

Northwind Sales Data Analysis Documentation

This project involves an in-depth analysis of the Northwind Traders sales data, focusing on customer loyalty, product performance, segment-based behaviour, operational efficiency, and seasonal trends.

The analysis was done using Python in a Jupyter Notebook and involves data cleaning, data transformation, and exploratory data analysis (EDA).

Data Preprocessing

Datasets Used:

- **Orders:** Information about orders placed, including dates, freight costs, and customer details.
- **Customers:** Details of customers, including their contact information and location.
- **Products:** Information about products, such as product names, categories, and prices.
- **Order Details:** Specifics about each order, including the products ordered, quantities, and discounts.

Key Preprocessing Steps:

1. Project Setup

- Import required libraries.

2. Data Loading

- Load datasets with appropriate encoding.
- Brief overview of each dataset (Customers, Order Details, Orders, Products).

3. Initial Data Inspection

- Summarised dataset properties (info(), describe(), and missing values).
- Converted date columns to datetime format.
- Handled missing values in the Orders dataset.

4. Data Quality Assessments

- Identified and handled outliers in key columns (Freight in Orders and Unit Price in Products).
- Ensured consistency in ID columns across datasets.

5. Data Merging and Feature Engineering

- Merged datasets into a consolidated dataset for analysis.
- Renamed columns for clarity.
- Created new fields (total_order_value, days_to_ship) to facilitate analysis.

6. Exploratory Data Analysis (EDA)

- **Customer Loyalty Analysis:** Top customers by order count to show the most frequent buyers.
- **Product Popularity Analysis:** Top products by quantity sold, to identify the most purchased products
- **Customer Segmentation:** Segment customers by spending level (Low, Medium, High) and analyse product preferences within each segment.
- **Shipping Analysis:** Average days to ship by product to monitor and manage shipping efficiency.
- **Order Frequency:** Analyse monthly trends in order frequency.
- **Average Order Value:** Calculate and compare average order value by customer segment.

7. Exporting Results

- Export merged dataset and analysis results to CSV and Excel files for further use or sharing.

Power BI Visualization

The Power BI dashboard visualises key insights from the analysis:

- **Monthly Order Trend:**
 - This line chart shows the number of orders placed each month from July 2013 to April 2015, highlighting peaks and troughs in sales activity.
- **Revenue Distribution by Customer Segment:**
 - A pie chart illustrates the proportion of revenue contributed by each customer segment, with the "High" segment dominating the revenue share.
- **Best-Selling Products:**
 - A bar chart lists the top products by sales volume, providing a quick overview of the most popular items.
- **Highest-Frequency Customers:**
 - A heatmap identifies the customers who place orders most frequently, allowing the company to target these loyal customers with personalised offers or rewards.

- **Global Sales Distribution:**
 - A map visualisation shows the geographic distribution of sales, indicating regions where the company is most active.
- **Year-over-Year Sales Comparison:**
 - This line chart compares sales trends across 2013, 2014, and 2015, offering insights into seasonal trends and overall growth.

This analysis of Northwind's sales data provides several actionable insights:

- Focus on High-Value Customers, the "High" revenue segment drives the majority of the company's revenue.
- Optimise Inventory for Best-Selling Products, ensuring adequate stock levels for items like "Camembert Pierrot", to meet customer demand.
- Improve Shipping Times, by addressing delays in shipping for certain products can enhance customer satisfaction and retention, potentially leading to repeat business.
- Capitalise on Seasonal Trends, The observed peaks in orders around the end of the year suggest that seasonal promotions or campaigns could be effective in boosting sales during these periods.