Task 2

SALES FORECASTING USING TIME SERIES ANALYSIS

This project aims to analyze historical sales data, clean and preprocess it, and apply time series forecasting techniques to generate accurate future predictions.

- Additionally, I have created a dashboard to visually present the insights, making the data more accessible and actionable.

Objectives

- Preprocess and clean historical sales data.
- Perform exploratory data analysis (EDA) to identify trends and seasonality.
- Build a time series forecasting model.
- Evaluate the model's performance using statistical metrics.
- Develop a Tableau dashboard for sales visualization.
- Provide business insights and recommendations.

Tools & Technologies Used

Programming & Libraries:

- **Python (**Jupyter Notebook)
- pandas, numpy: Data manipulation
- matplotlib: Data visualization
- statsmodels: Statistical analysis
- Prophet: Time series forecasting
- sklearn: Model evaluation

Visualization:

- Matplotlib for data visualization
- Tableau for interactive dashboarding

Data Export:

- CSV files for cleaned and forecasted data

Data Preprocessing:

-To ensure data quality and accuracy, the following steps were taken:

1. Loading the Dataset:

- The dataset was loaded from stores_sales_forecasting.csv.

2. Data Cleaning & Transformation:

- Selected relevant columns: Order Date and Sales.
- Converted Order Date to datetime format for time series processing.
- Set Order Date as the index.

3. Outlier Detection & Removal:

- Applied the **Interquartile Range (IQR)** method to remove extreme sales values.

4. Resampling Data:

- Aggregated sales data into **monthly intervals** to smooth fluctuations.

5. Feature Engineering:

- Created a **lag feature ("Sales.L1")** to help in predictive modeling

<u>Exploratory Data Analysis (EDA) & Dashboard Insights</u>

<u>Key Findings</u>

- A **box plot** was used to detect and remove outliers.

- The **Augmented Dickey-Fuller (ADF) test** confirmed that the data required transformation for stationarity.

VISUALIZATION

Tableau Dashboard Analysis:

1. Comparison of Actual vs. Forecasted Sales (2017):

1. Forecast Accuracy Trends

In some months (March, April, and December), forecasted sales closely align with actual sales, indicating the model performs well in stable periods.

2. Underestimation & Overestimation Trends.

Underestimation (Actual Sales Vs Forecasted Sales)

- June, November, December 2017 - Indicates that the model did not fully capture seasonal demand spikes or external factors.

Overestimation (Forecasted Sales > Actual Sales)

- March, May, August 2017 → Suggests that the model predicted higher sales than what was actually recorded, possibly due to incorrect seasonal trend assumptions.

3. Seasonality & Unexpected Spikes

- June 2017 saw the highest actual sales, indicating a potential seasonal trend or external event.

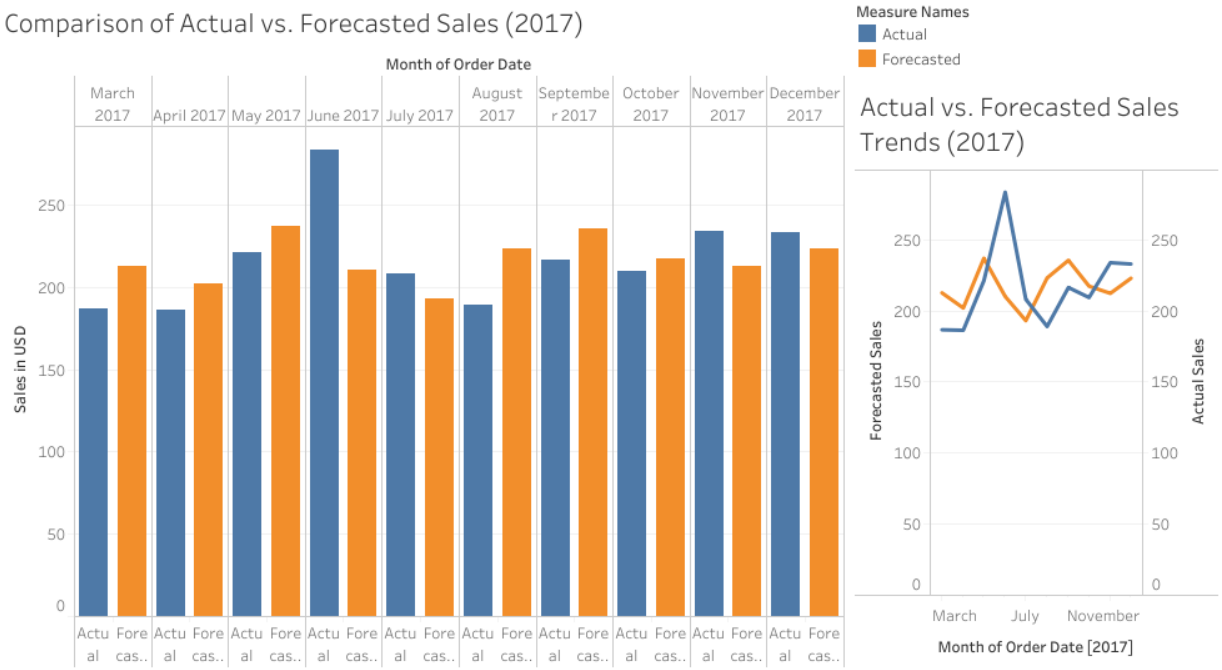
- Sales stabilized from August to October, where the forecast was more aligned, indicating better model performance in steady sales months.

Sales Trends Over Time:

- A line chart was used to visualize trends in both **actual** and **forecasted** sales.

- The trend follows a predictable pattern with fluctuations due to seasonality.

Dashboard showing the bar charts and line graph.



Business Insights & Recommendations

Based on the forecasting results and Tableau dashboard analysis, the following recommendations were made:

1. Inventory Optimization:

- Stock levels should be adjusted according to predicted **high-demand months**.

2. Marketing Strategy:

- Promotional campaigns should be intensified during months with low predicted sales.

3. Workforce & Resource Allocation:

- Business operations should align with forecasted sales trends to **improve efficiency.**

4. Revenue Planning:

- The insights can help in setting **realistic financial targets** and **budgeting**.

Conclusion

This project successfully applied **Time Series Analysis** and **Forecasting Techniques** to predict future sales trends.

The **Prophet Model** provided valuable insights that can be leveraged for strategic planning, inventory management, and financial forecasting.

The **Tableau dashboard** effectively visualized **Actual vs. Forecasted Sales**, helping stakeholders make data-driven decisions.