	355.5375	469.5375	91
212617	9961	356.9625	469.5875	127
212619	9961	141.7875	177.4125	13
212622	9984	87.6375	87.6375	52
212623	9984	86.925	86.925	27
212624	9984	86.2125	86.2125	10
212626	9984	131.1	131.1	32
212627	9984	130.3875	130.3875	26
212628	9984	170.2875	170.2875	30
212632	9984	194.5125	194.5125	85
212633	9984	327.0375	327.0375	15
212634	9984	168.825	210.9	204
212635	9984	205.9125	205.9125	20
212636	9984	205.9125	205.9125	12
212637	9984	239.4	239.4	23
212638	9984	235.8375	235.8375	38
212639	9984	235.8375	235.8375	30
212642	9984	357.675	483.7875	31
212643	9984	141.7875	191.6625	12
212644	9984	234.4125	234.4125	15

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 research problem.
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:

Train the selected model on your 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}")
```