Project Report: Towards Data Heterogeneity and Case Refinement

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BIDSS Assignment 04

# 1. Introduction

The purpose of this project is to develop a comprehensive Business Intelligence and Decision Support System (BIDSS) for a fictional retail company operating a chain of supermarkets. In this report, we will address specific challenges faced by the company through data-driven solutions and insights. The focus of this report will be on utilizing cloud and weather-related datasets to analyze the impact of weather on retail sales, customer behavior, inventory management, and store performance. We will outline the proposed BIDSS components and techniques to handle data heterogeneity for enhanced decision-making.

# 2. Statement of Issues and Questions to be Addressed

## 2.1 Cloud and Weather Impact on Retail Sales

Weather has a significant influence on consumer behavior, especially in the retail sector. To better understand the relationship between weather and retail sales, we aim to address the following questions:

- How does weather affect consumer behavior and purchasing decisions?

- Is there a correlation between cloud cover and retail store foot traffic and sales?

- Can weather forecasts be leveraged to optimize inventory levels and stock management?

## 2.2 Customer Segmentation and Targeted Marketing with Weather Factors

Understanding customer preferences based on weather conditions can lead to more effective marketing strategies. This section aims to explore the following questions:

- How can we segment customers based on their response to weather conditions?

- What targeted marketing campaigns can be designed using weather data to influence customer behavior?

## 2.3 Weather-based Sales and Revenue Forecasting

Accurate sales and revenue forecasting are crucial for resource planning. To develop weather-based sales forecasts, we aim to address the following questions:

- How can historical weather data be used to predict future sales and revenue?

- What are the most suitable time-series forecasting techniques to incorporate weather variables into sales predictions?

## 2.4 Store Performance Analysis with Weather Variables

Weather fluctuations can impact the performance of individual stores. In this section, we will analyze the impact of weather on store performance metrics and answer the following questions:

- How does weather affect various store performance metrics, such as revenue and foot traffic?

- Can we identify stores that are particularly sensitive to weather variations and propose improvement strategies?

## 2.5 Weather Data for Supplier Management

Weather conditions can influence the supply chain and supplier performance. We will explore how weather data can be utilized to enhance supplier management and ensure efficiency in the following:

- How does weather affect the supply chain, and how can we incorporate this data into supplier evaluation and decision-making?

- What aspects of the supply chain require human consideration and reflection to improve resilience against weather-related disruptions?

# 3. Data Acquisition and Preprocessing

## 3.1 Weather Data from External Sources

To address the above questions, we obtained relevant weather datasets from external sources, including the National Oceanic and Atmospheric Administration (NOAA) and weather APIs. The weather data was loaded and preprocessed using Pandas to prepare it for analysis.

## 3.2 Internal Retail Sales Data

In addition to external weather data, we integrated the company's internal sales data, including sales records, inventory data, customer information, and store performance metrics, into the BIDSS for a comprehensive analysis.

# 4. Exploratory Data Analysis

## 4.1 Weather Data Exploration

We conducted exploratory data analysis on the weather data to identify patterns, trends, and correlations between weather variables and retail sales. Visualization techniques were applied using Pandas and Matplotlib to gain insights into the impact of weather on the business.

## 4.2 Customer Segmentation based on Weather Preferences

Using customer transaction data and weather variables, we performed customer segmentation to understand their behavior in different weather conditions. Clustering algorithms were implemented to group customers based on their responses to weather.

## 4.3 Weather-based Sales Forecasting

Time-series analysis was conducted on historical sales and weather data to develop forecasting models that consider weather influences. The accuracy of the forecasts was evaluated using appropriate metrics to assess the reliability of weather-influenced sales predictions.

## 4.4 Store Performance Analysis with Weather Variables

Store-level data, including revenue, foot traffic, and customer feedback, was analyzed in conjunction with weather data to identify factors influencing store performance. Visualizations were used to present the findings effectively.

# 5. BIDSS Development

## 5.1 Weather Impact on Retail Sales Component

Based on the EDA, the weather impact on retail sales was integrated into the BIDSS. The component provides insights into the relationship between weather and sales trends, enabling the company to make informed decisions based on weather conditions.

## 5.2 Customer Segmentation Component

The BIDSS incorporates a customer segmentation component based on weather preferences to tailor marketing strategies according to different customer segments' weather responses.

## 5.3 Weather-based Sales Forecasting Component

This component within the BIDSS enables the company to predict sales based on weather conditions, providing essential forecasting insights for resource planning and inventory management.

## 5.4 Store Performance Analysis Component

The BIDSS includes a store performance dashboard with weather insights, allowing the company to identify stores sensitive to weather fluctuations and take appropriate actions to improve performance.

## 5.5 Weather-informed Supplier Management Component

The BIDSS integrates weather data into supplier evaluation and supply chain management to enhance efficiency and resilience against weather-related disruptions.

# 6. Conclusion

In conclusion, this project successfully developed a BIDSS for a fictional retail company, leveraging cloud and weather-related datasets to address specific challenges. The proposed BIDSS components enable the company to optimize inventory, enhance marketing strategies, and improve overall store performance through data-driven decision-making. The integration of weather data into supplier management enhances supply chain efficiency and resilience against weather-related disruptions.

# 7. Recommendations and Future Work

Based on the findings of this project, we recommend that the company invests in real-time weather data integration to enable dynamic adjustments to inventory and marketing strategies. Additionally, future work could involve incorporating machine learning techniques for more accurate sales forecasts and expanding the BIDSS to encompass other external factors that may influence retail performance.

# 8. References

<https://catalog.data.gov/dataset/u-s-daily-climate-normals-1981-20101>

<https://catalog.data.gov/dataset/ncdc-storm-events-database2>