Datathon Handbook

Problem statement (Part 1)

In the construction industry, efficient demand forecasting and inventory management play a crucial role in optimizing business operations. Accurate sales predictions help companies meet customer demands while minimizing excess stock and reducing operational costs. **This hackathon challenges participants to develop a machine learning model that predicts daily sales, demand for construction machinery and propose an optimization technique for inventory management. The solution should be business-oriented and practically feasible.**

Objective

Participants are required to:

Develop a machine learning model to predict demand based on the available data.

- Integrate the given case study to inventory and propose an optimization algorithm or technique for efficient inventory management.
- Ensure the solution is business-oriented, feasible, and provides actionable insights for decision-making.

Column Descriptions

- **Date**: Represents the date of each sales entry.
- **Infrastructure Machineries:** Describes the type of construction machinery used for infrastructure development.
- **Daily Sales Percentage**: Indicates the percentage of total sales for each machinery model.
- **Daily Sales Quantity**: Specifies the number of units sold on each day.
- **Market Share**: Represents the organization's share in the market relative to competitors.
- **Political**: Describes the political leaning of the organization towards the government.
- **Marketing**: Similar to the political column, indicating the organization's relationship with the government, which influences marketing opportunities.
- **Budget**: Specifies the amount of budget allocated by the government for infrastructure development, impacting daily sales, production, and to a lesser extent, political and marketing factors.
- **Customer_ID:** Specifies the unique ID of each customer.
- **Region :** Represents the region of each sales entry.

Problem Constraints and Considerations

- The prediction model should be able to generalize well and handle unseen data effectively.
- The optimization algorithm should balance stock availability and minimize holding costs.
- The solution should be scalable and adaptable to varying market conditions.
- Business feasibility and practical implementation should be key considerations.

Case Study: Demand Forecasting and Inventory Optimization for Heavy Machinery (Part 2)

Background

XYZ, a leading heavy machinery manufacturer, is looking to enhance its demand forecasting and inventory management strategies. The company deals with multiple types of heavy machinery, including Backhoe Loaders, Excavators, Loaders, Skid Steer Loaders, Compactors, and Tele Handlers. The demand for these machines fluctuates due to various factors such as seasonality, market share, political influences, and marketing budget allocation.

Currently, the company faces challenges in maintaining an optimal inventory level for finished goods due to uncertainties in demand forecasting. Managing warehouse space efficiently is critical, as excessive inventory leads to increased holding costs while insufficient stock results in lost sales opportunities.

Objective

Participants must develop a **demand forecasting model** using historical sales data and associated market factors. Based on the predicted demand, they must then optimize the inventory levels while considering storage constraints.

Constraints

- The **total available inventory space** is **5000 cubic meters**.
- Each machinery type occupies a specific amount of storage space and has an associated value:

Backhoe Loader: 15 cubic meters per unit, ₹30,00,000 per unit
Excavators (crawler): 25 cubic meters per unit, ₹50,00,000 per unit
Loaders (Wheeled): 20 cubic meters per unit, ₹40,00,000 per unit
Skid Steer Loaders: 10 cubic meters per unit, ₹20,00,000 per unit
Compactors: 12 cubic meters per unit, ₹25,00,000 per unit

Tele Handlers: 18 cubic meters per unit, ₹35,00,000 per unit

Tasks

1. **Develop a Demand Forecasting Model:**
    a. Utilize the provided dataset to build a model that predicts future daily sales for each machine category.
2. **Optimize the Inventory for Finished Goods:**
    a. Determine the optimal inventory level for each machinery type based on forecasted demand.
    b. Ensure that the inventory to be stored does not exceed 5000 cubic meters.
    c. Implement an allocation strategy that minimizes stockouts to avoid excess inventory.

Note: You will be given a dataset (input_data), using which you have to predict the demand of the mentioned dates

Evaluation Criteria

Your submission will be evaluated based on the following criteria:

1. **Accuracy and Performance**: Effectiveness of the demand prediction model.
2. **Optimization Strategy**: Innovation and feasibility of the inventory management approach.
3. **Business Impact**: Practicality and real-world applicability of the solution.
4. **Scalability**: Ability to adapt to changing market and business needs.
5. **Technical Excellence**: Use of appropriate machine learning techniques and optimization methods.

Expected Deliverables

- A Jupyter Notebook or Python script with the demand forecasting model.
- An inventory optimization plan detailing the proposed stock levels.

- A presentation summarizing key insights, methodology, and recommendations.

Submission Guidelines

- Submit the final code, models, and report in the prescribed format.
- Ensure clarity in explanations and proper documentation.
- The submission should be reproducible and well-structured.

Learnings:

This hackathon not only evaluates participants on their technical skills but also emphasizes their ability to think in a business-oriented manner. The best solutions will demonstrate a balance between data-driven decision-making, practical feasibility, and business impact. Participants are encouraged to develop strategies that align with real-world business challenges while optimizing sales forecasting and inventory management. Good luck!