UNIVERSITY OF COLORADO DENVER

Final Project Proposal

Optimize inventory management using prescriptive analytics.

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INTRODUCTION

Our project's main goal is to help a retail establishment with several locations manage their inventory better. The store is currently having problems with having too much inventory for certain things and not enough for others. This results in expensive storage expenses for extra inventory and missed sales when well-liked goods run out of stock. The primary issue is that managing inventory across several businesses is challenging because of shifting consumer wants, distinct seasons, and varied promotional offers. It is difficult to maintain the proper level of stock for every product as a result. To assist the shop in making more informed judgments about the quantity and location of merchandise, we want to employ optimization and data analysis approaches. We can help the shop save money and keep sales from declining by doing this. Our objective is to strike an equilibrium in inventory levels that lowers expenses while maintaining customer satisfaction by ensuring that the goods they desire are accessible. The success of a retail shop depends on effective inventory management as it has an impact on sales and customer satisfaction. Our research uses prescriptive analytics, which uses data to suggest improvements to inventory management, to address these problems.

OBJECTIVE

Our project's goal is to create a simple inventory model that will enable a retail establishment to handle its goods more effectively. We'll use fundamental forecasting techniques to project future product demand by examining historical sales and inventory data from the shop. To help with decisions about buying and stock distribution among retailers, our model will recommend the ideal stock levels for every product. Our approach will be straightforward yet efficient, with all the code written in Python for user-friendliness. Our main objectives are to show the usefulness of data-driven inventory management by drastically lowering the store's inventory expenses and guaranteeing that popular goods are always accessible.

METHODOLOGY

1)Preliminary Analysis: With a focus on seasonal trends and variations between product categories and retail locations, we will use Python to examine sales patterns. Finding patterns is what we want to do, especially when it comes to popular things that are often out of stock.
2)Modeling Approach: We intend to create an inventory optimization model that is stochastic, or random. To reduce anticipated overall costs, this model will utilize past sales data to forecast future demand uncertainty and assist in determining order amounts and reorder points for each product and location.
3) Algorithms for Optimization: For effective optimization, we will use approximation methods like simulated annealing, given the vast array of choice factors across goods and regions. This method works well for complicated, large-scale inventory issues. These algorithms will be written in Python with the help of tools like NumPy.
4) Data Analysis: We will work with historical sales data, inventory levels, and supply chain logistics information. Our data preprocessing will involve handling missing data and outliers to ensure accuracy in analysis.
5) Predictive Analytics: We plan to implement time series forecasting methods to predict future demand patterns. This will help us in understanding and anticipating sales trends.
6) Optimization Models: An aspect of our approach is the development of an inventory replenishment model using linear programming. With this methodology, we can ensure that service level criteria are met while keeping costs as low as possible.
7) Simulation: We will test various inventory scenarios using simulation techniques to evaluate the robustness and effectiveness of our optimization model in different situations.

LITERATURE RERVIEW SUMMERY

Research in inventory optimization has shown the effectiveness of operations research and data science in enhancing supply chain efficiency. Studies like Templemore (2006) and Balakrishnan et al. (2021) demonstrate cost reductions and improved service levels using stochastic optimization and mixed integer programming. Our project will leverage these insights, integrating predictive analytics with optimization techniques to develop customized inventory management solutions for the retail sector.

DATASET DISCRIPTION

Sales data are the daily transaction records that include pricing, store IDs, product IDs, and amounts sold.
Data on inventory: Weekly reports on the amount of each product and location's inventory, shipments, and backorders.
Product Information: Describes more than 5,000 goods, including sizes, prices, suppliers, and classifications.
Store Data: Details about each individual store, including size, type (regular, express, clearance), region, and local market demographics.
Details on sales occasions, holidays, the introduction of new products, and other events that may affect demand are included in promotions and events.

CONCLUSION

Our initiative aims to enhance stock availability by 20–30% and reduce expenses by 10-15%, revolutionizing inventory management for retail stores. We'll make it possible to make more precise stocking decisions based on reliable data analysis by fusing optimization methods with predictive analytics. In addition to improving consumer pleasure, this strategy will raise the bar for efficiency in retail operations and open the door for comparable advances in other industries.

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