Interim Report

“Optimizing Operational Efficiency and Inventory Management for Tim Hortons”

Table of Contents

1. Introduction

This report provides an update on the progress of the Capstone project, "Optimizing Operational Efficiency and Inventory Management for Tim Hortons." The project aims to develop data-driven insights for improving inventory management, reducing waste, and enhancing workforce optimization at a Tim Hortons store in Lasalle, Windsor. By leveraging advanced machine learning techniques, sentiment analysis, and real-time data integration, the project seeks to provide actionable recommendations for operational efficiency and inventory optimization.

The report highlights advancements in data acquisition, pipeline implementation, dashboard integration, and machine learning applications. It also outlines challenges encountered, solutions implemented, and the roadmap for the next phase of the project.

2. Progress Overview

2.1 Data Collection & Preprocessing

- Successfully gathered and integrated **Sales Per Labour Hour (SPLH)** and **Cost Per Labour Hour (CPLH)** data from the store.
- Collected additional data on **waste variance reports, product sales, and inventory records**.
- Extracted text-based **Google reviews** to conduct sentiment analysis comparing the Lasalle store with other Windsor locations.
- Preprocessed and cleaned datasets to ensure consistency and accuracy for further analysis.
- Generated synthetic data to simulate real-world inventory and waste patterns, improving the robustness of model training.

2.2 Data Pipeline Implementation

- Built a **batch processing pipeline** for automated data ingestion from uploaded monthly files.
- Implemented a **SQL Server database** to store structured data.
- Established **Tableau integration** to visualize real-time insights from the SQL database.
- Developed a **user-friendly front-end interface** for uploading and managing data.

2.3 Machine Learning Implementation

- Began exploratory work on **Workforce Optimization using Predictive Modeling**.
    - Identified key features affecting workforce efficiency, such as sales trends, peak hours, and labor cost patterns.
    - Tested initial regression and classification models for forecasting labor requirements.
- Implemented **Random Forest models** for waste prediction by analyzing historical trends and identifying high-risk inventory items.
- Applied **LSTM (Long Short-Term Memory) Networks** for time-series forecasting to predict sales trends based on past performance.
- Utilized **NLP-based sentiment analysis models** to extract customer sentiment from product reviews and incorporate insights into forecasting.

3. Challenges & Solutions:

Challenge	Solution
Data inconsistencies across reports	Standardized data format and preprocessing pipelines.
Complexity in ML feature selection	Conducted feature engineering and exploratory data analysis (EDA).
Limited access to proprietary data	Engaged in discussions with store owners for additional insights.
Ensuring model accuracy	Implemented rigorous testing and validation to avoid overfitting.
Data integration complexities	Automated ETL workflows and iterative refinements for consistency.

---

4. Next Steps

1. **Enhancing Machine Learning Models**
    - Improve predictive workforce optimization models.
    - Develop models for **demand forecasting** to minimize overstocking and waste.
    - Expand sentiment analysis to extract more detailed insights from customer reviews.
2. **Finalizing Reporting & Documentation**
    - Prepare final project deliverables, including a detailed methodology.
    - Validate insights with store managers to ensure practical implementation.
    - Document findings and recommendations for future improvements.
3. **Testing and Deployment**
    - Conduct extensive testing and validation before final deployment.
    - Explore scalability options for enterprise-level applications.

---

5. Conclusion

Significant progress has been made in data collection, pipeline implementation, and initial machine learning applications. The next phase will focus on enhancing predictive models, refining dashboards, and ensuring practical usability of insights for Tim Hortons management. This project is on track to provide valuable contributions to operational efficiency and inventory management strategies.