

CONCEPTS

Time series analysis is a part of the machine learning domain wherein the data consists of data points over a period. There can be two types of time-series data. The first one being stationary data and the second one being seasonal time-series data.

Stationary data is a term referred to as the time-series data wherein a consistent change of data occurs at a specific period. On the other hand, **seasonal** time-series data is referred to as the data wherein increase or decrease in the values take place at any given point of time.

Seasonal decomposition is a technique to determine whether the time-series data is stationary or not. It helps in selecting forecasting methods.

Typically, time-series data consists of 2 **components**:

1. Systematic
2. Non-systematic

The systematic component is further divided into level, trend and seasonality. While the non-systematic component is further divided into noise or residual.

Level: Average value in the series

Trend: Increase or decrease in values

Seasonality: Increase or decrease in a short span of time that is in a day, week, month

Noise: Random variation in the data

There are 2 ways in which the time-series components can be combined:

1. **Additive model:** Here the model is linear. There are no fluctuations in the data. The trend and seasonality graph depict a linear nature.
2. **Multiplicative model:** This is a non-linear model. Here, there is an increase or decrease in the values of data and thus a non-linear graph is seen.

Further, to select the optimum model, we look at the seasonal decomposition of time-series data. If we can see that there is a consistent change in the values at times, the data is stationary and an **ARIMA** model is used. On the other hand, if seasonal data is observed, a **SARIMA** model is used.

For both the models, values of p , d and q need to be determined. The **value of d** can be set as 0 or 1 according to the nature of data. For stationary data, $d=0$ and for seasonal data, $d=1$. To determine the **values of p and q** we can plot the graphs of autocorrelation and partial autocorrelation respectively using Python functions. Another workaround would be the usage of **pmdarima library**.

Using this model, we can train the model and then predict the values of USD to INR exchange rates. The code is provided in the repository. Feel free to go through it and enjoy the process!