

Project Overview

Predictive Modelling Using Historical Sales Data To Forecast Future Product Demands

1. Introduction:

In today's competitive market, effective inventory management is essential for businesses to **meet customer demands while minimizing costs**. This project focuses on **utilizing Python-based predictive analytics** to analyze **historical sales data** and forecast future product demand.

By leveraging **machine learning techniques**, businesses can optimize stock levels, reducing both **stockouts and overstocking**, which are major challenges faced by retailers and manufacturers. This project aims to:

- **Identify trends in sales data** to enhance demand prediction.
- **Implement predictive modeling** using **Python libraries** to improve inventory decisions.
- **Develop an automated system** for real-time inventory tracking and forecasting.

2. Objective:

- **To analyze historical sales data** using Python-based data processing tools (**Pandas, NumPy**).
- **To develop a machine learning-based forecasting model** that accurately predicts future product demand (**Scikit-learn, Statsmodels, Prophet**).
- **To optimize inventory levels** by reducing errors in manual stock predictions.
- **To compare different forecasting techniques**, including **ARIMA, LSTM, and XGBoost**, to evaluate their effectiveness.
- **To automate real-time inventory tracking** and generate **alerts/reports** for businesses to manage stock levels efficiently.

3. Applications:

- **Retail & E-commerce** : AI-powered demand forecasting ensures that products remain available to meet customer demands.
- **Manufacturing** : Forecasting models **streamline production schedules** and optimize **raw material procurement**.
- **Supply Chain & Logistics Management** : Real-time **inventory tracking** and demand analysis ensure efficient **stock distribution** across multiple warehouses.
- **Pharmaceutical Industry** : Ensures **optimal stock levels of medicines** to prevent overstocking and expiration-related losses.
- **Food & Beverage Industry** : Reduces **food spoilage and wastage** by ensuring accurate inventory management.
- **Automotive & Spare Parts** : Helps manage **fluctuating demand** for different vehicle components.
- **Fashion & Apparel** : AI models predict **seasonal demand shifts** and fast-changing fashion trends.

4. Tools & Technology Required:

- **Programming: Python** – For ML, automation, and web development.
- **Data Processing:** Pandas, NumPy – Data cleaning, transformation, and feature extraction.
- **ML & Forecasting:**
 - Statsmodels, Prophet – ARIMA & time series forecasting.
 - Scikit-learn – Regression & decision trees for demand prediction.
 - TensorFlow/Keras – LSTM for sequential forecasting.
 - XGBoost, Random Forest – Ensemble learning for accuracy improvement.
- **Database Management:**
 - SQL (MySQL, PostgreSQL) – Structured inventory & sales data storage.
 - NoSQL (MongoDB, Firebase) – Scalable, real-time inventory tracking.
- **Visualization & Reporting:**
 - Matplotlib, Seaborn, Plotly – Demand trend visualization.
 - Power BI, Tableau – Dashboards & performance reports.
- **Web & Deployment:**
 - Flask/Django – Web-based inventory management.
 - AWS, GCP, Azure – ML model & API deployment.

5. References:

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- [2]. <https://disk.com/resources/inventory-forecasting-methods-to-reduce-stockouts-overstock/#:~:text=Seasonality%20Analysis,-Retailers%20often%20face&text=This%20method%20relies%20on%20historical,by%20managing%20their%20inventory%20carefully>
- [3]. <https://www.pecan.ai/blog/predictive-inventory-management/>
- [4]. <https://thousense.ai/blog/accurate-demand-forecasting-for-effective-inventory-management/>
- [5]. <https://codup.co/blog/how-to-avoid-overstocking-and-stockouts-in-retail-best-practices-for-inventory-planning/>
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