**TIME SERIES ANALYSIS**

A time series is a sequence of observations recorded over a certain period. A simple example of time series is how we come across different temperature changes day by day or in a month.

Timeseries forecasting in simple words means to forecast or to predict the future value (example: stock price) over a period. There are different approaches to predicting the value, consider example there is a company XYZ that records the website traffic in each hour and now wants to forecast the total traffic of the coming hour.

A different person can have a different perspective one can say find the mean of all observations, one can have like take the mean of recent two observations, one can say like give more weightage to current observations and less to past, or one can say use interpolation. There are different methods to forecast the values.

While forecasting time series value, 3 important terms need to be taken care of and the main task of time series forecast these three terms.

**Seasonality**

Seasonality is a simple term that means while predicting a time series data there are some months in a particular domain where the output value is at a peak as compared to other months. For example, if you observe the data of tours and travel companies for the past 3 years then you can see that in November and December the distribution will be very high due to the holiday season and festival season. So, while forecasting time series data we need to capture this seasonality.

**Trend**

The trend is also one of the important factors which describe that there is certainly an increasing or decreasing trend time series, which means the value of organization or sales over a period of time and seasonality is increasing or decreasing.

**Unexpected Events**

Unexpected events mean some dynamic changes occur in the organization, or in the market which can not be captured. For example, a current pandemic we are suffering from, and if you observe the Sensex or nifty chart there is a huge decrease in stock price which is an unexpected event that occurs in the surroundings.

Methods and algorithms are using which we can capture seasonality and trend but the unexpected event occurs dynamically so capturing this becomes very difficult.

**Rolling statistics and stationarity in time-series**

A stationary time series is data that has a constant mean and constant variance. If I take a mean of T1 and T2 and compare it with the mean of T4 and T5 then is it the same, and if different, how much difference is there? So, constant mean means this difference should be less and the same with variance.

If the time series is not stationary, we must make it stationary and then proceed with modeling. Rolling statistics is help us in making time series stationary. So basically, rolling statistics calculates the moving average. To calculate the moving average, we need to define the window size which is basically how much past values to be considered.

For example, if we take the window as 2 then to calculate a moving average in the above example then, at point T1 it will be blank, at point T2 it will be the mean of T1 and T2, at point T3 mean T3 and T2, and so on. And after calculating all moving averages if you plot the line above actual values and calculated moving averages then you can see that the plot will be smooth.