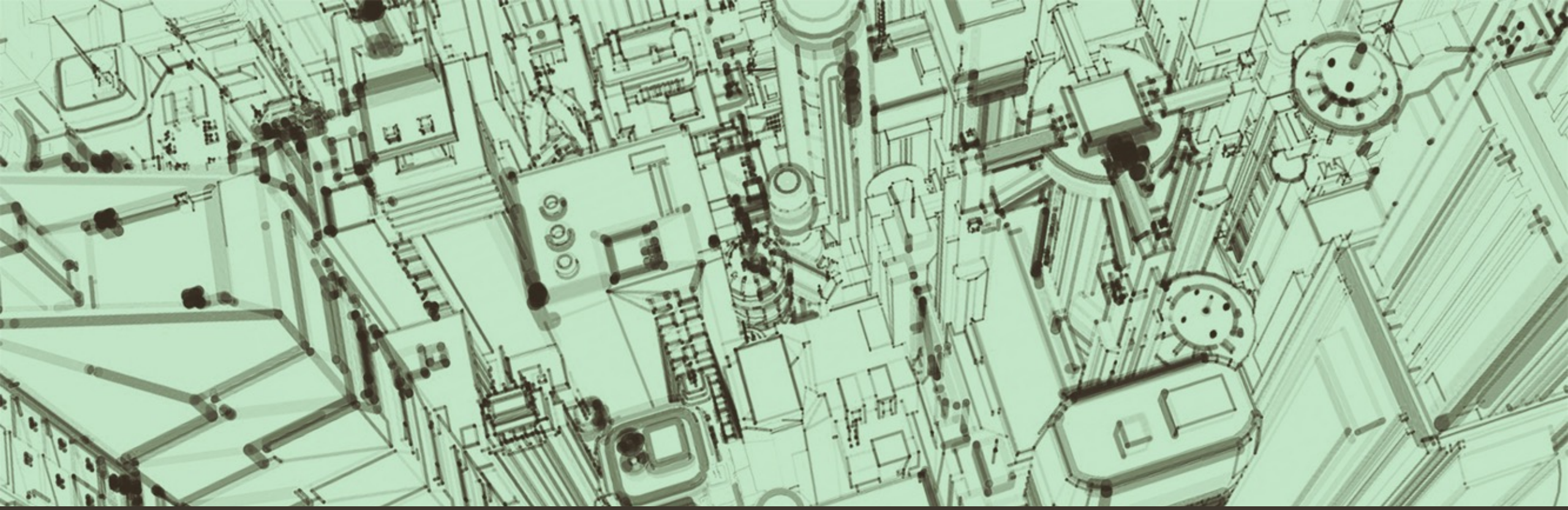


Time Series Forecasting on Global Super Store Dataset

By CHINMAY ERANDE

Objective

- To explain the methodology used to find the most profitable market segment, namely the Coefficient of variation
- Explaining the insights derived from the forecast plots
- To find out if the MAPE values are in line with the model selection from the flowchart

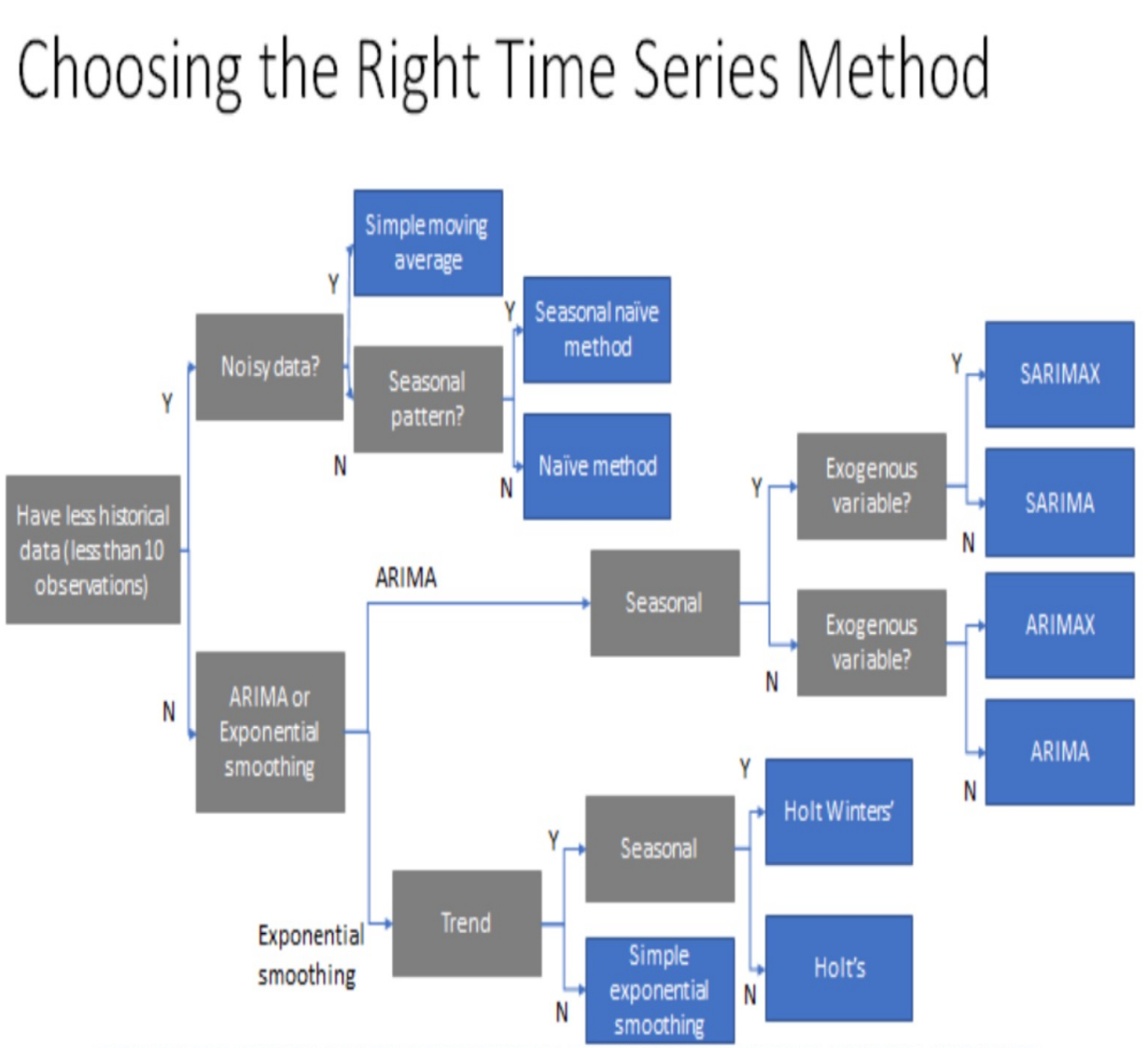
Coefficient of Variation (COV)

- Coefficient of variation values can tell us the variation in a dataset, and how reliable it is for a use case. It is denoted by (Standard Deviation/Mean)
- We find the COV values by aggregating the Profit values with the Order Date by using a pivot table, and then deriving the COV.
- "APAC-Consumer" Market Segment is the segment with the lowest COV value and should be chosen for the next step.

	Market_segment	COV
0	APAC-Consumer	0.522725
1	APAC-Corporate	0.530051
2	APAC-Home Office	1.008219
3	Africa-Consumer	1.310351
4	Africa-Corporate	1.891744
5	Africa-Home Office	2.012937
6	Canada-Consumer	1.250315
7	Canada-Corporate	1.786025
8	Canada-Home Office	2.369695
9	EMEA-Consumer	2.652495
10	EMEA-Corporate	6.355024
11	EMEA-Home Office	7.732073
12	EU-Consumer	0.595215
13	EU-Corporate	0.722076
14	EU-Home Office	0.938072
15	LATAM-Consumer	0.683770
16	LATAM-Corporate	0.882177
17	LATAM-Home Office	1.169693
18	US-Consumer	1.010530
19	US-Corporate	1.071829
20	US-Home Office	1.124030

Seasonal Decomposition

- Seasonal Decomposition shows the presence of trend and seasonality
- According to the flow chart, Holt Winter's Exponential Smoothing method and Sarima method should work best



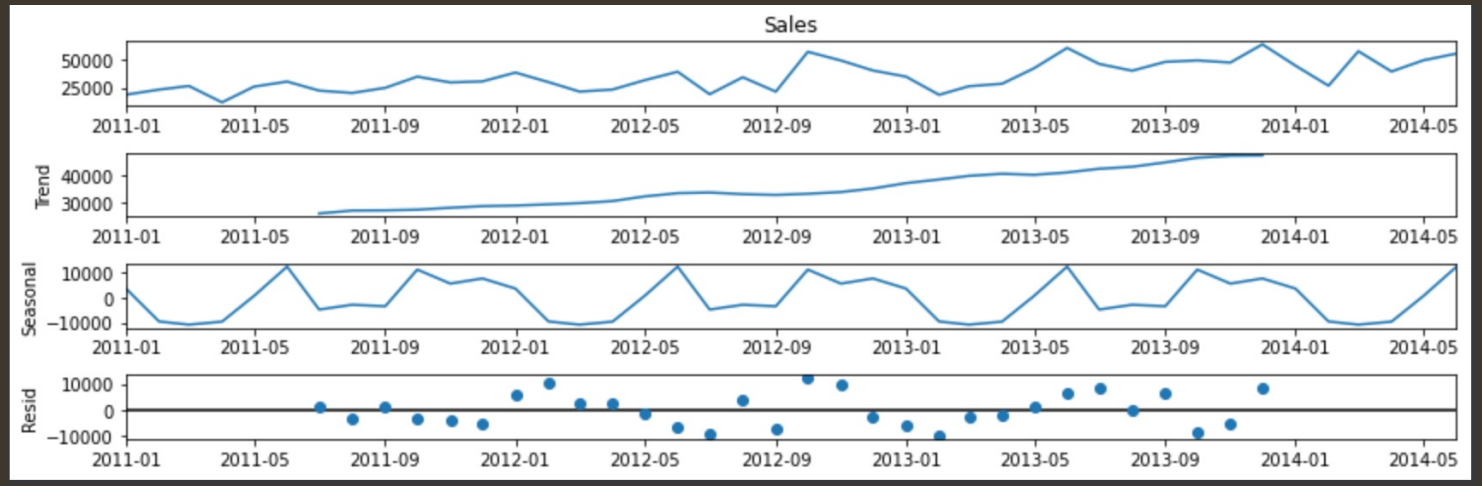
example in which the techniques mentioned here can be used is in determining the number of monthly visitors

to an amusement park. With increased marketing, the number of visitors to the amusement park keeps

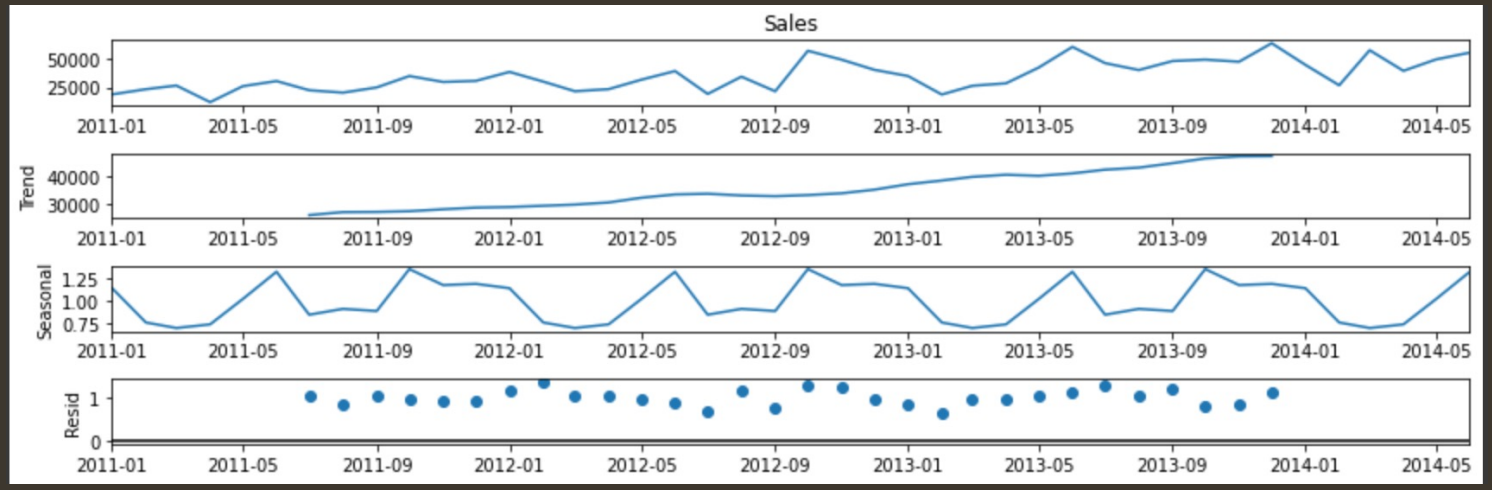
Choosing the Right Time Series Method

Decomposition Plots : Additive and Multiplicative

Additive



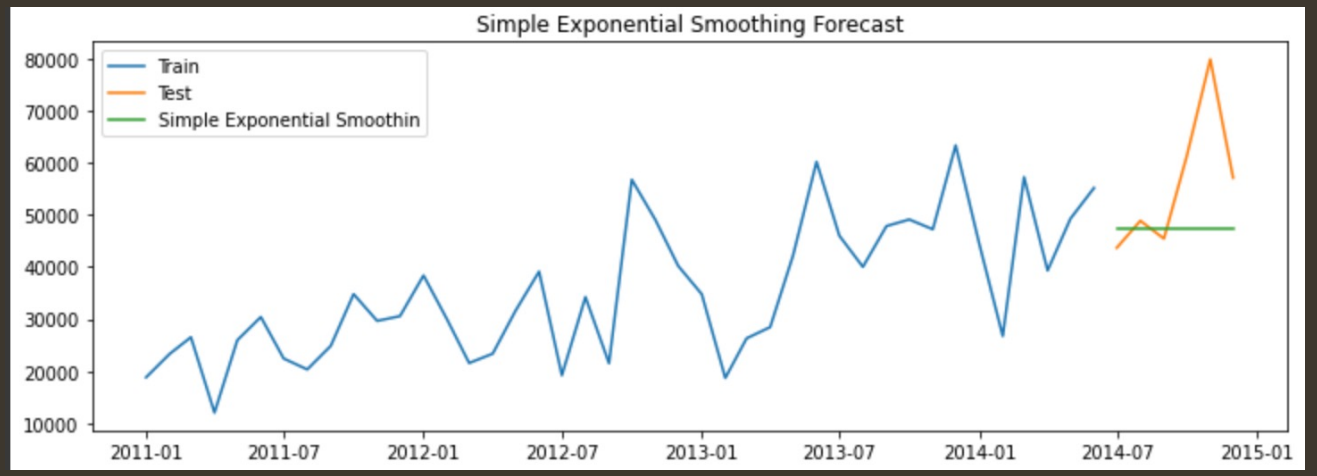
Multiplicative

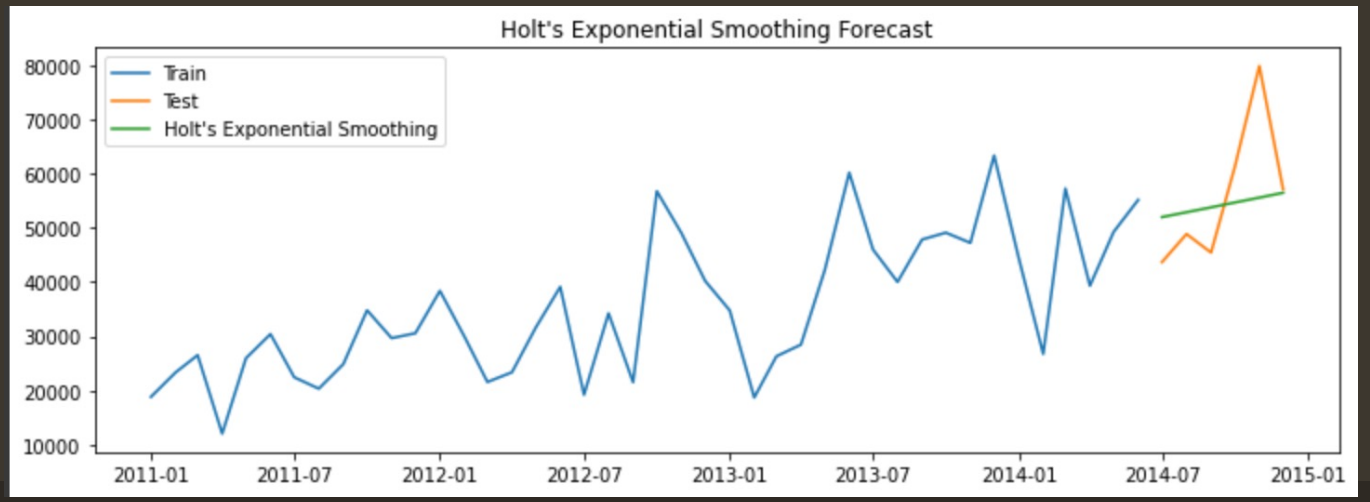


Smoothening Methods : Simple Exponential and Holt's Exponential Method

- From the plots, we can clearly see that Holt's Exponential Method is forecasting better
- The MAPE values of the two methods are as follows (lower is better):

Method	MAPE
Simple Exponential Smoothing	15.99
Holt's Exponential Smoothing	14.64

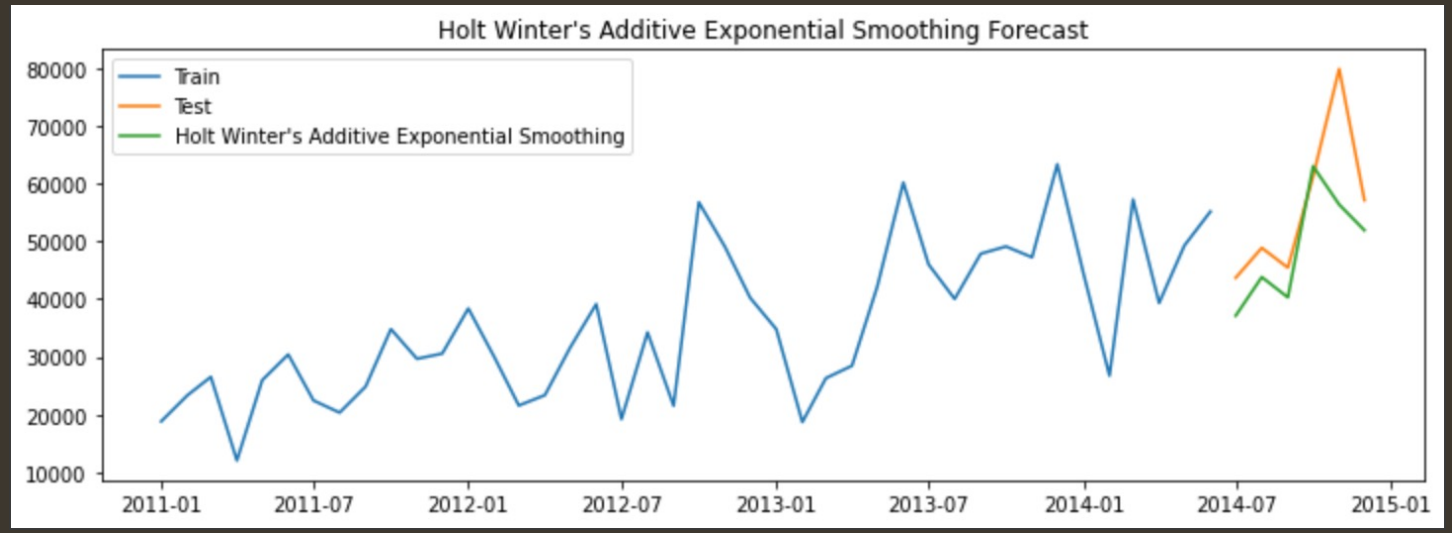


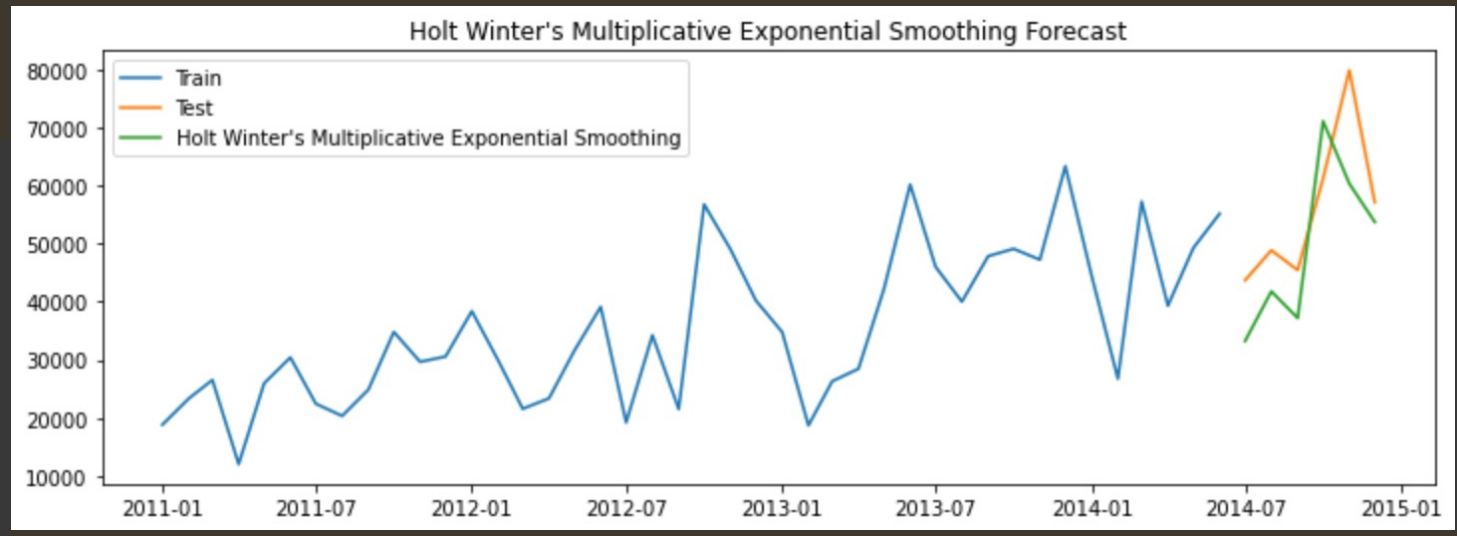


Smoothening Methods :Holt's Winters Additive and Multiplicative Methods

- Again, from the plots, it is clear that both these methods are forecasting much better than other smoothening methods
- From the values, we can see that Holt Winter's Additive method is the best method for our data
- The MAPE values of all smoothening methods are as follows (lower is better):

	Method	MAPE
0	Simple Exponential Smoothing	15.99
1	Holt's Exponential Smoothing	14.64
2	Holt Winter's Additive Exponential Smoothing	13.02
3	Holt Winter's Multiplicative Exponential Smoot...	17.17

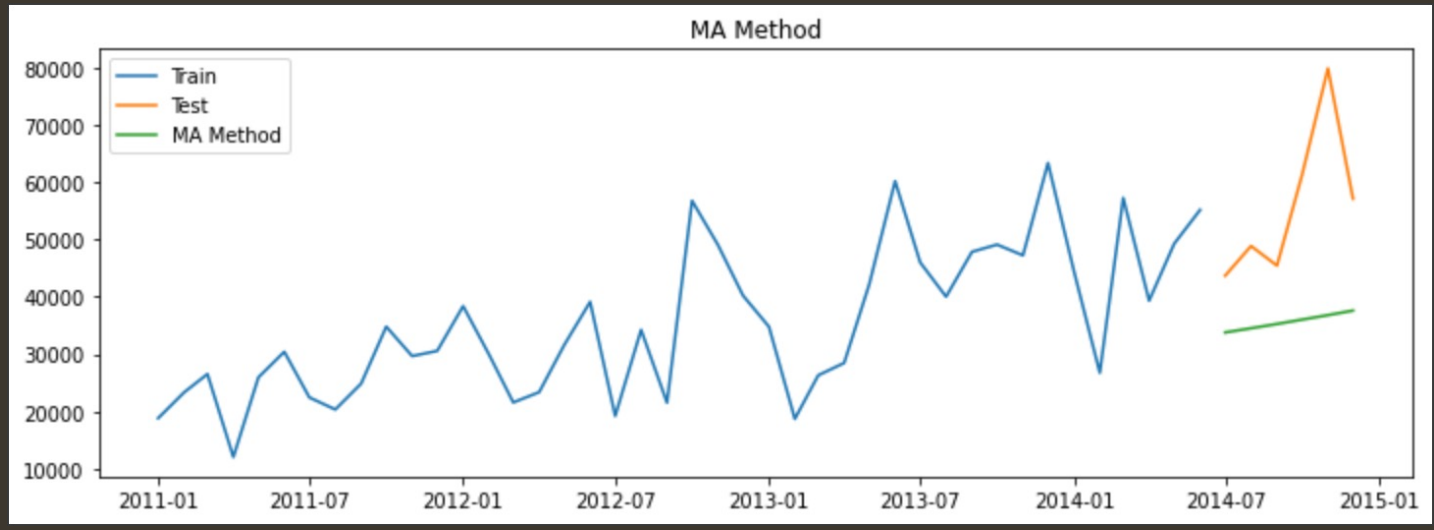


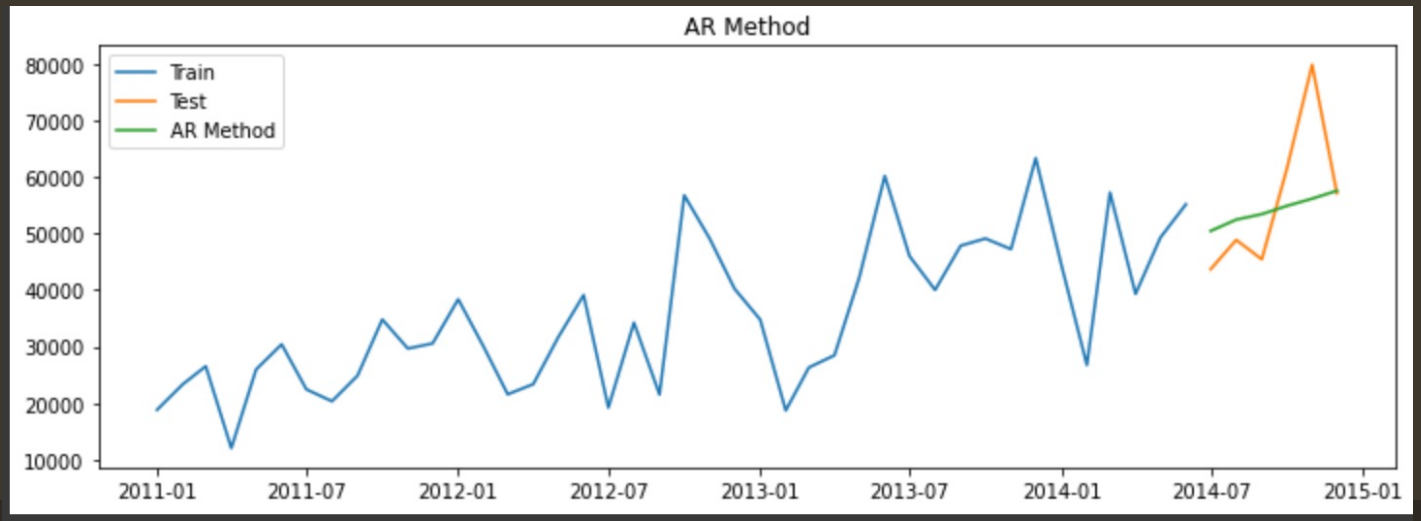


ARIMA Methods: AR, MA Methods

- From the plots, we can clearly see that AR method works better here.
- The updated MAPE values of the methods are as follows (lower is better):

	Method	MAPE
0	Simple Exponential Smoothing	15.99
1	Holt's Exponential Smoothing	14.64
2	Holt Winter's Additive Exponential Smoothing	13.02
3	Holt Winter's Multiplicative Exponential Smoot...	17.17
4	AR Method	13.55
5	MA Method	33.95

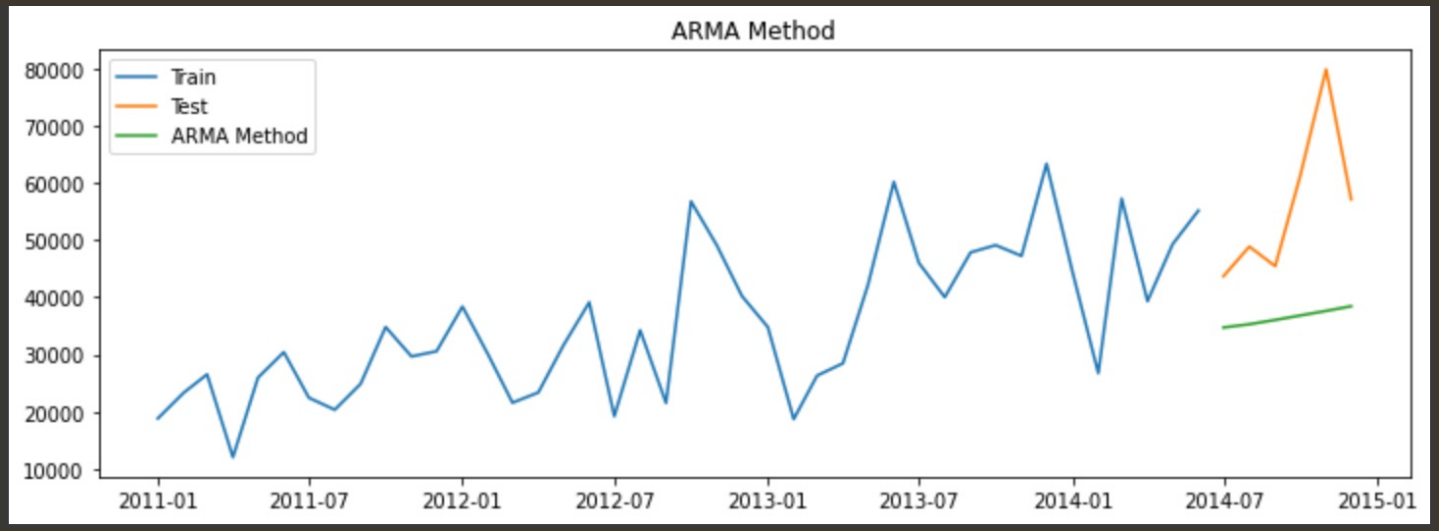


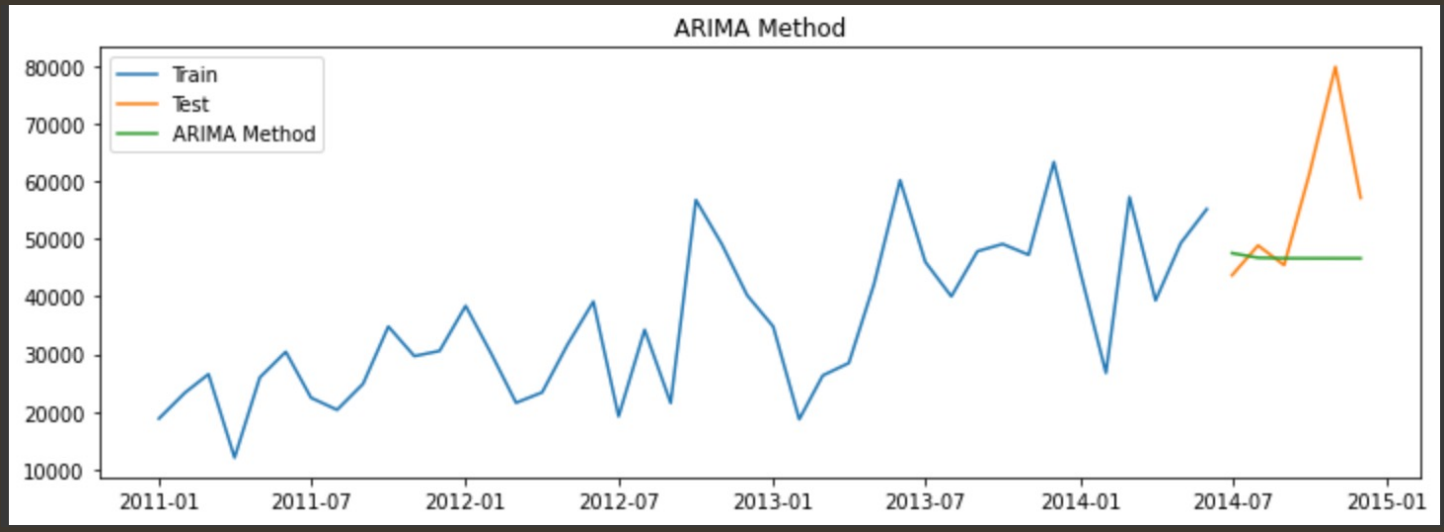


ARIMA Methods: ARMA, ARIMA Methods

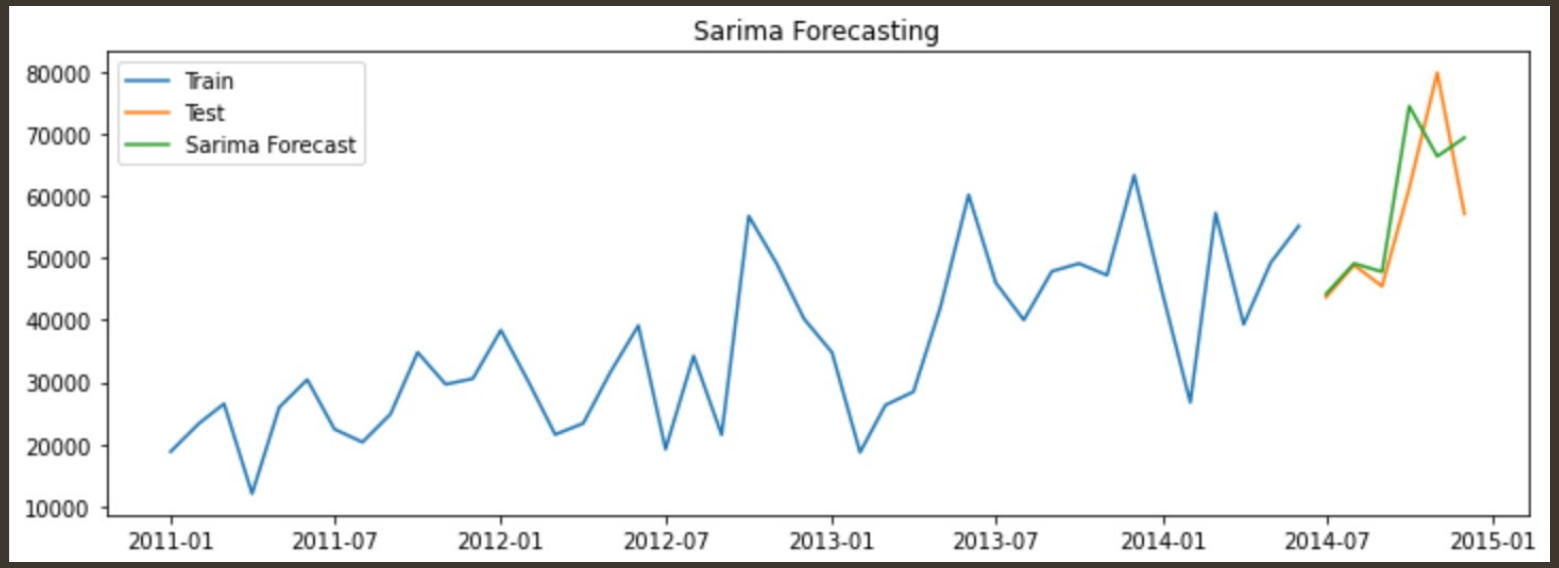
- From the plots, we can clearly see that ARIMA method works better here.
- The updated MAPE values of the methods are as follows (lower is better):

	Method	MAPE
0	Simple Exponential Smoothing	15.99
1	Holt's Exponential Smoothing	14.64
2	Holt Winter's Additive Exponential Smoothing	13.02
3	Holt Winter's Multiplicative Exponential Smoot...	17.17
4	AR Method	13.55
5	MA Method	33.95
6	ARMA Method	32.41
7	ARIMA Method	16.61





ARIMA Methods: SARIMA method



- SARIMA method forecasts values in a much better way, as seen in the plot
- The MAPE value is also the least, as seen in the final MAPE table

	Method	MAPE
0	Simple Exponential Smoothing	15.99
1	Holt's Exponential Smoothing	14.64
2	Holt Winter's Additive Exponential Smoothing	13.02
3	Holt Winter's Multiplicative Exponential Smoot...	17.17
4	AR Method	13.55
5	MA Method	33.95
6	ARMA Method	32.41
7	ARIMA Method	16.61
8	SARIMA Method	11.13

Conclusions

- The COV value is used for finding the market segment with least variation in profit. “APAC-Consumer” is the target market segment for which we are making the forecasts
- Since there is a seasonality and trend component as seen in the decomposition plots, the best methods according to the flowchart would be the Holt Winter’s Exponential methods and the SARIMA method
- The forecast plots and the MAPE values support the above argument. The methods found from the flowchart track close to the test values, and the MAPE values are the lowest for them