

RETAIL GAIN SALES FORECASTING

(Time Series Analysis)

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Business Problem Statement

Global Mart is an online supergiant store that has worldwide operations. This store takes orders and delivers across the globe and deals with all the major product categories — consumer, corporate and home office.

As a sales manager for this store, you have to forecast the sales of the products for the next 6 months, so that you have a proper estimate and can plan your inventory and business processes accordingly.

You want to **forecast the sales** for that **most consistently profitable market-segment only**. This way you know that the market region your company is investing in will be beneficial for the company as the forecasts will be reliable.

Overall, we want the **best forecasting method** in the **smoothing** technique **as well as the ARIMA** set of techniques.

Data Understanding and Preparation

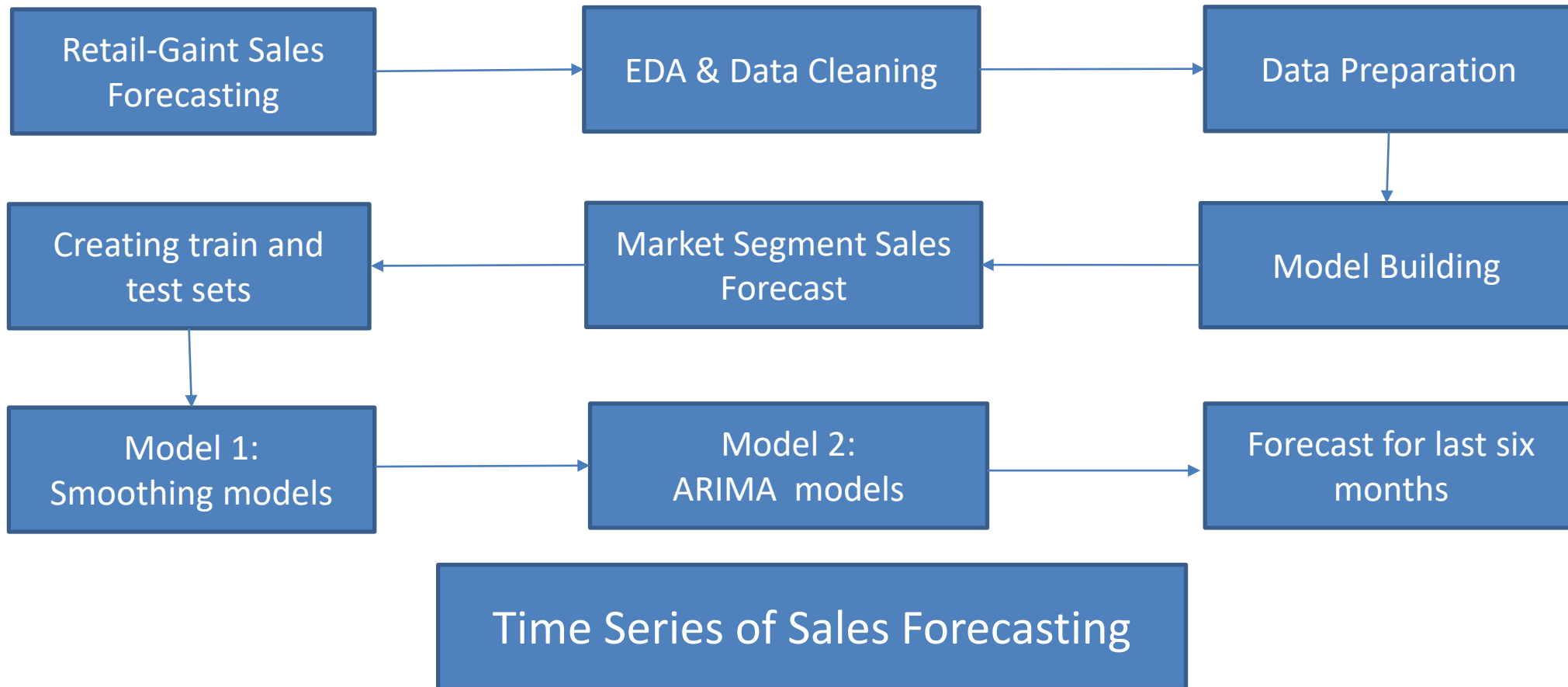
Data Understanding

- 51290 transactions from 2011 – 2014.
- Focusing mainly on month and year wise aggregated values of Sales, Profit and Quantity.
- With 3 segments and in 7 market regions.

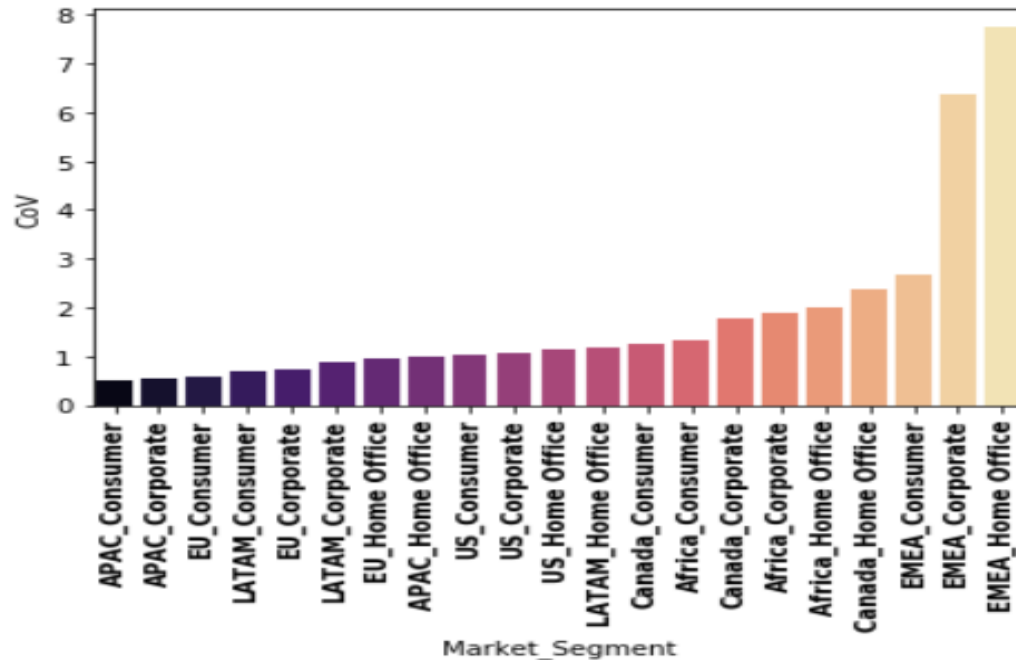
Data Preparation

- Prepared the aggregated data with 21 market-segments.
- Found the most profitable market segment by calculating Coefficient of Variation.

Forecasting Steps



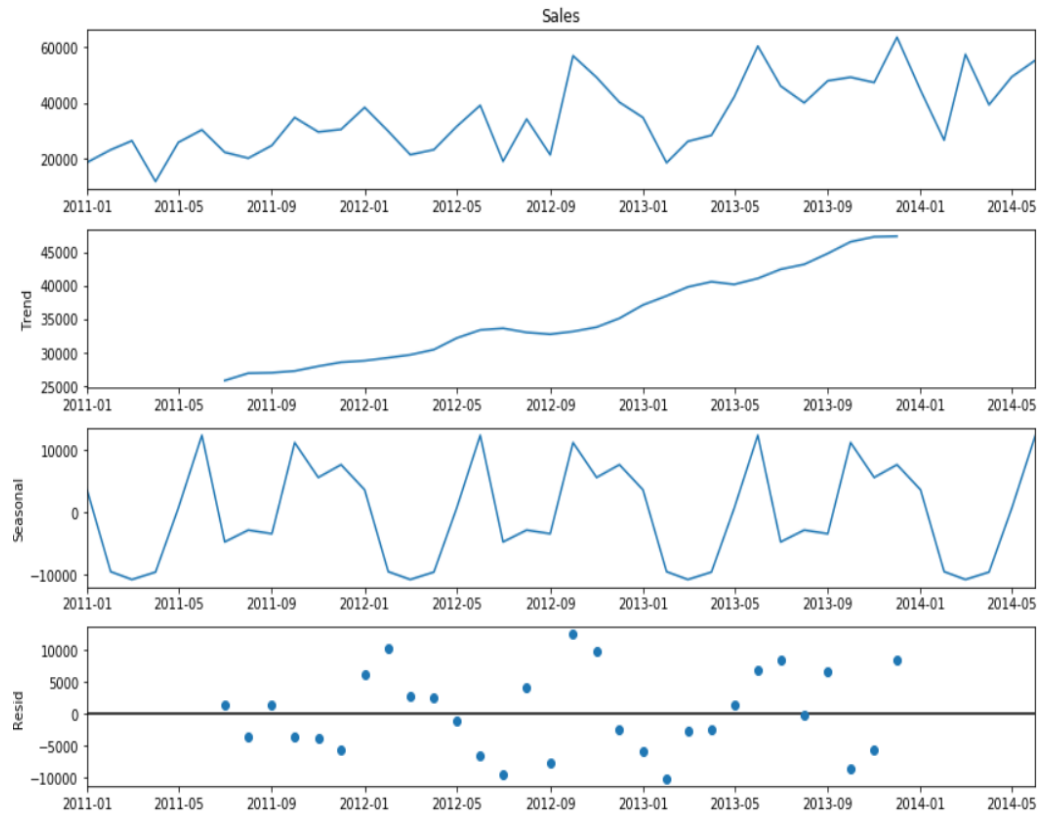
CoV Value for market segments



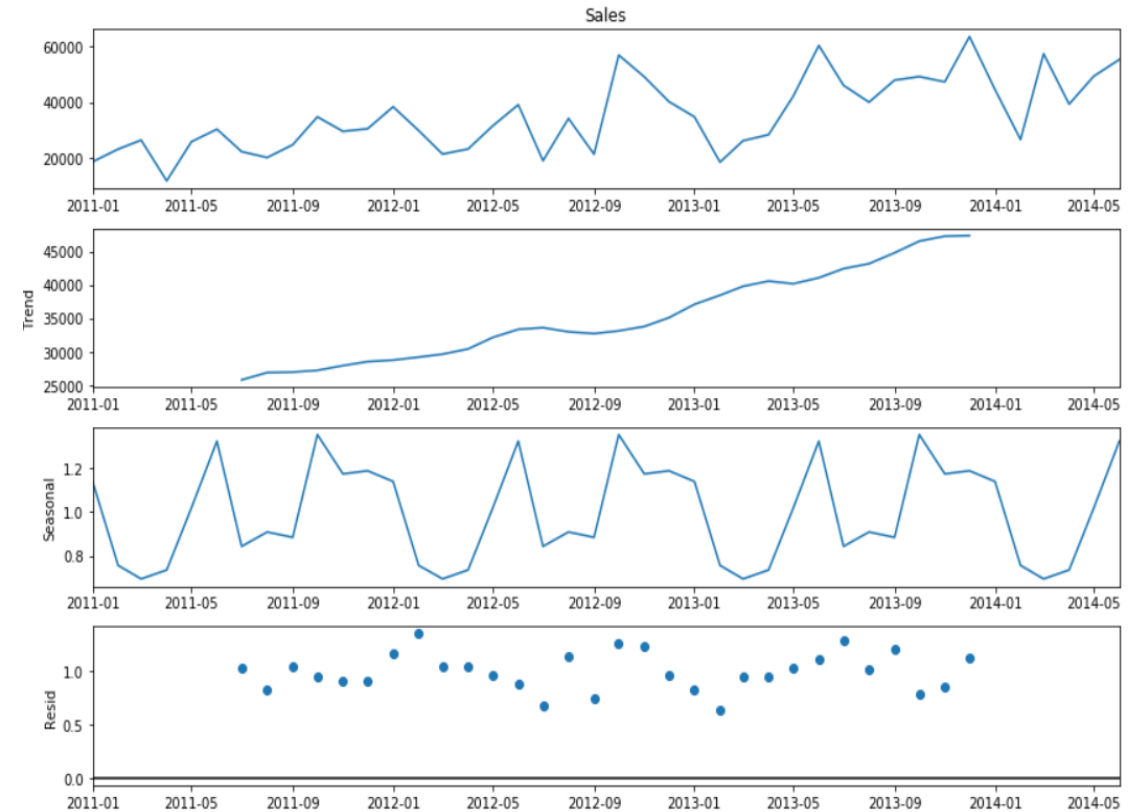
- We can see that Lowest CoV is 0.52272
- We can infer that the corresponding Market Segment is "APAC_Consumer"

The most profitable Market Segment is APAC_Consumer

Additive and Multiplicative Seasonal Decomposition



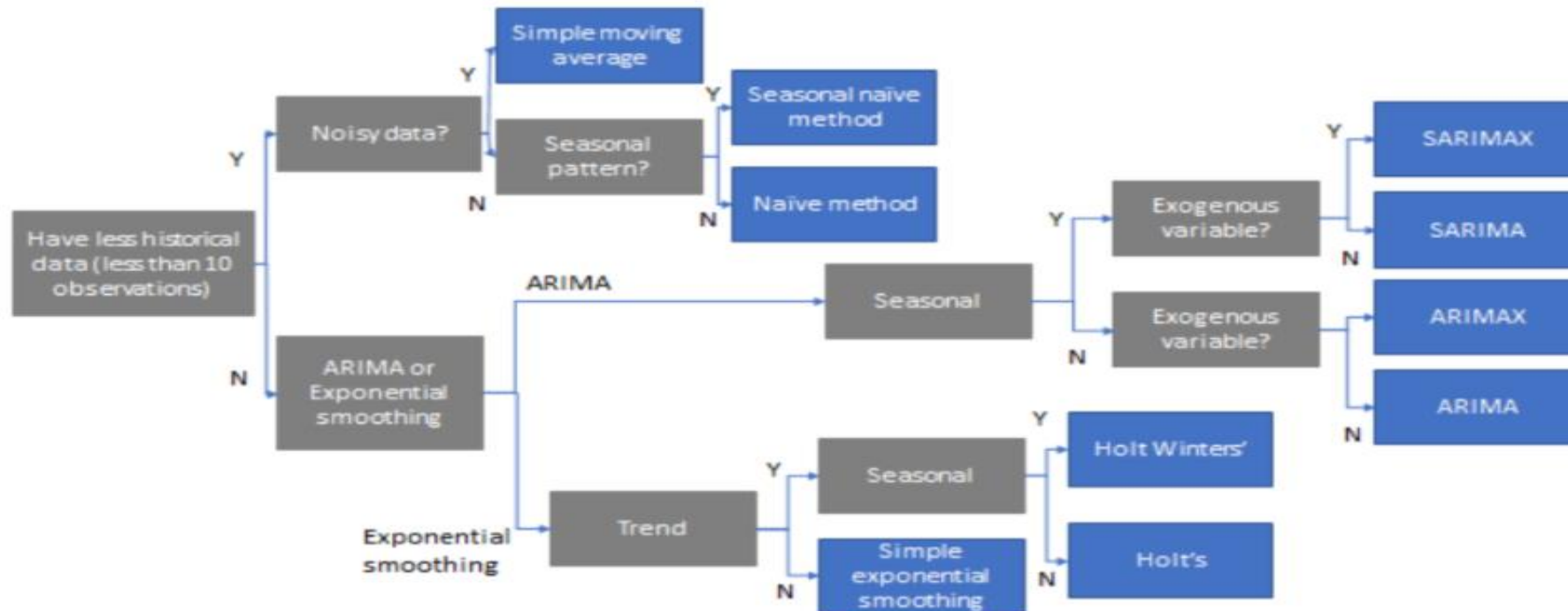
Additive Seasonal Decomposition



Multiplicative Seasonal Decomposition

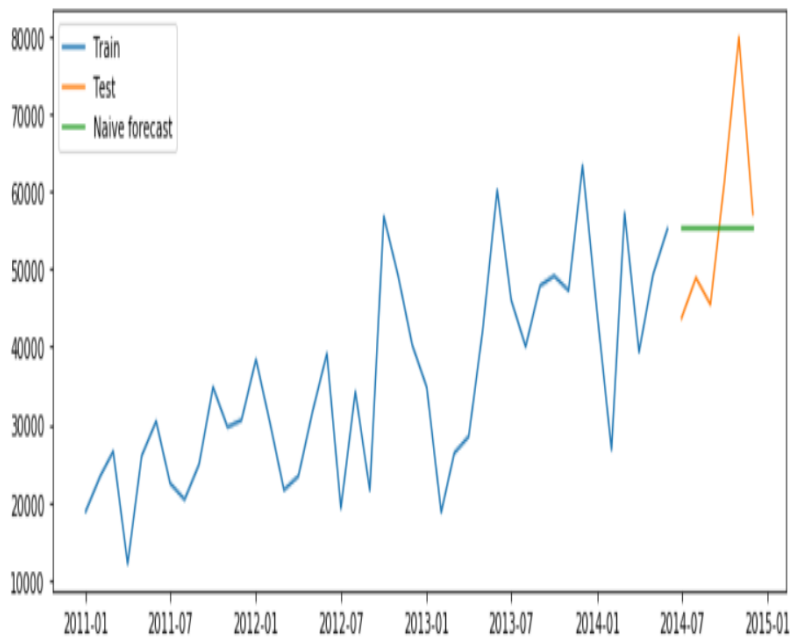
Flow Chart for choosing the Right Time Series Method

Choosing the Right Time Series Method

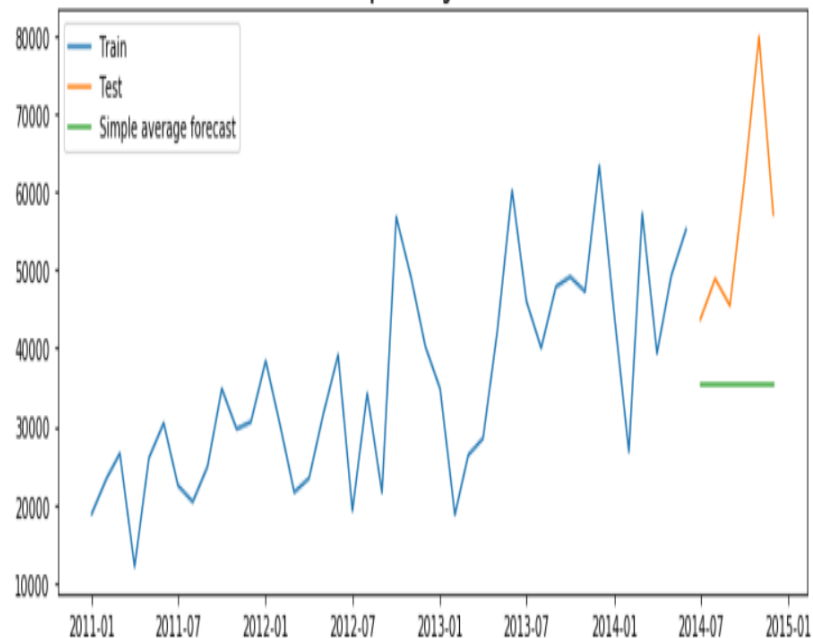


Simple Time Series Methods

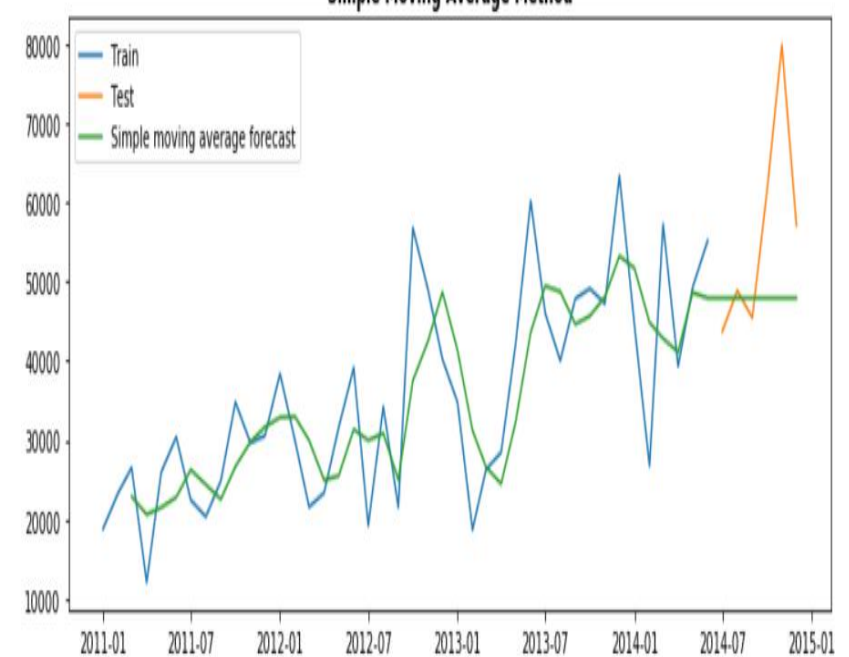
Naive Method



Simple Average Method

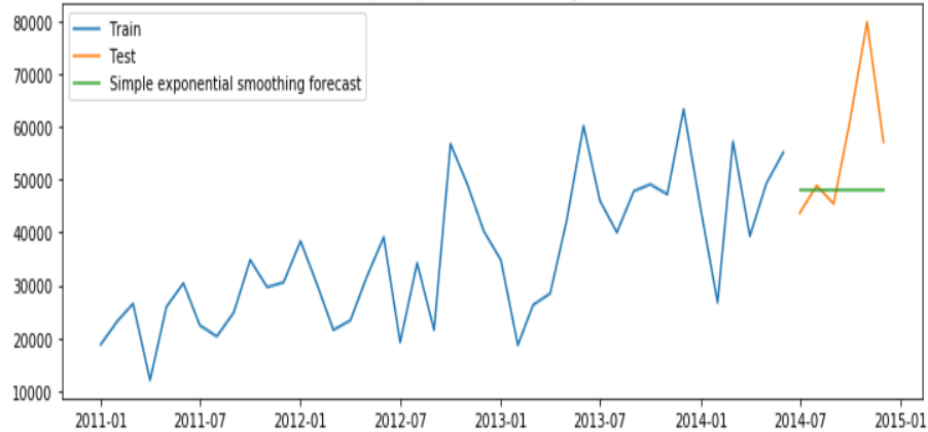


Simple Moving Average Method

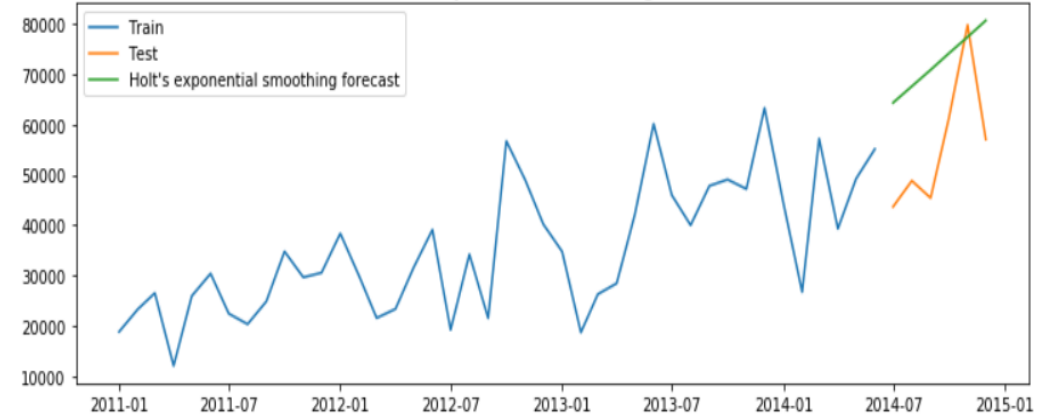


Exponential smoothing methods

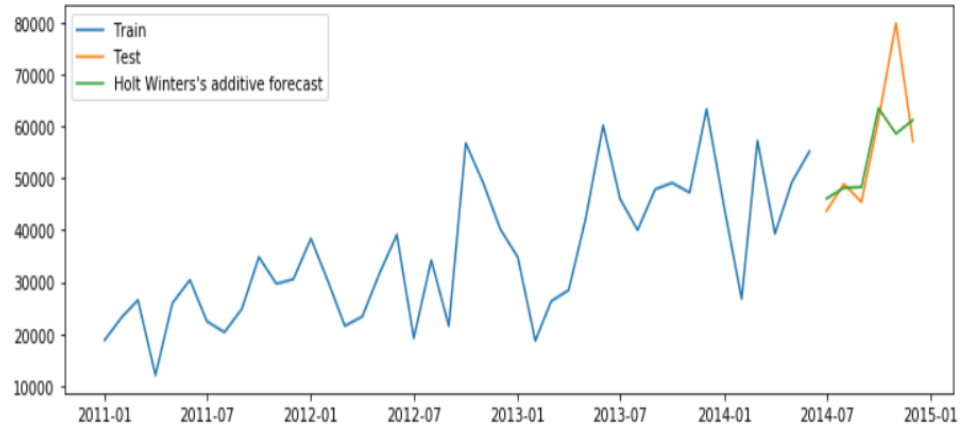
Simple Exponential Smoothing Method



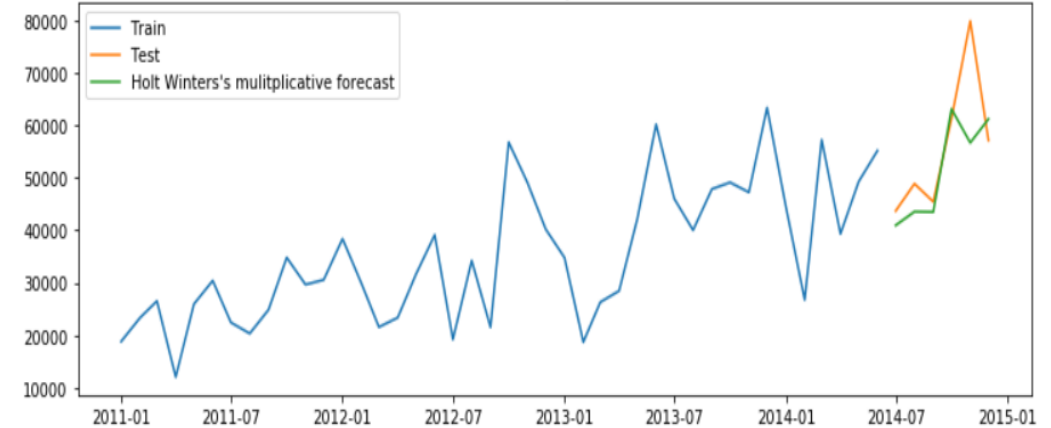
Holt's Exponential Smoothing Method



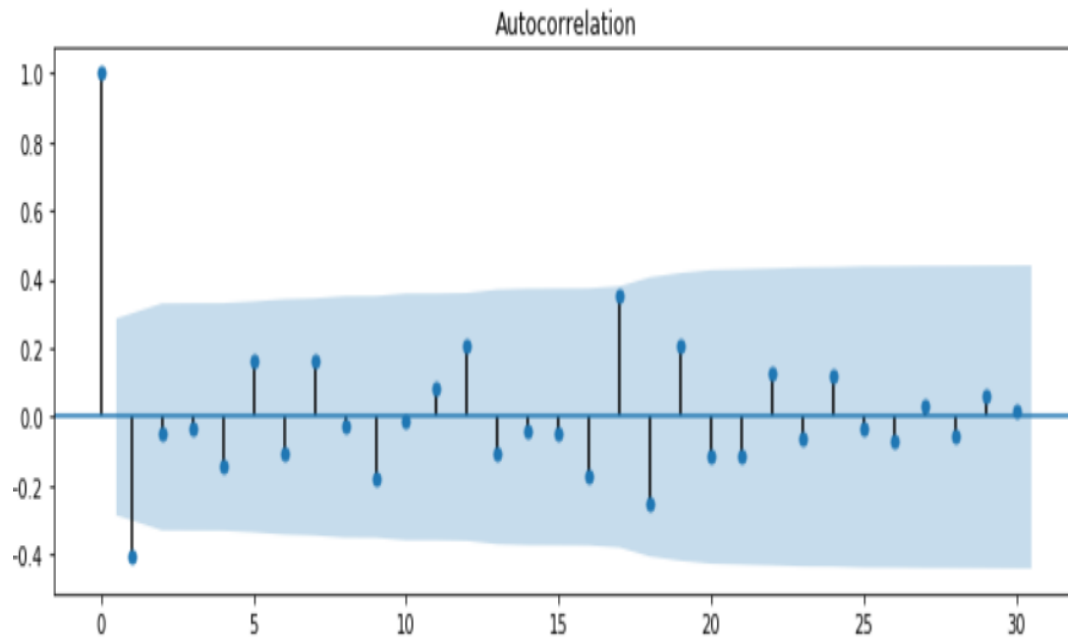
Holt Winters' Additive Method



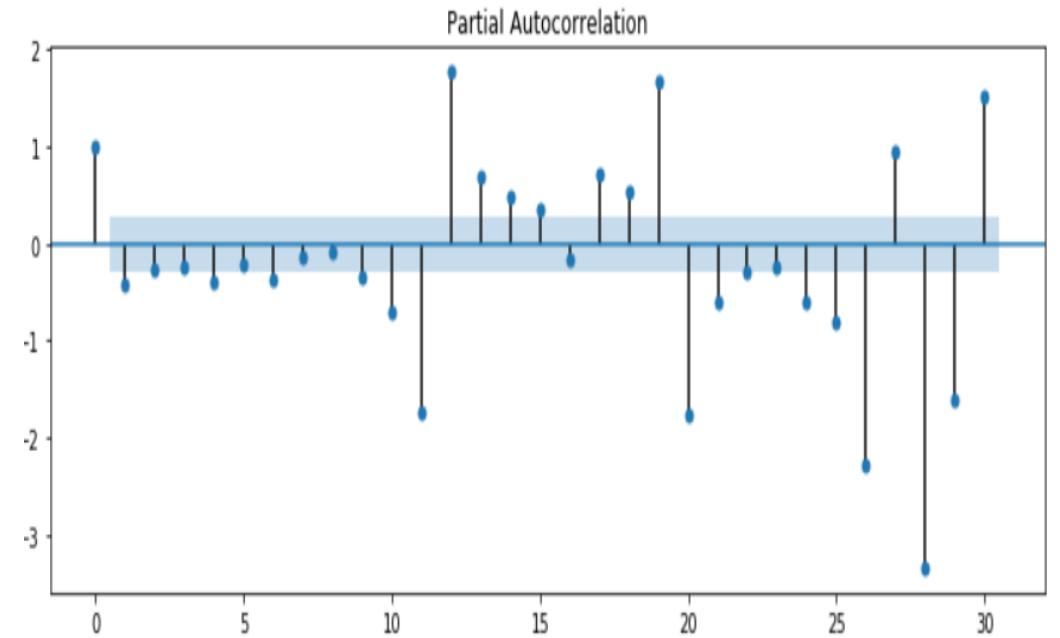
Holt Winters' Multiplicative Method



ACF and PACF

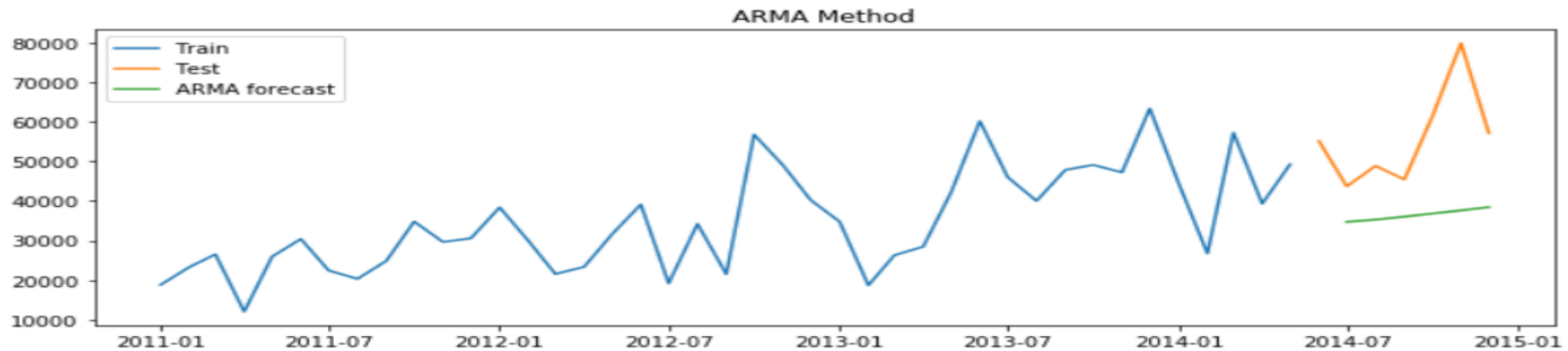
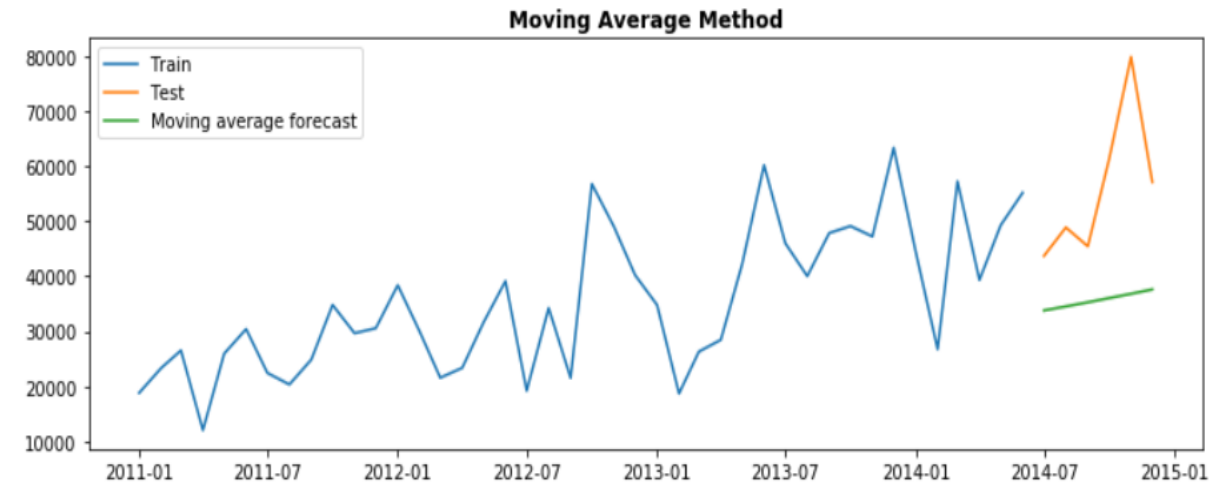
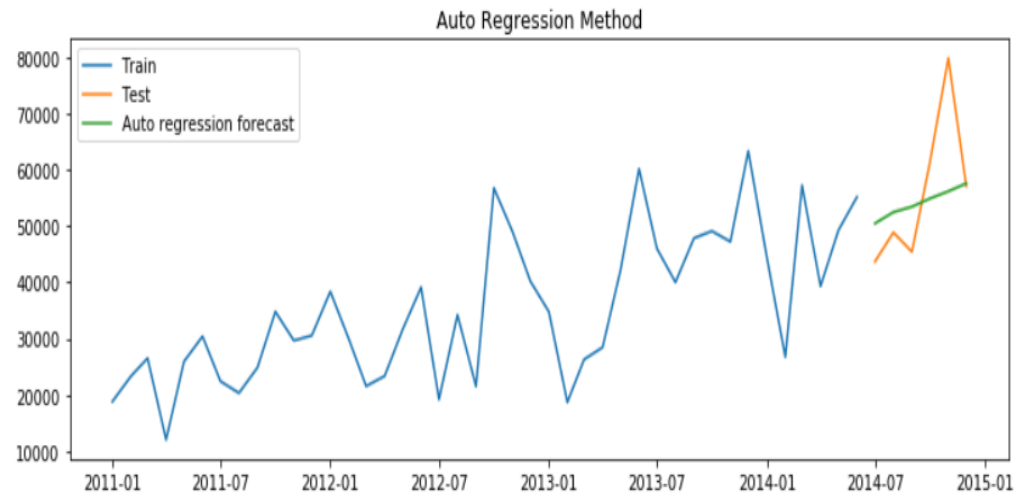


Autocorrelation function (ACF)

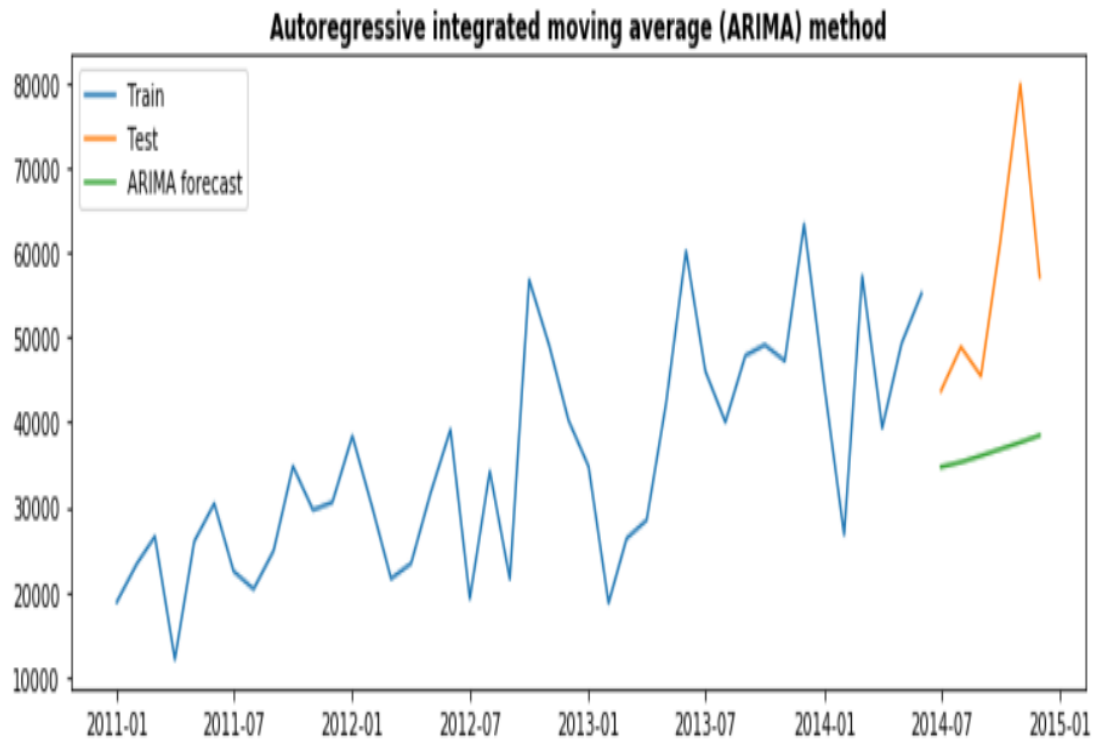


Partial Autocorrelation function (PACF)

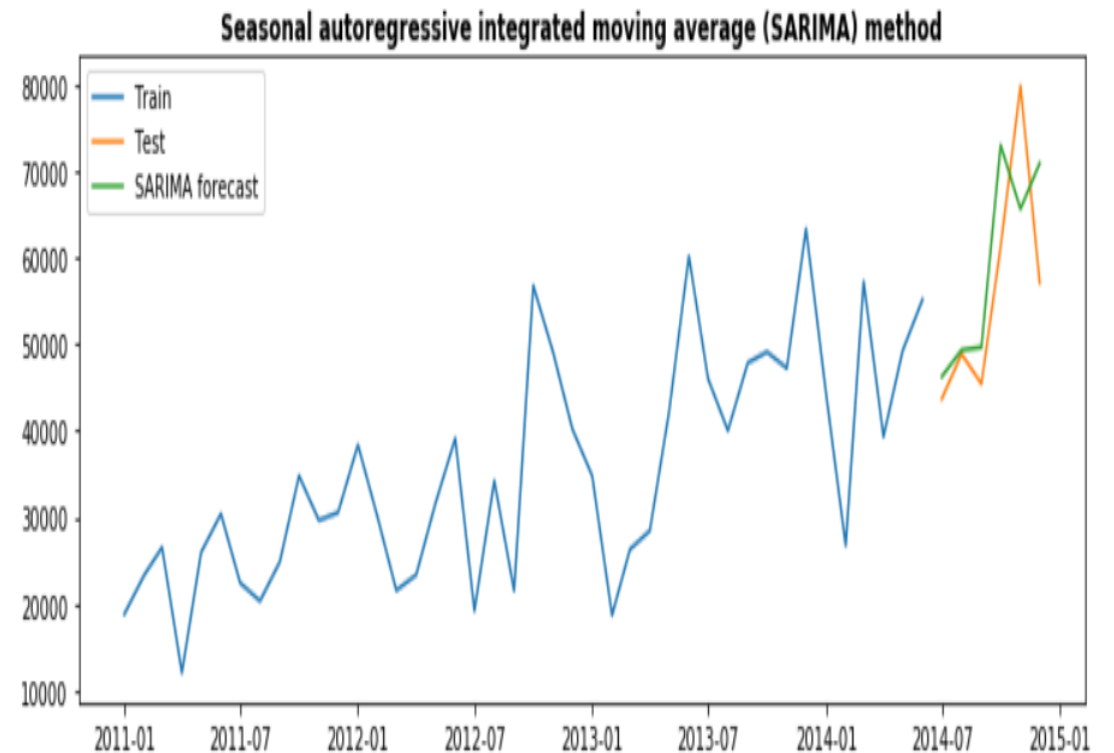
Auto Regression Methods



Auto Regression Methods (Contd..)



ARIMA Method



SARIMA Method

Conclusion

Thus we can conclude that,

- **Holt Winters additive method** is the best forecasting method in the smoothing technique.
- **SARIMA - Seasonal Autoregressive Integrated moving average** is the best method in ARIMA set of techniques.

Since our data had trend and seasonal component and it is well captured and forecasted by these two methods. Also these two methods gave us the **least RMSE and MAPE values**.

Method	RMSE	MAPE
Naive method	12355.97	17.47
Simple average method	24146.06	34.34
Simple moving average forecast	14756.73	15.82
Simple exponential smoothing forecast	14764.97	15.83
Holt's exponential smoothing method	18976.37	34.57
Holt Winters' additive method	9026.50	8.44
Holt Winters' multiplicative method	9976.49	10.12
Autoregressive (AR) method	10985.28	13.56
Moving Average (MA) method	23360.02	33.93
Autoregressive moving average (ARMA) method	22654.33	32.40
Autoregressive integrated moving average (ARIM...	22654.33	32.40
(SARIMA) Seasonal autoregressive integrated mo...	9616.86	12.88