What Is Time Series Analysis?

Time-series analysis is a method of analyzing a collection of data points over a period of time. Instead of recording data points intermittently or randomly, time series analysts record data points at consistent intervals over a set period of time.

While time-series data is information gathered over time, various types of information describe how and when that information was gathered. For example:

- Time series data: It is a collection of observations on the values that a variable takes at various points in time.
- Cross-sectional data: Data from one or more variables that were collected simultaneously.
- Pooled data: It is a combination of cross-sectional and time-series data.

The variable varies according to the probability distribution, showing which value Y can take and with which probability those values are taken.

$Yt = \mu t + \varepsilon t$

Each instance of Yt is the result of the signal μt

εt is the noise term here.

Why Do We Need Time-Series Analysis?

Time series analysis has a range of applications in statistics, sales, economics, and many more areas. The common point is the technique used to model the data over a given period of time.

The reasons for doing time series analysis are as follows:

- Features: Time series analysis can be used to track features like trend, seasonality, and

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- Forecasting: Time series analysis can aid in the prediction of stock prices. It is used if you would like to know if the price will rise or fall and how much it will rise or fall.
- Inferences: You can predict the value and draw inferences from data using Time series analysis.

Time Series Analysis Example

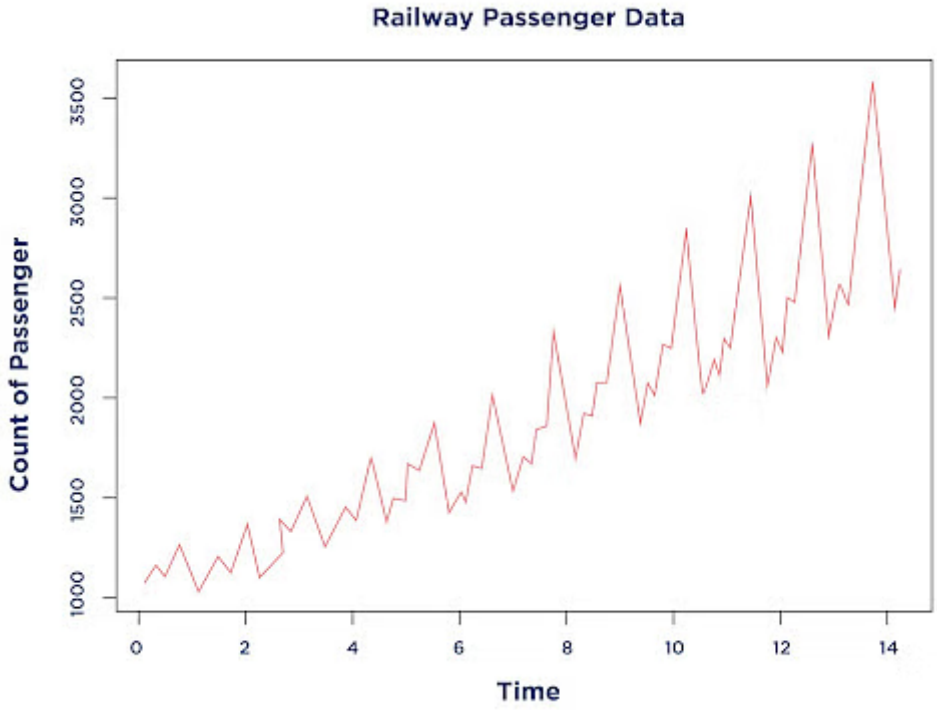
Non-stationary data—that is, data that is constantly fluctuating over time or is affected by time—is analyzed using time series analysis. Because currency and sales are always changing, industries like finance, retail, and e-commerce frequently use time series analysis. Stock market analysis, especially when combined with automated trading algorithms, is an excellent example of time series analysis in action.

Time series analysis can be used in -

- Rainfall measurements
- Automated stock trading
- Industry forecast
- Temperature readings
- Sales forecasting

Consider an example of railway passenger data over a period of time.

On the X-axis, we have years, and on the Y-axis, you have the number of passengers.



The following observations can be derived from the given data.

1. Trend: Over time, an increasing or decreasing pattern has been observed. The total number of passengers has risen over time.
2. Seasonality: Cyclic patterns are the ones that repeat after a certain interval of time. In the case of the railway passenger, you can see a cyclic pattern with a high and low point that is visible throughout the interval.

Time Series Analysis Types

Some of the models of time series analysis include -

- Classification: It identifies and assigns categories to the data.
- Curve Fitting: It plots data on a curve to investigate the relationships between variables in the data.
- Descriptive Analysis: Patterns in time-series data, such as trends, cycles, and seasonal variation, are identified.
- Explanative analysis: It attempts to comprehend the data and the relationships between it and cause and effect.
- Segmentation: It splits the data into segments to reveal the source data's underlying

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ARIMA

ARIMA is an acronym for Autoregressive Integrated Moving Average. The Box-Jenkins method is another name for this method.

Now you will explore the ARIMA parameters in detail:

- Autoregressive Component: AR stands for autoregressive, and is denoted by p. When the value of p is 0, it means there is no correlation in the series. When the value of p is 1, it means that the auto-correlation is up to one lag.
- Moving Average: Moving average is denoted by q. When q=1, it means that there is an error term.
- Integration: Integration is denoted by d. When the value of d is 0, the series is stationary. When the value of d is 1, the series is not stationary, and you can make it stationary by taking the difference.

Conclusion

Time series analysis has a wide range of applications and is one of the most important areas of study. It plays an important role in forecasting models and meaningful statistical characteristics.