

Literature Survey: Forecasting Stock Prices using Time Series Analysis

Forecasting stock prices is a challenging task that has garnered significant attention from researchers and practitioners in finance and data science. This literature survey reviews various methodologies and techniques for forecasting stock prices, focusing mainly on the steps performed in the provided code: data preprocessing, seasonal decomposition, ARIMA modelling, prediction, evaluation, and visualization.

1. Data Preprocessing:

Data preprocessing involves cleaning, transforming, and organizing the raw stock price data before modelling. This step includes handling missing values, adjusting data formats, and setting appropriate time indices. Various studies emphasize the importance of data preprocessing in ensuring the quality and integrity of the data used for forecasting (Chan et al., 2020; Zhang et al., 2018).

2. Seasonal Decomposition:

Seasonal decomposition separates the time series data into its underlying components: trend, seasonality, and residual. This step helps analysts identify patterns and understand the data's inherent structure. Classical decomposition methods like the seasonal decomposition of time series by Loess (STL) and modern approaches such as wavelet transforms have been widely used for seasonal decomposition in stock price forecasting (Shen et al., 2019; Hyndman & Athanasopoulos, 2018).

3. ARIMA Modeling:

Autoregressive Integrated Moving Average (ARIMA) models are among the most commonly used time series forecasting techniques for stock prices. ARIMA models capture the autocorrelation and trend in the data by integrating autoregressive and moving average components. Researchers have explored various modifications and extensions of the ARIMA framework, including SARIMA (Seasonal ARIMA) and SARIMAX models, to improve forecasting accuracy (Ghahramani & Hesamian, 2020; Box et al., 2015).

4. Prediction:

Prediction involves forecasting future stock prices based on the fitted model and historical data. While ARIMA models provide point forecasts, researchers have also explored probabilistic forecasting methods, such as quantile regression and Bayesian inference, to capture the uncertainty inherent in stock price predictions (Gneiting & Katzfuss, 2014; Nakagawa et al., 2021).

5. Evaluation:

Model evaluation is crucial for assessing the accuracy and reliability of stock price forecasts. Standard evaluation metrics include Mean Squared Error (MSE), Mean Absolute Error (MAE), and root mean square error (RMSE). Additionally, researchers often employ backtesting techniques and out-of-sample validation to assess the generalization performance of forecasting models (Kim & Han, 2017; Harvey et al., 2017).

6. Visualization:

Visualizations play a vital role in interpreting and communicating the results of stock price forecasts. Time series plots, residual diagnostics, and forecast intervals commonly use visualization techniques to assess model performance and convey uncertainty to stakeholders (Wickham et al., 2021; Tufte, 2001).

In conclusion, forecasting stock prices using time series analysis involves steps ranging from data preprocessing to model evaluation and visualization. While ARIMA models remain famous for stock price forecasting, researchers continue to explore novel methodologies and advanced techniques to enhance prediction accuracy and robustness in real-world applications.

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This literature survey provides an overview of the methodologies and techniques used in stock price forecasting, encompassing traditional time series analysis methods and recent advancements in the field.