

ARIMA

ARIMA consists of three parameters: ARIMA(p,q,d)

AR (Auto Regression): The auto-regressive parameter **p** specifies the number of lags used in the model.

MA (Moving Average): The moving-average parameter **q** specifies the number of error terms used in the model.

I (Integrated): Differencing a series involves simply subtracting its current and previous values **d** times.

* ARIMA model works only on Stationary Time Series.

ARIMA - Time Series Forecasting

Step-by-step analysis of ARIMA model

1. Visualize the time series

2. Stationarize the series

3. Plot ACF/PACF charts and find optimal parameters

4. Build the ARIMA model

5. Make Predictions

Visualize the Time Series

Typically, business time series are divided into the following four components. Visualization helps to know which of the following components are present in the time series.

Trend – overall direction of the series i.e. upwards, downwards etc.

Seasonality – monthly or quarterly patterns.

Cycle – long-term business cycles, they usually come after 5 or 7 years

Irregular remainder – random noise left after extraction of all the components

The fundamental idea for time series analysis is to decompose the original time series to check if any of the above components exist.



Stationarize the Series

Dickey - Fuller is one of the popular test to check stationarity of the series.

If the series is stationary, then we get parameters (p,q) and fit the ARIMA model.

If the series is found to be non-stationary we must stationarize it. One of the commonly used technique to make a time series stationary is **Differencing**.

Differencing gives **d** parameter.

Eg: If $d=1$, $x(t) - x(t-1) = \text{ARMA}(p, q)$

Plot ACF, PACF and build ARIMA model

The parameters **p,q** can be found using ACF and PACF plots.

With the parameters p,q in hand, we can build ARIMA model.

The p,q values found might be an approximate estimate and we need to explore more (p,d,q) combinations.

Predict sales on in-sample date using the best fit ARIMA model and find mean squared error.

If error is small enough, forecast the series using the best fit ARIMA model.

