Time Series Forecasting Report

Report: Time Series Forecasting

Objective

To perform time series forecasting using historical data on Alcohol Sales and Miles Traveled, applying models like Exponential Smoothing and ARIMA, and evaluating their forecasting performance.

Dataset Overview

- Alcohol_Sales.csv
- Miles_Traveled.csv
- Both datasets are indexed by DATE (parsed as datetime objects).

Data Preprocessing

The datasets were read using pandas with date parsing and setting DATE as the index.
Basic visualization was performed to inspect trends and patterns over time.

Visualization

A dual-line plot comparing Alcohol Sales and Miles Traveled was created to analyze seasonality, trends, and correlations.

Time Series Decomposition

Performed using seasonal_decompose from statsmodels to break the series into trend, seasonality, and residuals.

Forecasting Models Used

1. Exponential Smoothing
   - Used to model level, trend, and seasonal components.
   - Implemented via statsmodels.tsa.holtwinters.ExponentialSmoothing.

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2. ARIMA (AutoRegressive Integrated Moving Average)

- Applied using statsmodels.tsa.arima.model.ARIMA.
- Focused on capturing autocorrelation structure.

Evaluation

Metric: Mean Squared Error (MSE)

Used to compare forecasted values against actual values.

Visualizations Included

Time series line plots

Decomposed components (trend, seasonality, residual)

Forecast plots for each model

Conclusion

The notebook demonstrates basic to intermediate forecasting techniques on real-world time series datasets. Models were evaluated using MSE, and visual inspection helped in understanding model accuracy.