Title : A Comparative Study of Forecasting Performance for Daily Closing Prices of the Top 10 S&P 500 Stocks Using Statistical and Deep Learning Methods

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ABSTRACT

This study aims to compare the forecasting performance of daily closing prices for the top 10 stocks in the S&P 500 index (MSFT, AAPL, NVDA, AMZN, META, GOOGL, GOOG, BRK.B, AVGO, and TSLA) using 1,432 days of historical data. Statistical techniques, including Forecast Sheets, Classical Decomposition, Double Exponential Smoothing, and the Box–Jenkins method, are evaluated against deep learning approaches, namely Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM). Forecast accuracy is assessed using Root Mean Square Error (RMSE).

The results indicate that all stock price series exhibit non-stationary characteristics. For models requiring stationarity assumptions, particularly the Box–Jenkins approach, appropriate transformations were applied, including the Box–Cox transformation to stabilize variance and differencing procedures to achieve stationarity. In addition, Min–Max normalization was conducted for the deep learning models prior to training.

Comparative results reveal that Double Exponential Smoothing provides the most accurate forecasts for BRK.B, GOOG, AVGO, META, GOOGL, and AMZN, particularly for series with clear trend components. In contrast, deep learning models outperform traditional statistical methods for stocks with less distinct trend patterns, such as TSLA, AAPL, and NVDA. These findings suggest that forecasting performance depends on the structural characteristics of the time series rather than the complexity of the modeling technique alone.