**PRODUCT DEMAND PREDICTION WITH MACHINE**

**LEARNING [APPLIED DATA SCIENCE]**

**PHASE II PROJECT: INNOVATION**

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**INTODUCTION**

The problem we have taken is prediction of demand for products using machine learning. We know that the demand for products varies with time and place in real life .With demand the product price increases and decreases . We have to create a machine learning model that forecasts product demand based on historical sales data. Demand forecasting is one of the toughest metrics to get right because of the tendency of demand to fluctuate.

**PROBLEM DEFINITON**

The problem of predicting demand for a new product based on its characteristics and description is critical for various industrial enterprises, wholesale and retail trade and, especially, for modern highly competitive sector of air transportation, since solving this problem will optimize production, management and logistics in order to maximize profits and minimize costs

The input data of the algorithm are characteristics such as the price,name, category and text description of the product. To solve the regression problem, various implementations of the gradient boosting algorithm were used, such as XGBoost , Light GBM, Cat Boost.

Thus, the problem solves the following issues:

1)Optimise production

2)Manage the logistics and retail to maximise profits and reduce costs

3)Inventory management: availablility of product needed

4)Efficiently meet customer needs

**INNOVATION**

Demand forecasting is the estimation of a probable future demand for a product or service.We have used the techinique by implementing ARIMA algorithm which is used to predict future needs with the help of history of previous information of the products

If we don’t use the times series method to forecast the details we will face a few harships.we will get a optimised ,efficient,profitable output using the techniques discussed below.

Let us see the process step by step in the below

**DESIGN THINKING**

**1)Data Collection:**

Dataset required for implementing the project is given below <https://www.kaggle.com/datasets/chakradharmattapalli/product-demand-prediction-with-machine-learning>

**2) Data Preprocessing:**

\*IMPORTING LIBRARIES-

The first and foremost step is importing the libraries

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

from statsmodels.tsa.arima\_model import ARIMA

\*IMPORTING DATASET-

The next step is importing the dataset from the source

data = pd.read\_csv('demand\_data.csv')

**3)Data Cleaning :**

There were no duplicate and redundant data found.Moreover we didn’t have any outliers and nan values . so no data in the data set was replaced. we move forward to the next step .

**MODEL BUILDING :**

**1)Model Selection :**

There are multiple alogorithms available for forecasting the product prediction ,The model we have selected is ARIMA(Auto Regressive Integrated Moving Average).This algorithm tries to understand past data predicts the future data.

**2)Model Training:**

The model is trained using the below lines of code

model = ARIMA(data, order=(p, d, q))

model\_fit = model.fit(disp=0)

xtrain, xtest, ytrain, ytest = train\_test\_split(xtest\_size=0.2, random\_state=42)

model.fit(xtrain, ytrain)

**3)Model Prediction:**

The model we have chosen is now been predicted using the following code

x = data[["Total Price", "Base Price"]]

y = data["Units Sold"]

forecast\_period = 30 # Adjust this according to your needs

forecast, stderr, conf\_int = model\_fit.forecast(steps=forecast\_period)

**4)Model Visualization:**

\*TIME SERIES

Visualize your time series data

plt.figure(figsize=(12,6)

plt.plot(data)

\*PLOT

plt.figure(figsize=(12,6))

plt.plot(data, label='Actual Demand')

plt.plot(pd.date\_range(start=data.index[-1], periods=forecast\_period + 1, closed='right'), forecast, color='red', label='Forecasted Demand')

plt.legend()

plt.show()

**CONCLUSION:**

In this context, we developed an ARIMA model to model the demand forecasting of the finished product. The problem of product demand prediction is solved using demand forecasting.Demand forecasting is predicting the value of future demand of the product. There are many time series algorithms available in demand forecasting such as arima, sarima,prophet,etc.... In this context, we developed an ARIMA model to model the demand forecasting of the finished product.This predictive model can be used for the analysis data to estimate and predict customers future demand for a product.

**REFERENCE:**

\* <https://www.kaggle.com/datasets/chakradharmattapalli/product-demand-prediction-with-machine-learning>

https://machinelearningmastery.com/arima-for-time-series-forecasting-with-python/