Retail Giant Sales Forecasting assignment

Submitted by-

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Introduction

- Global Mart is an online supergiant with multiple categories such as consumer, corporate and home office.
- It operates in Different regions and wants us to identify the key market segment and predict sales inmost profitable market segment of next 6 months.

Problem Statement

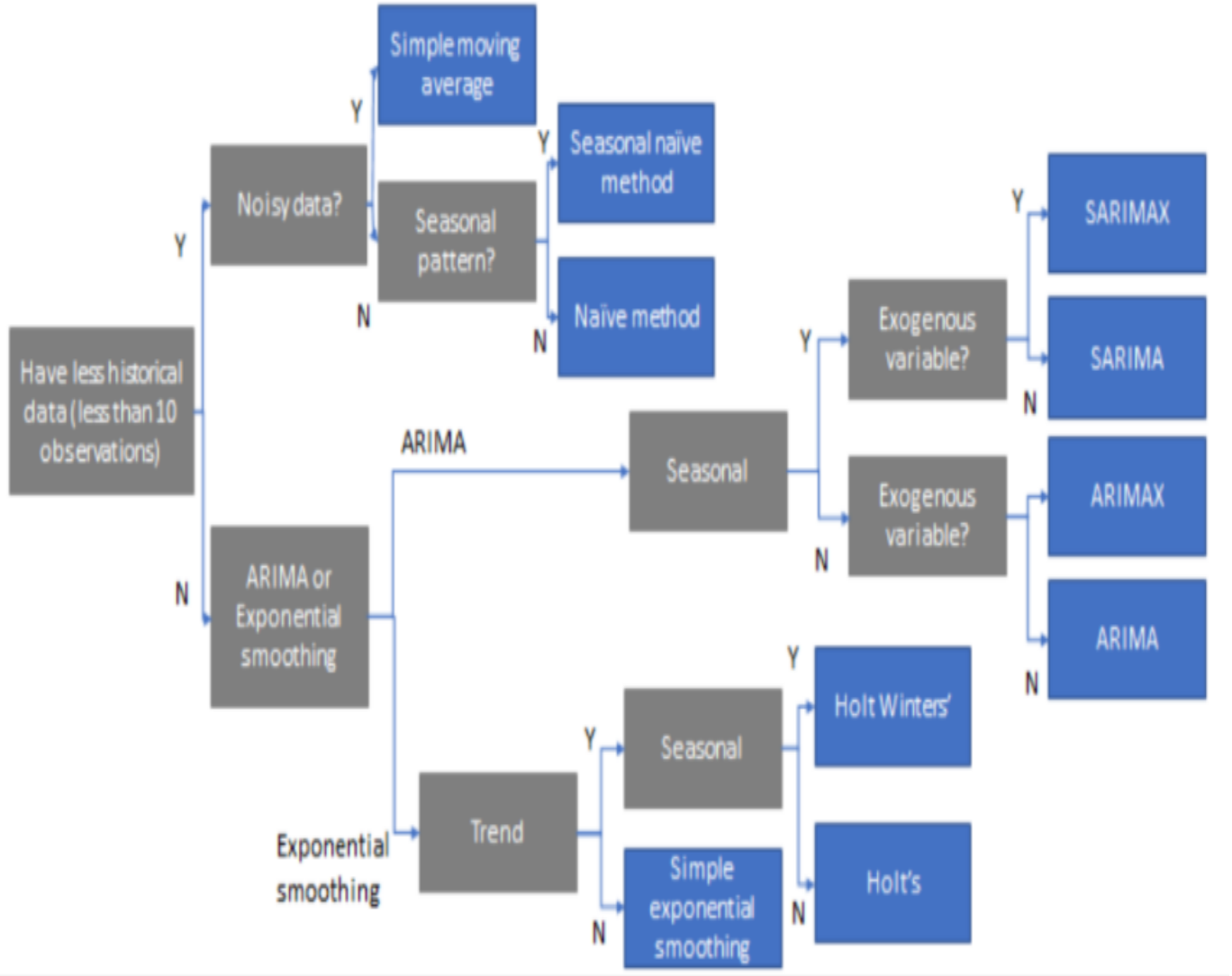
- We need to forecast the Sales of next 6 months for most consistent market Segment for given Global Store.
- We need to follow Data Preparation and Forecasting techniques using various Smoothing and ARIMA models techniques.

Coefficient of Variation(CoV) for Market-Segment

segment	cov
Consumer-APAC	0.522725
Consumer-Africa	1.310351
Consumer-Canada	1.250315
Consumer-EMEA	2.652495
Consumer-EU	0.595215
Consumer-LATAM	0.683770
Consumer-US	1.010530
Corporate-APAC	0.530051
Corporate-Africa	1.891744
Corporate-Canada	1.786025
Corporate-EMEA	6.355024
Corporate-EU	0.722076
Corporate-LATAM	0.882177
Corporate-US	1.071829
Home Office-APAC	1.008219
Home Office-Africa	2.012937
Home Office-Canada	2.369695
Home Office-EMEA	7.732073
Home Office-EU	0.938072
Home Office-LATAM	1.169693
Home Office-US	1.124030

- There are in total 21 Distinct Market Segments and out of which 'Consumer-APAC' Market Segment is having the least value of Covariance.
- Thus, based on Covariance value we can say that 'Consumer-APAC' is the most Consistent Market Segment.
- The lest consistent market segment is ‘Home Office-EMEA’ as it have the highest COV value.

Optimum technique from Flowchart that might work best for predicting sales.



- As per the flow chart, we have Historical data of more than 10 observations.
- From ARIA techniques, we can observe Seasonality in data, without any exogenous variable.
- Preferred technique can be considered as SARIMA method in case of ARMIA Models.
- From Smoothing techniques, we prefer Holt Winters over other Smoothing method as it captures Seasonality along with Level and Trend in the Global Market data set.

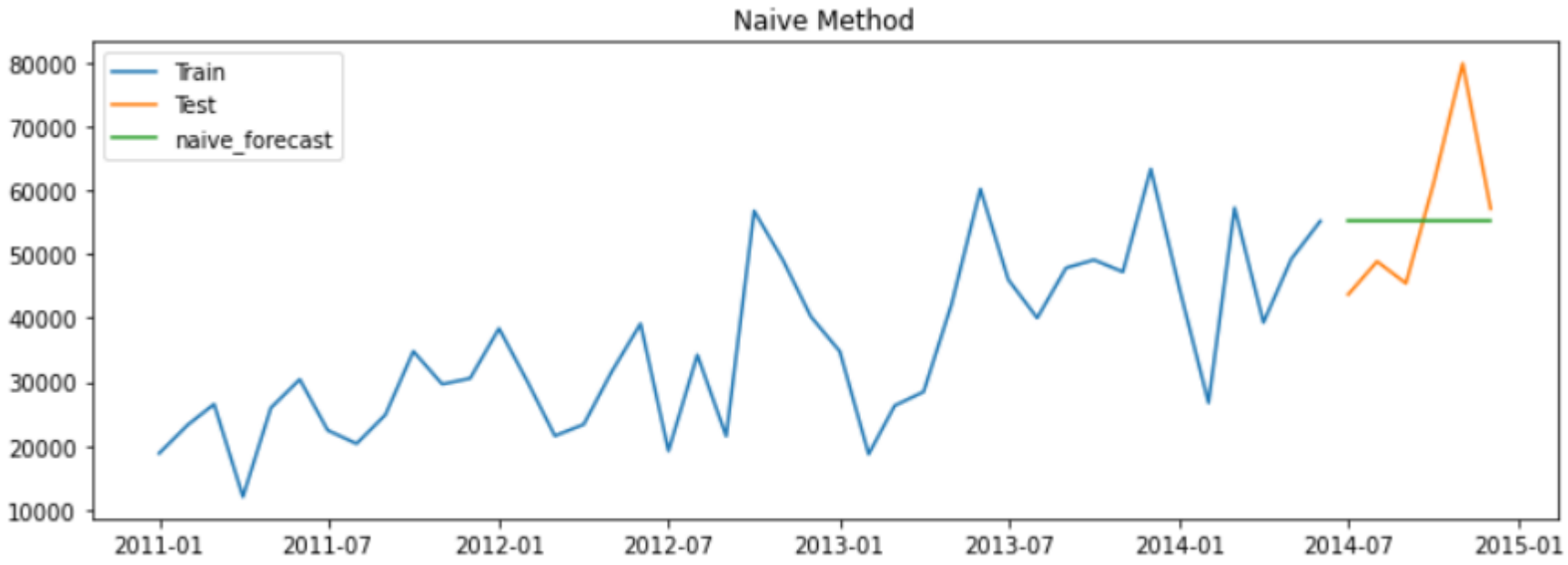
Smoothing Technique

Following techniques were used to forecast next six month sales.

- Naive method
- Simple average
- Simple Moving Average
- Simple Exponential Smoothing technique
- Holt method
- Holts Winter Additive method
- Holts Winter Multiplicative method

Naive method

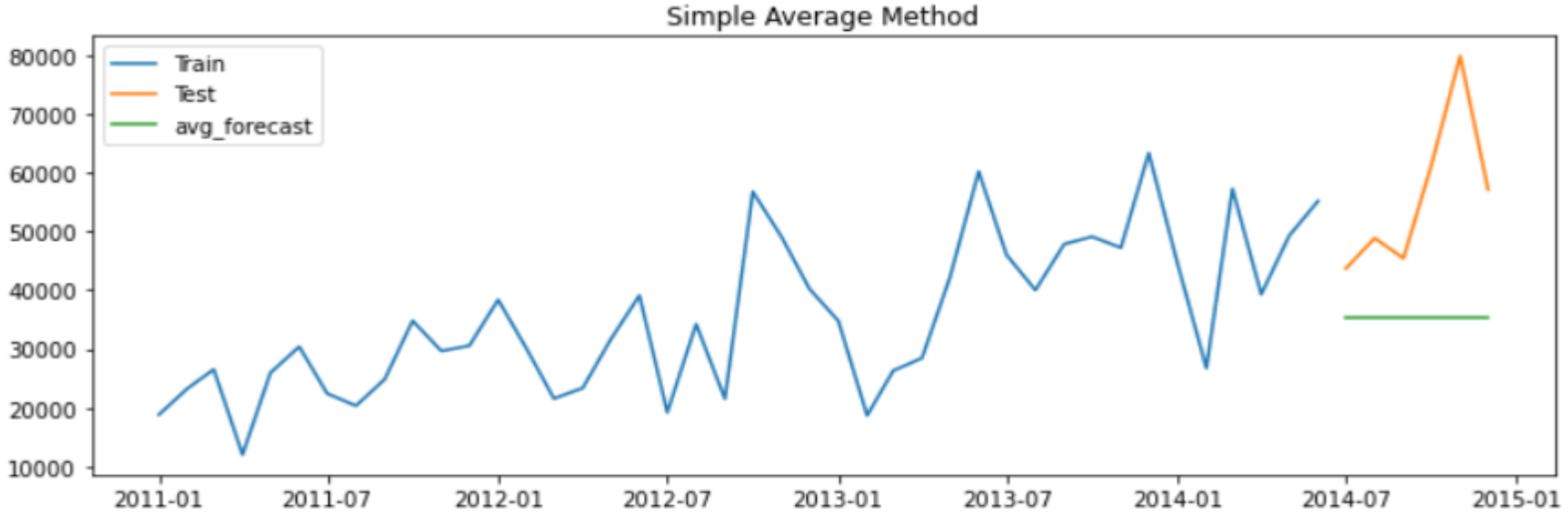
- Here , the green Straight line parallel to axis represents the Naive forecast for 6 months duration.
- In Naive Method, Sales is predicted based on the Last Months Sale.
- It captures only the LEVEL with the forecast value as 55151.4699.
- APE value was calculate to be around 17.47



Method	MAPE
Naive Method	17.47

Simple Average method

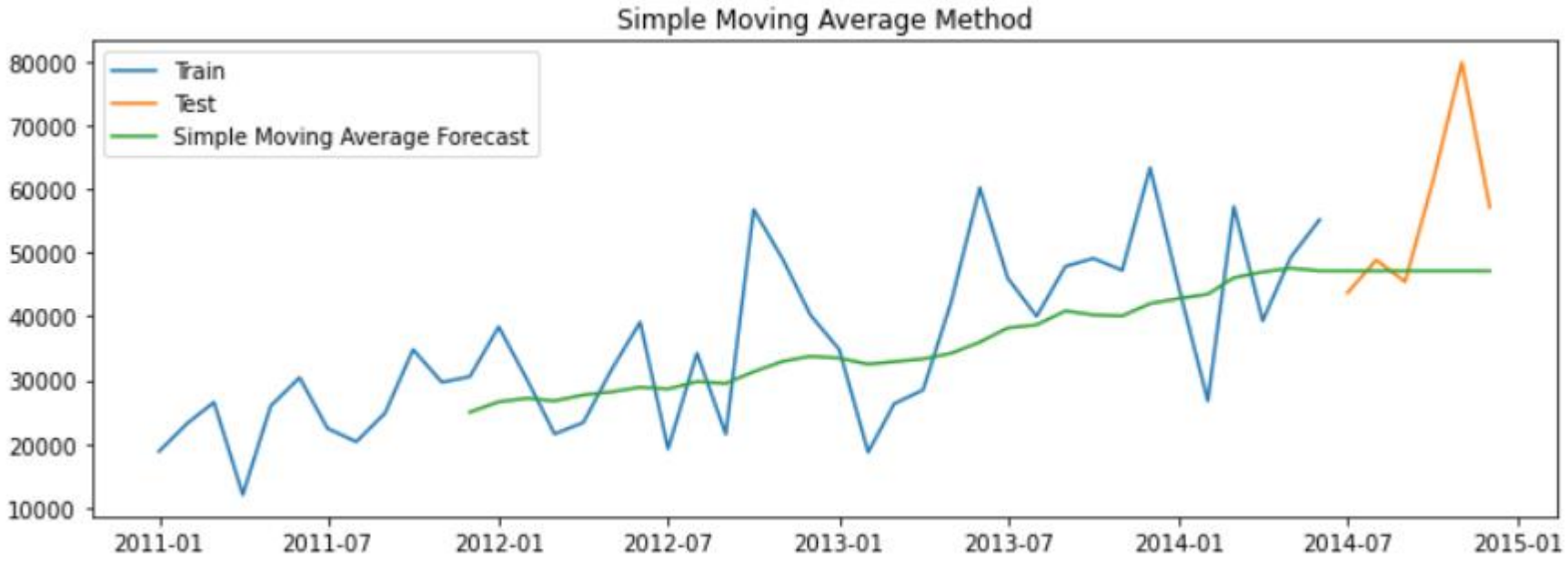
- Here , the Green Straight line parallel to axis represents the Simple Average forecast for 6 months duration.
- In Simple Average Method, Predicted Sales is the Average of all the previous months Train data.
- It captures the Level of average values with forecast value as 35253.632814.
- MAPE value of Simple Average Method is greater than Naive method in this case.
- It means Naive method is better among these two methods for the current problem statement.



Method	MAPE
Naive Method	17.47
Simple Average Method	34.34

Simple Moving Average method

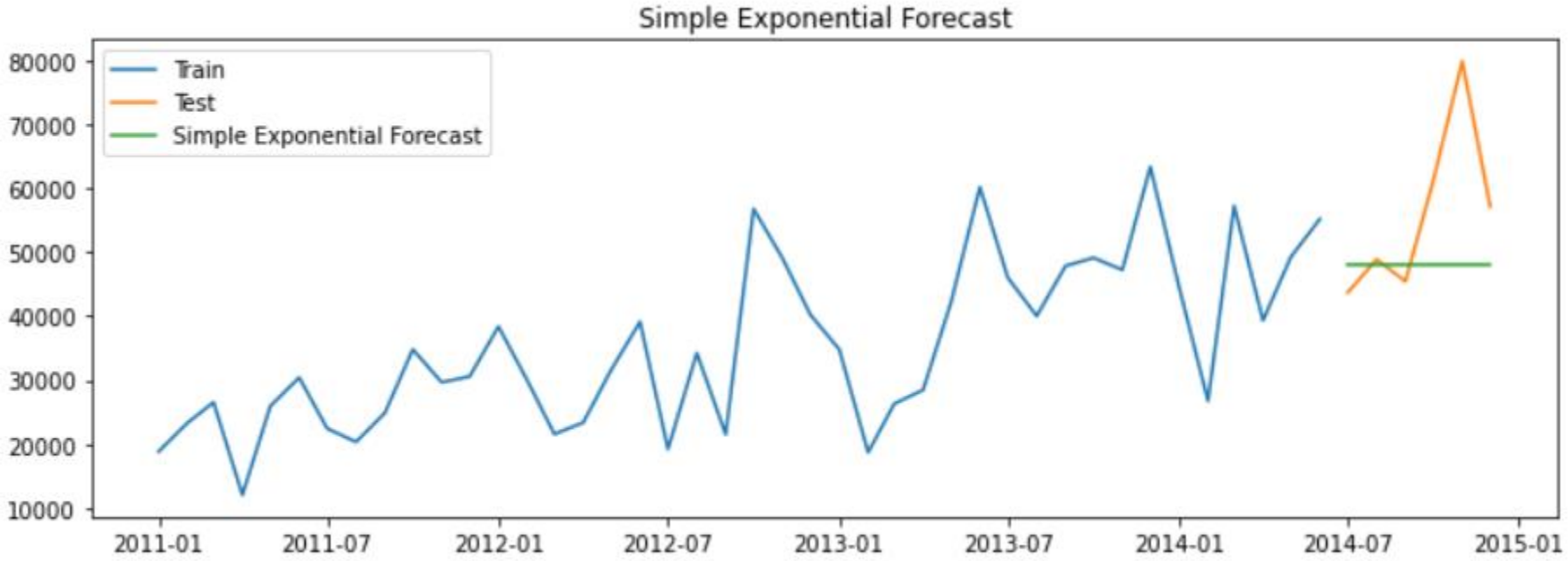
- Here , the Green line represents the Simple Moving Average.
- In Simple Moving Average Method, we have taken Moving window size of 12 months.
- Predicted Sales is the Average of moving 12 months Train data window.
- It gives importance to the weight of each window and captures the increasing Trend.
- Based on MAPE value, Simple Moving Average method is performing better than Simple Average method.



Method	MAPE
Naive Method	17.47
Simple Average Method	34.34
Simple Moving Average Method	16.10

Simple Exponential Smoothing

- Here , the green line parallel to axis represents the Simple Exponential Smoothing.
- In Simple Exponential Smoothing Method, most recent value gets the Higher weight while, the Older values gets the lower weight assigned to them.
- It captures only the Level of Data, by moving Average window with higher weightage to closest/latest data than older/past data.



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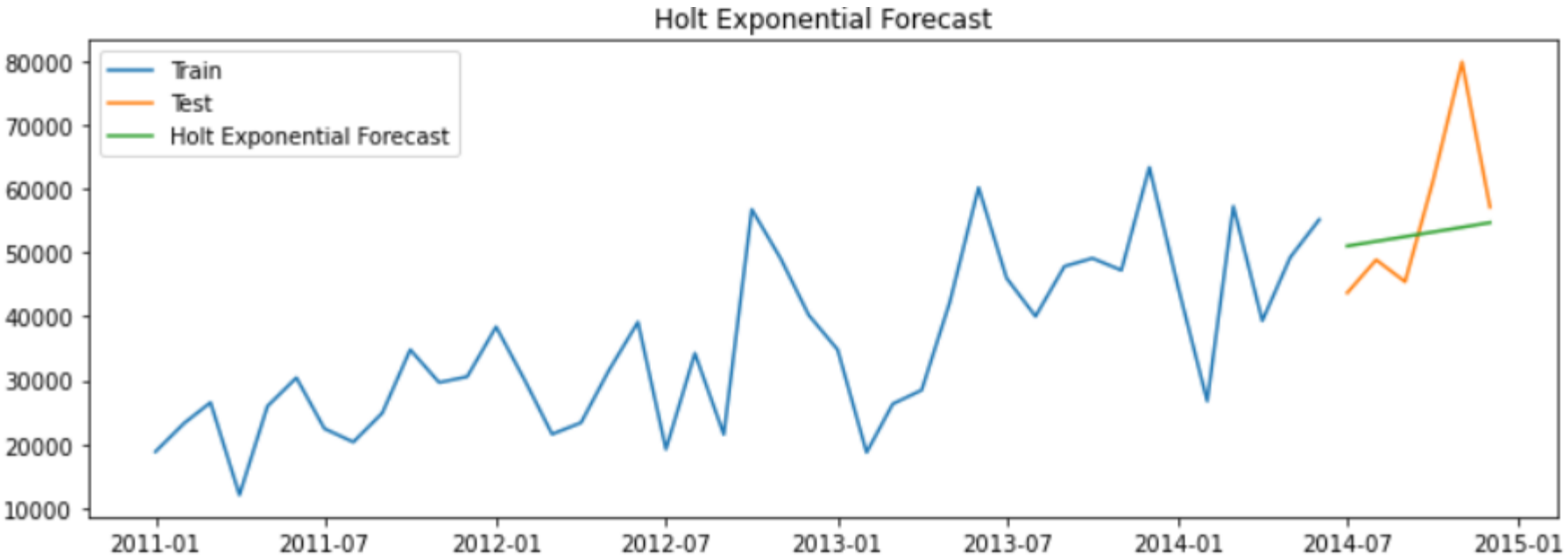
Simple Moving Average Method	16.10
Simple Exponential Smoothing	15.83

Holt method

- Here, the green line represent an Upward trend which is Holts Exponential forecast.
- It captures both Level as well as Trend in the forecast.
- An upward increasing trend and level is captured as part of the model.



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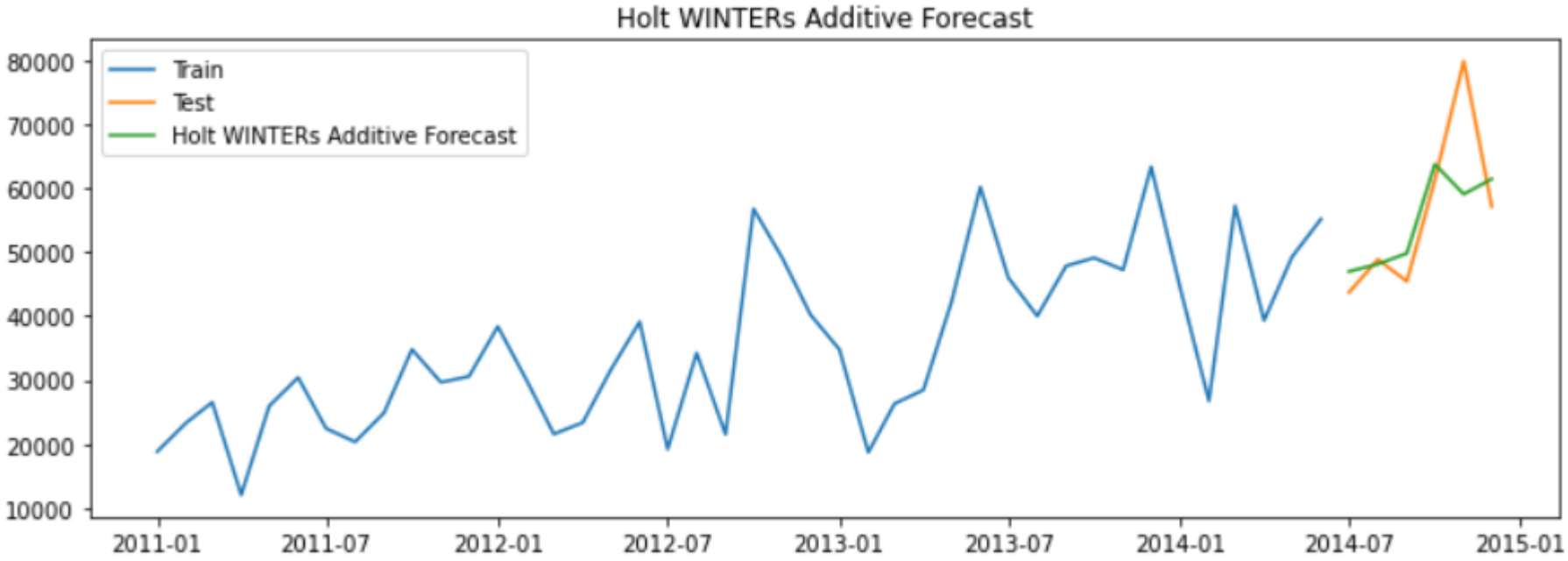
HOLT Exponential Forecast	14.67

Holt Winters Additive method

- Here the green line , represents the Holts Winter Additive forecast, obtained by following an Additive approach.
- We have captured the Level and an Upward Increasing Trend and Seasonality, which is quite close to actual Test data.



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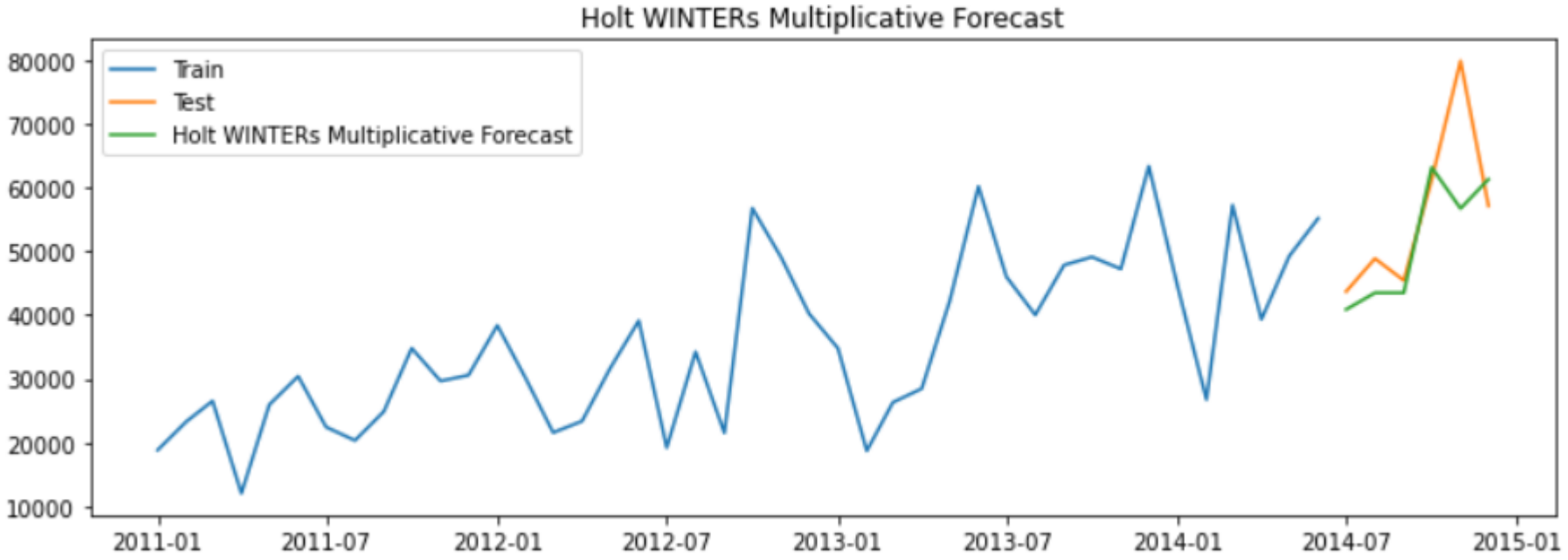
Holt Winters Multiplicative method

- Here, the green Line is the Holts Winter Multiplicative forecast .
- It captures the Trend and level and Seasonality using Multiplicative approach in calculation.
- We observe the Forecast value is quite close to the test data.



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Inference

- Based on the Smoothing techniques, we can see lowest MAPE value is for Holts Winter Additive Forecast- which means its best suited for prediction.
- Visually, the forecast for Holts Winter Additive and Multiplicative method appears much closer to actual 6 months data than other smoothing techniques.
- We were able to capture the Seasonality in data in Holt Winters method.

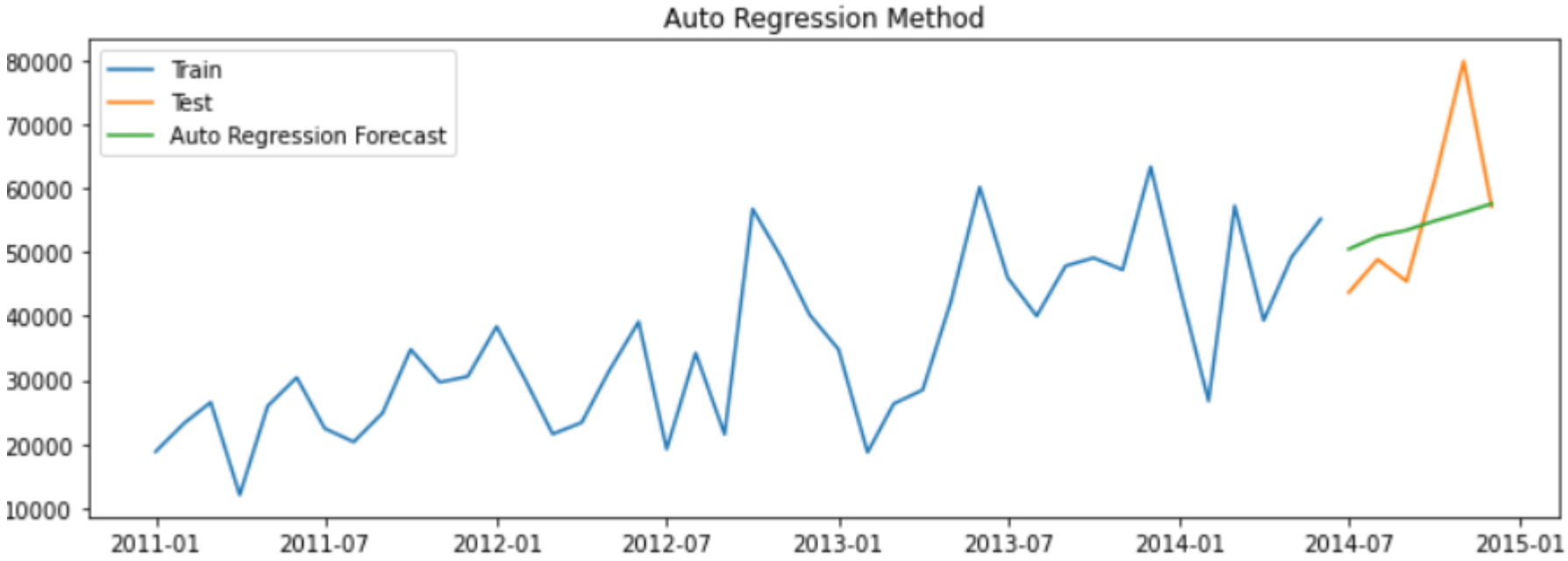
ARIMA techniques

Following is the list of ARIMA techniques executed:

- Simple Auto Regressive(AR)
- Moving Average(MA)
- Auto Regressive Moving Average(ARMA)
- Auto Regressive Integrated Moving Average(ARIMA)
- Seasonal Auto Regressive Integrated Moving Average(SARIMA)

Simple Auto Regressive(AR) method

- Here, the green line indicates the Auto Regression method
- Auto regression method predicts the future observation as linear regression of past Sales data.
- In this case, value of Lag order i.e. p is taken as 1



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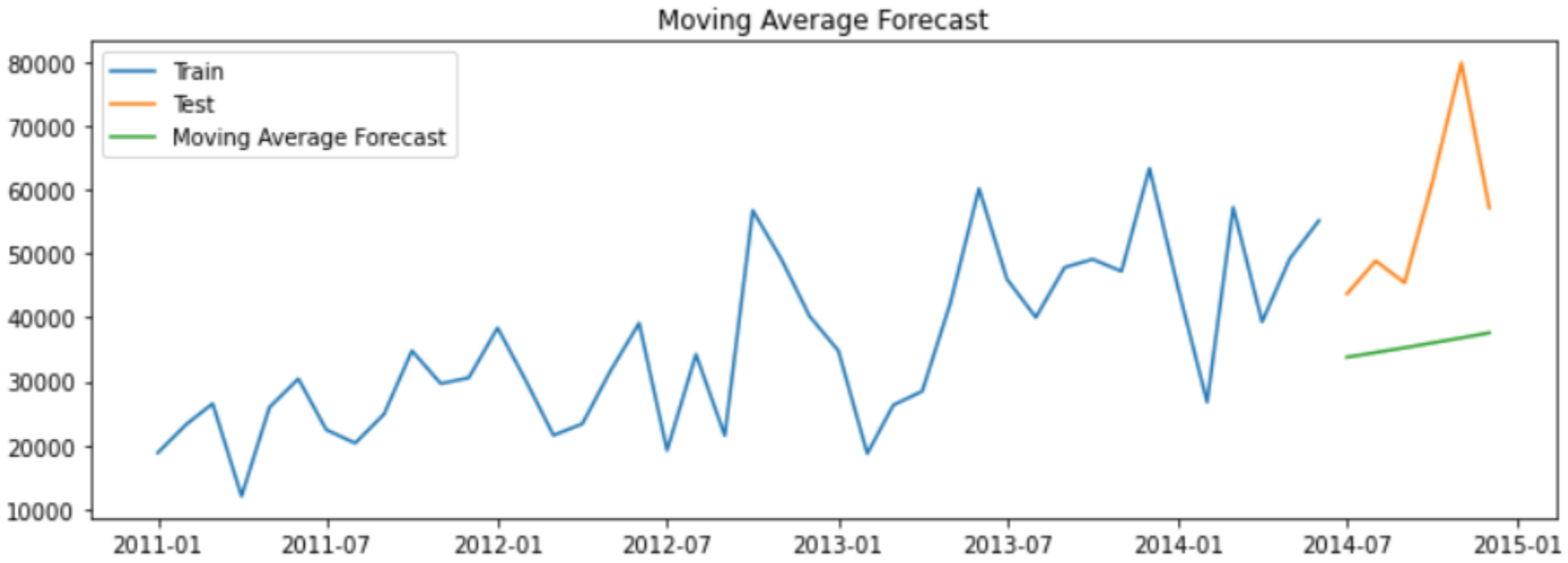
Auto Regressive (AR)method	13.56

Moving Average(MA) method

- Here, the green line indicates the Moving Average Forecast.
- Moving Average Forecast method predicts the Forecast value ,using the past forecast errors.
- It has single parameter window size i.e. q=1



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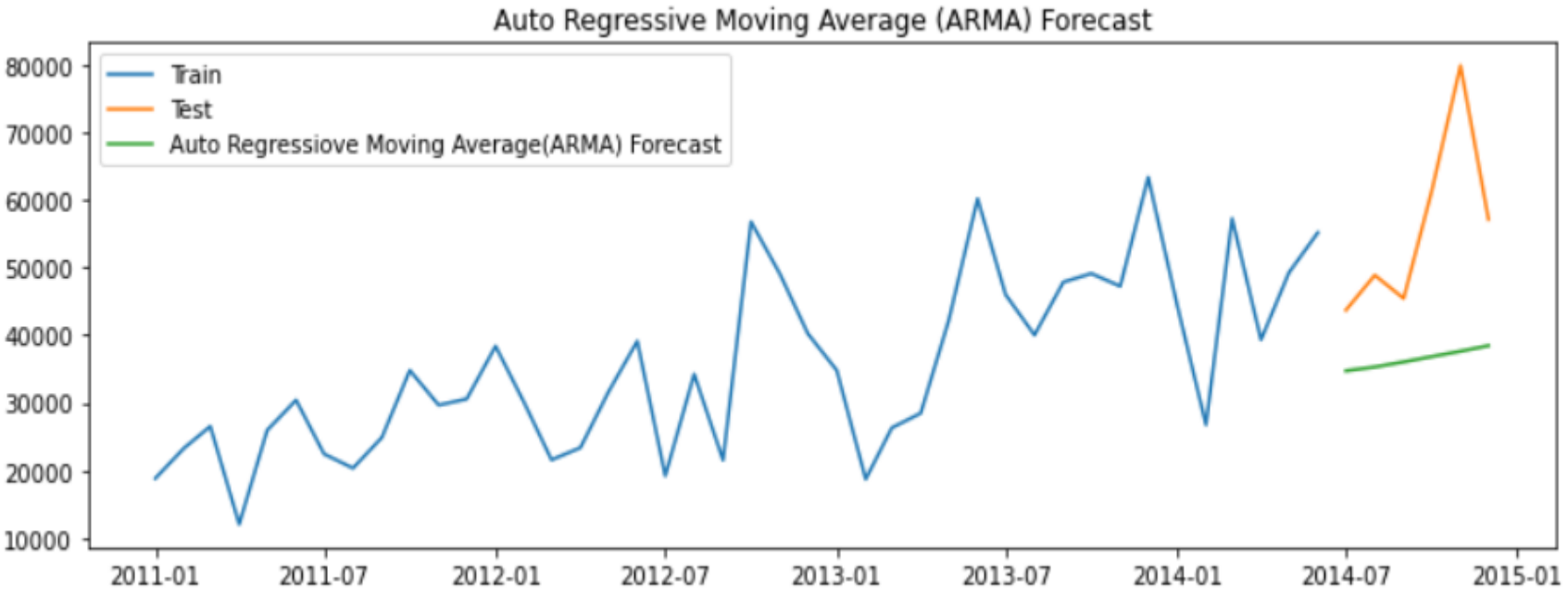
ARMA(Auto Regressive Moving Average) method

- Here, the Green line indicates the Auto Regressive Moving Average Forecast
- ARMA method predicts the Forecast value by combining both AR and MA method.
- It has two parameters : Lag Order(p=1) and window size(q=1).



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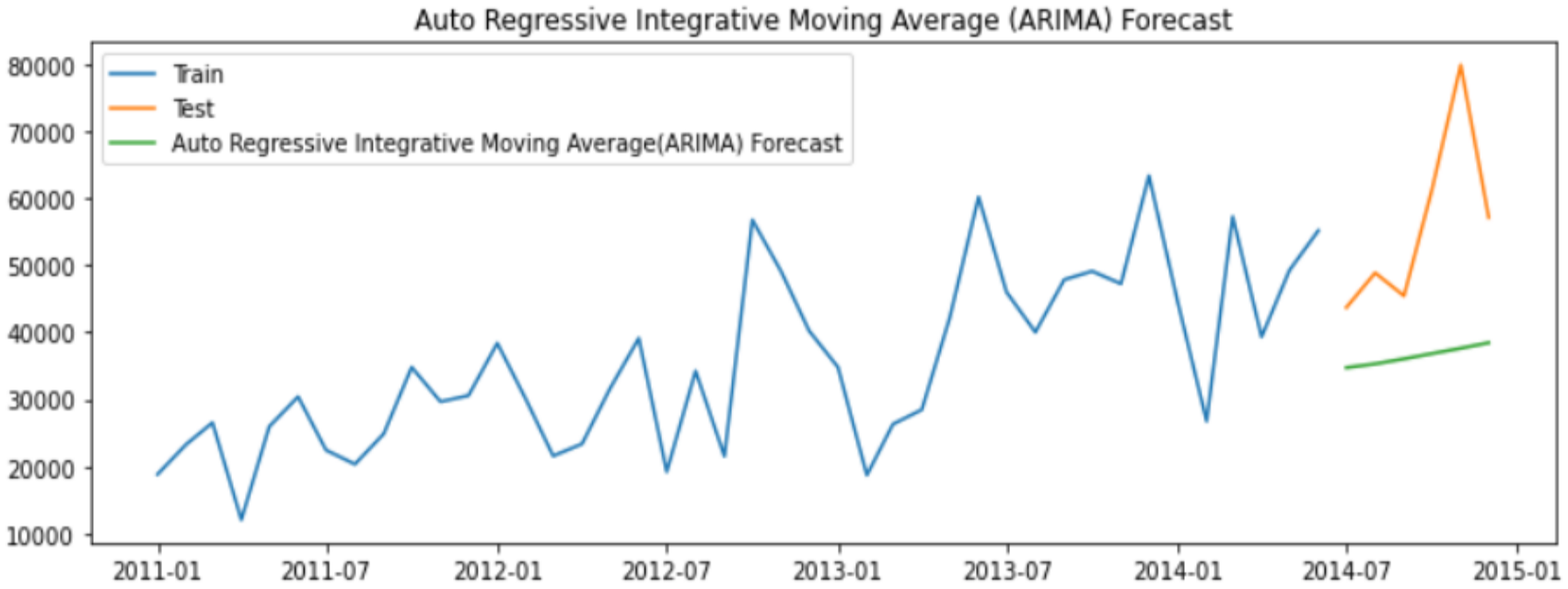
(ARMA) Auto Regressive Moving Average method	32.40

ARIMA(Auto Regressive Integrate Moving Average) method

- Here, the green line represents the ARIMA Forecast.
- ARIMA captures the Level and trend , but no Seasonality.



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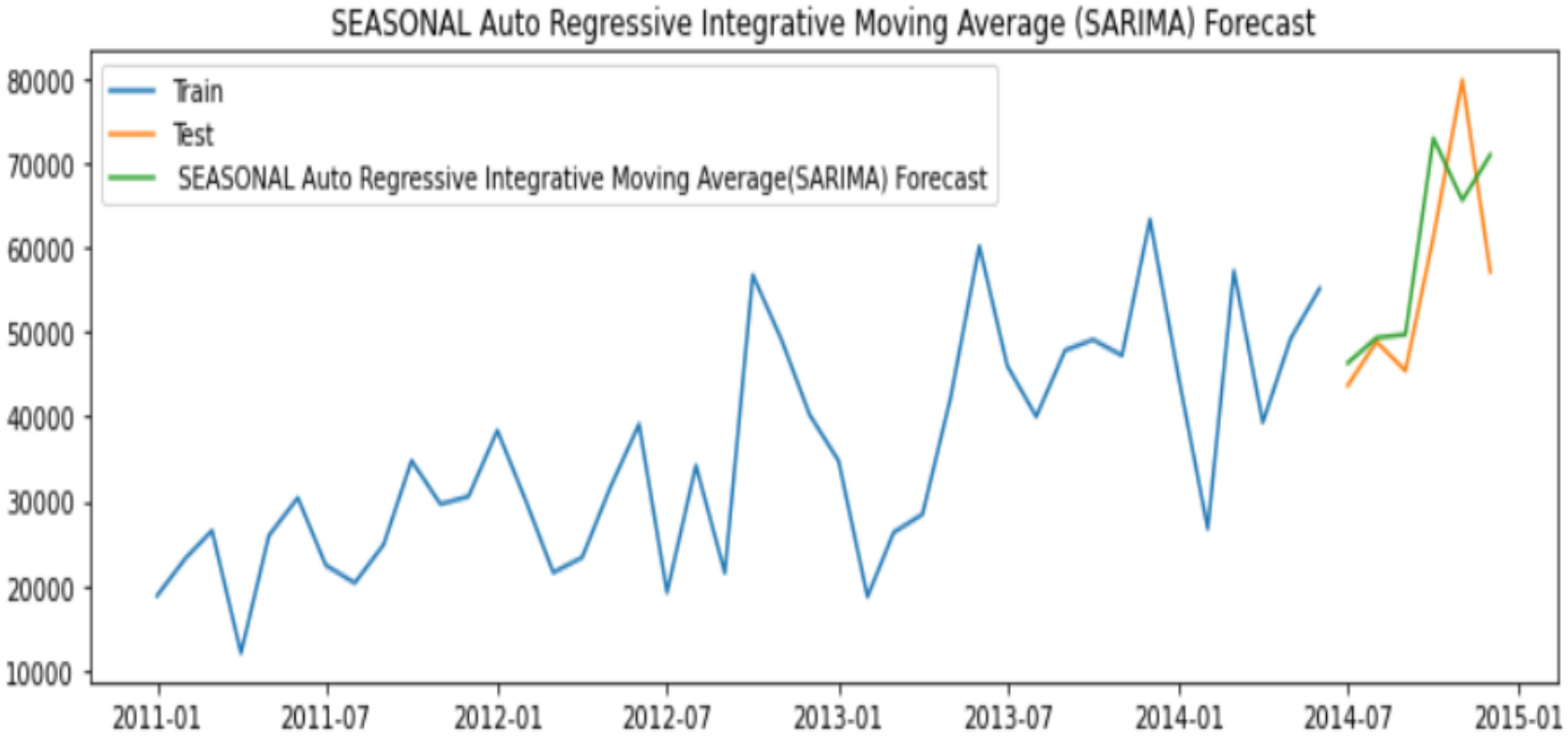
SARIMA(Seasonal Auto Regressive Integrated Moving Average) method

- Here, the Green line represent the SARIMA forecast.
- In the model, all 3 factors: Level, Trend and Seasonality are captured and observed.
- Forecast values observed to be very close to Actual values of next 6 months.



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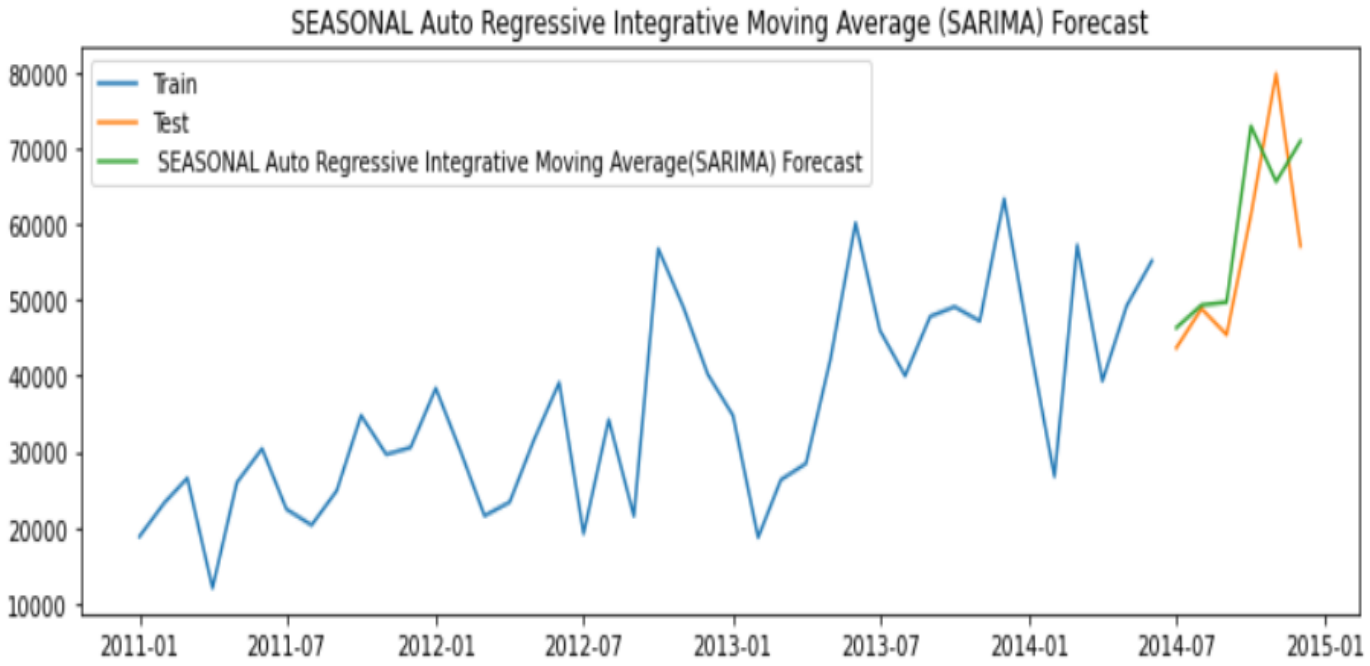
(SARIMA)Seasonal Auto Regressive Integrated Mo...	12.95

ARIMA Technique inference:

- Based on ARIMA techniques, we can observe the lowest value of MAPE is for SARIMA method- thus it’s the best suited of prediction of sale of nest 6 months.

Overall Inference:

- Overall, MAPE value is observed to have least value for Holts Winter and SARIMA model amongst all the models.
- Visually, SARIMA model is giving us better result and it have pretty decent MAPE value on lower side as well. So, we can prefer it.



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Thank you.