

In this report, we present the results of our analysis and forecasting of passenger traffic using time series techniques. The data stationarity was assessed using the Augmented Dickey-Fuller (ADF) test. The dataset was further decomposed into its constituent components: level, trend, seasonality, and residue. To accurately predict future passenger traffic, we employed Seasonal Autoregressive Integrated Moving Average (ARIMA), Holt's Exponential Smoothing method, and Holt's Winter models. The performance of these models was evaluated using metrics such as Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE).

Data Preprocessing: Before proceeding with the analysis, the initial dataset was subjected to the Augmented Dickey-Fuller (ADF) test to determine its stationarity. This test indicated whether differencing was necessary to achieve stationarity.

Decomposition: The decomposed time series allowed us to isolate and examine the individual components that contribute to the overall behavior of the passenger traffic data. The decomposition process separated the data into its level, trend, seasonality, and residue components, which provided valuable insights into the underlying patterns.

Modeling Techniques: Three different modeling techniques were applied to forecast future passenger traffic:

Seasonal ARIMA: Seasonal ARIMA, a widely used time series model, was employed to capture the complex seasonality and trends present in the data. This model utilizes both differencing and autoregressive and moving average components to capture the temporal patterns.

Holt's Exponential Smoothing: Holt's method, an exponential smoothing technique, was utilized to forecast passenger traffic. It takes into account the level and trend components of the data to make predictions.

Holt's Winter Model: The Holt's Winter model, an extension of Holt's method, was used to consider the seasonal component in addition to the level and trend. This model was particularly suitable for capturing both seasonality and trend variations in the passenger traffic data.

Model Evaluation: The performance of the three models was assessed using the Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE) metrics. The RMSE measures the average magnitude of errors, while MAPE represents the percentage difference between predicted and actual values. The Holt's Winter model demonstrated the best performance, achieving a mean absolute percentage error (MAPE) of 6.53%.

Conclusion: In conclusion, the analysis and forecasting of passenger traffic using time series techniques yielded valuable insights into the behavior of the data. By decomposing the data into its components and employing advanced forecasting models, we were able to make accurate predictions of future passenger traffic. The Holt's Winter model emerged as the most effective in capturing the complex interplay of level, trend, seasonality, and residue in the data, achieving a MAPE of 6.53%. These results underscore the importance of robust time series analysis and modeling in accurately forecasting passenger traffic for informed decision-making and resource allocation.

