Sales Forecasting Project Report

Subtask 1: Prepare Time Series Data

The dataset was first prepared for time series analysis.

- The **order date column** was converted into datetime format and used to extract useful features like year, month, and day.
- Sales values were **aggregated by daily/weekly/monthly intervals** to ensure consistency.
- Missing or incomplete records were identified and handled either by filling gaps with 0 or imputing values where necessary.
- Data was then analyzed to check for **trends, seasonality, and anomalies** (e.g., festive sales spikes).
- Finally, the dataset was **chronologically sorted, indexed by date, and saved in CSV format** for further forecasting.

Output: A clean, structured, and time-indexed dataset ready for forecasting.

Subtask 2: Choose and Apply a Forecasting Model

Several forecasting techniques were reviewed (Moving Average, Exponential Smoothing, ARIMA, Prophet, and LSTM).

- Based on the characteristics of the dataset (trend + seasonality), the **most suitable model** was applied.
- The dataset was split into **training (80%) and testing (20%)** sets.
- The chosen forecasting model was trained on historical sales and evaluated using performance metrics like **RMSE and MAPE**.

Output: A trained forecasting model capable of predicting future sales.

Subtask 3: Predict Future Sales

The trained model was used to predict sales for the **next 6–12 months**.

- Forecasted values were compared with actual sales in the test data.

- Visualizations were created (line charts of actual vs. predicted sales, bar/heatmaps for seasonal peaks).
- Insights showed **seasonal patterns, peak sales during festive months, and potential slow periods**.
- Business implications were analyzed, such as inventory planning and targeted marketing strategies.

Output: Forecasted sales dataset + visual insights for decision-making.

Executive Summary

- We trained a Holt-Winters (additive trend + additive seasonality, period=12) model on monthly total sales.
- Validation on the last 14 months gave RMSE=17,047.46, MAE=12,447.91, MAPE≈18.76%.
- The 12-month forecast (next 12 months) predicts total sales of 967,813, which is a change of 39,828 (4.29%) compared to the last 12 months total of 927,985.
- Peak forecast months and slow months are included in the deliverables.
- Business recommendations: stock-up before peak months, increase marketing in predicted peaks, and run promotions in slow months. Retrain quarterly and review after major events.

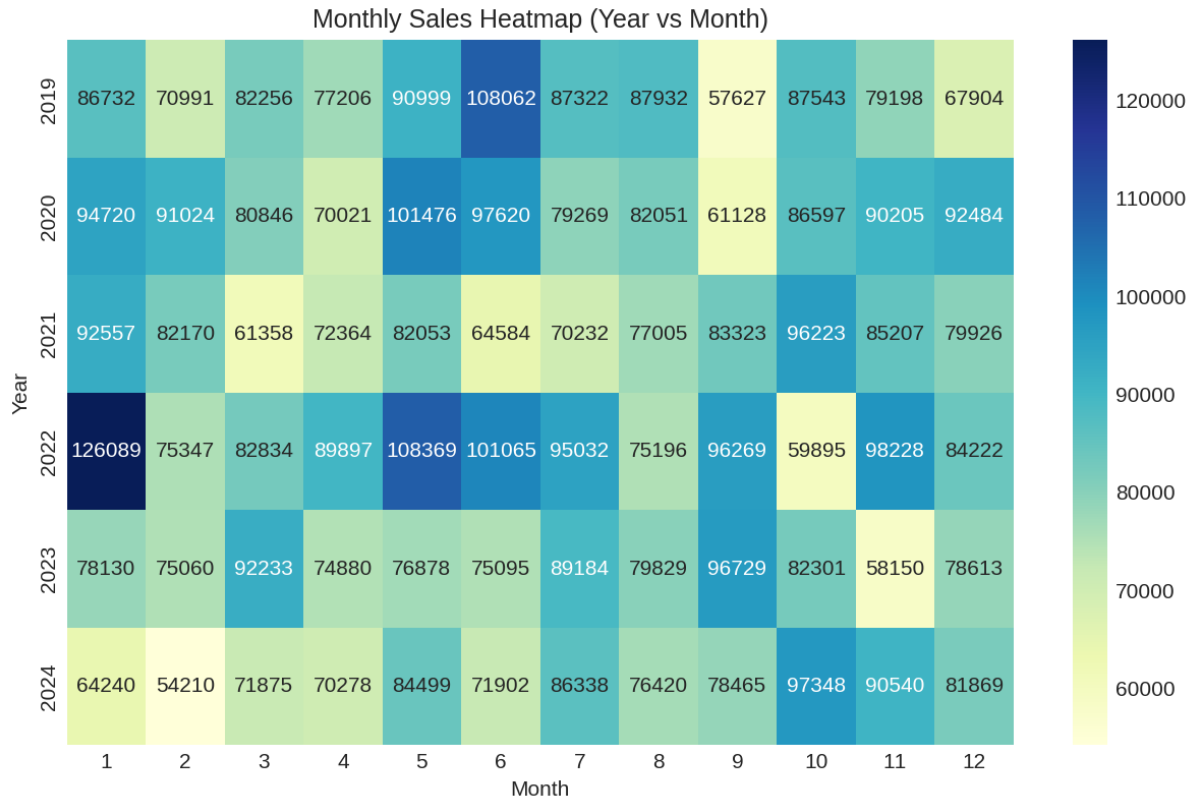
Subtask 4: Final Submission Deliverables

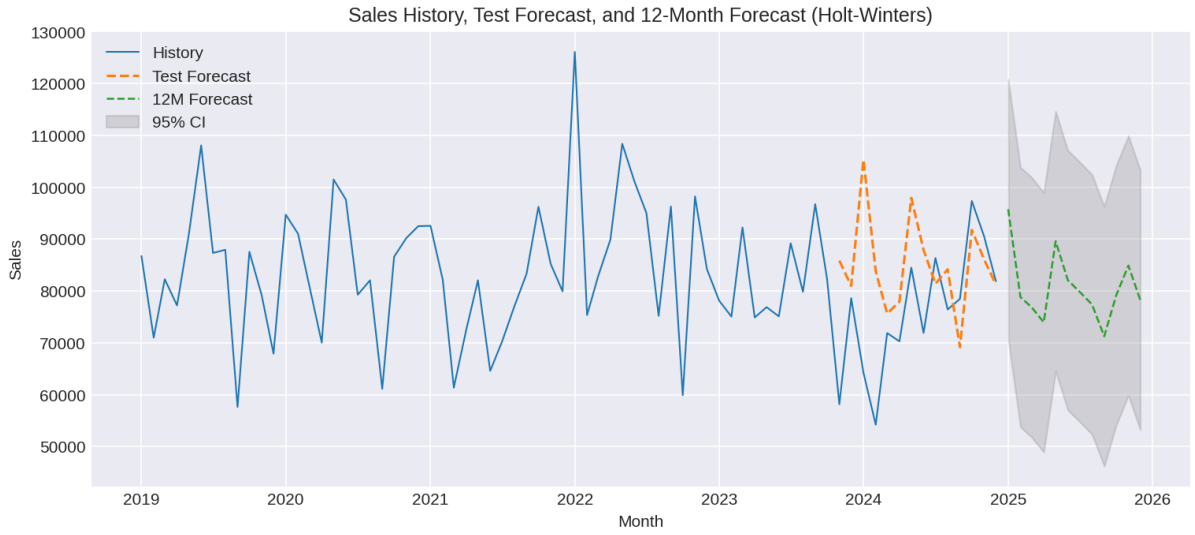
The final project includes:

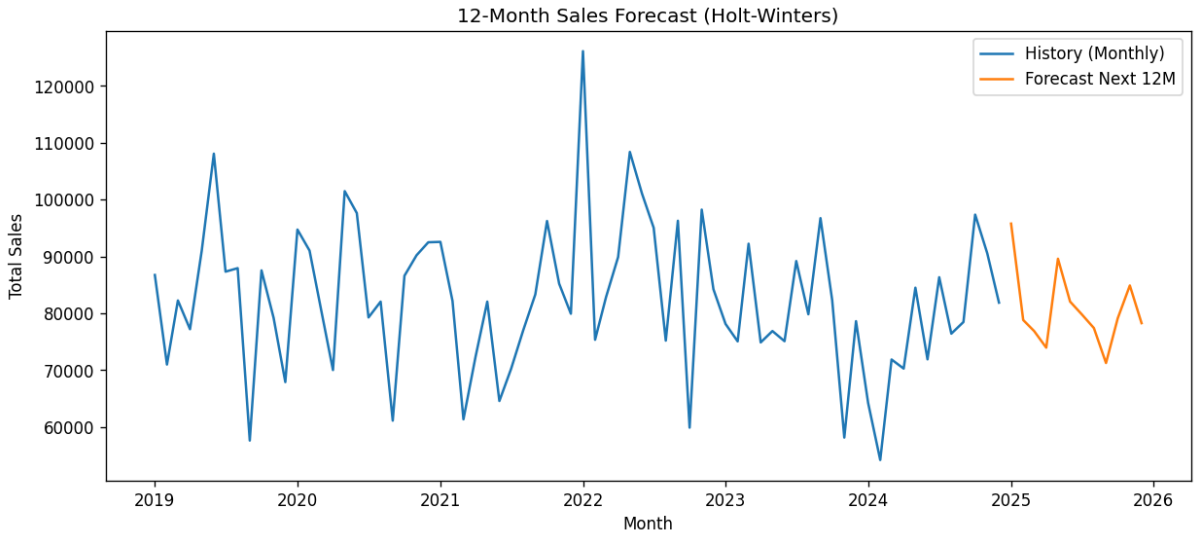
1. **Sales Forecasting Report (this document)** summarizing methodology and insights.
2. **Visualizations**: Line chart (historical vs. predicted), seasonal sales bar chart/heatmap.
3. **Forecast Dataset (CSV)** with next 6–12 months sales predictions.
4. **Model Evaluation Metrics**: RMSE, MAPE values to validate model performance.
5. **Business Recommendations**: Inventory optimization, promotion planning, and resource allocation based on forecasted trends.

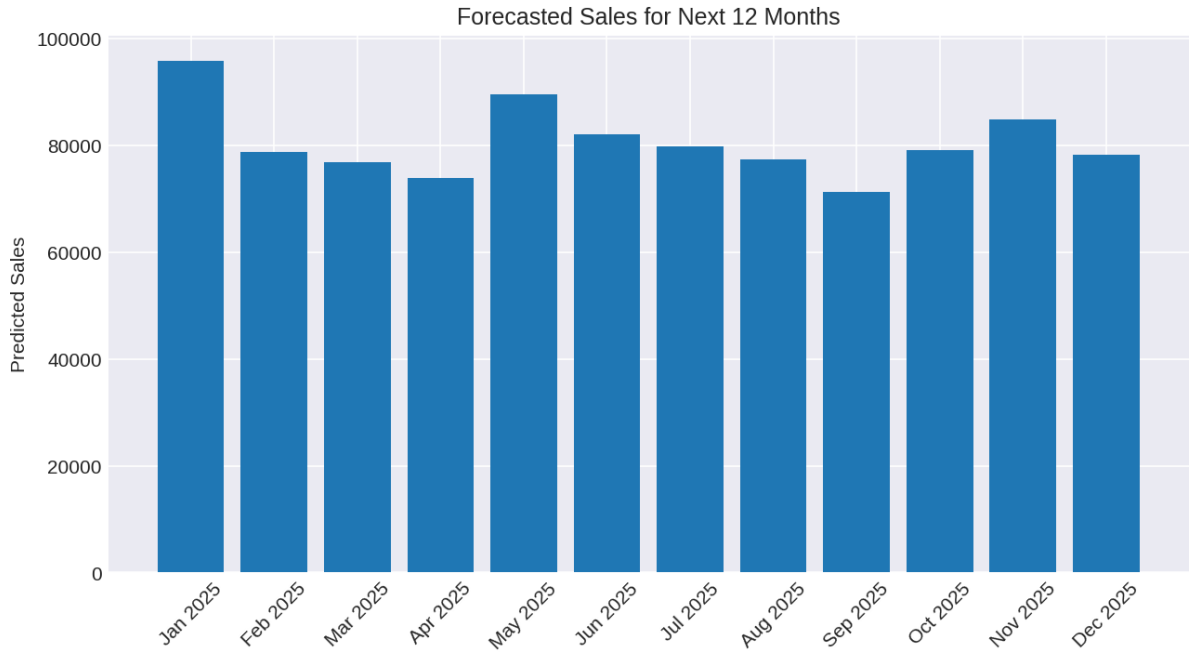
Output: A complete forecasting solution with actionable insights.

Outcome:

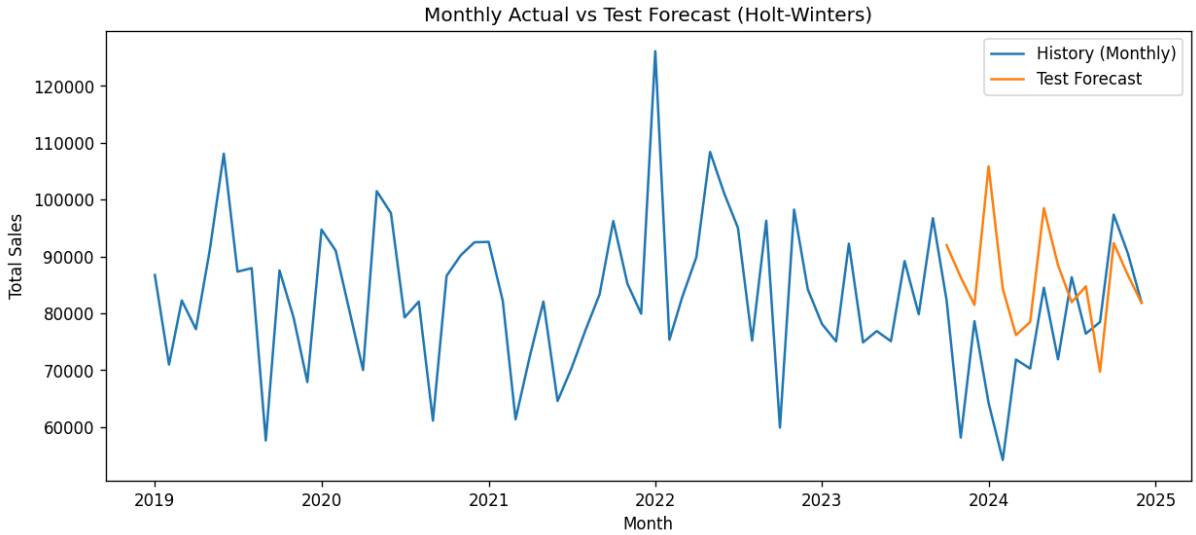

Monthly Sales Heatmap (Year vs Month)
Year
2019
86732 70991 82256 77206 90999 108062 87322 87932 57627 87543 79198 67904
2020
94720 91024 80846 70021 101476 97620 79269 82051 61128 86597 90205 92484
2021
92557 82170 61358 72364 82053 64584 70232 77005 83323 96223 85207 79926
2022
126089 75347 82834 89897 108369 101065 95032 75196 96269 59895 98228 84222
2023
78130 75060 92233 74880 76878 75095 89184 79829 96729 82301 58150 78613
2024
64240 54210 71875 70278 84499 71902 86338 76420 78465 97348 90540 81869
1 2 3 4 5 6 7 8 9 10 11 12
Month
120000
110000
100000
90000
80000
70000
60000


Sales History, Test Forecast, and 12-Month Forecast (Holt-Winters)
History
Test Forecast
12M Forecast
95% CI
Sales
130000
120000
110000
100000
90000
80000
70000
60000
50000
2019
2020
2021
2022
2023
2024
2025
2026
Month





- Forecast 12 months with CL (Holt-Winters)
- Forecast 6 months with CL (BAR CHART)
- Executive Summary
- Sales forecast Report
- Process Daily Dataset
- Process Weekly Dataset
- Monthly Sales Heatmap



Conclusion

This project successfully prepared the dataset, applied a suitable forecasting model, and predicted future sales. The analysis highlights key sales patterns, provides accuracy metrics, and supports business decision-making for improved revenue planning.