Chapter 1 - Getting Started

Time Series All Around Us

Whenever we are dealing with measurements collected throughout time at specified intervals, it becomes obvious that we are working with time series data and its specific challenges and complexities.

Time series data can take on different properties, by the nature of the data domain, thus requiring the practitioner to be familiar with the different methods and techniques available for analysis. These properties cluster time series data into different buckets or types depending on whether we are dealing with stationary, non-stationary, linear, non-linear, seasonal, non-seasonal, univariate, or multivariate time series data.

Time series data is all around us and in different domains and disciplines. Recent events have further simulated interest in learning time series analysis and prediction techniques, whether it is classic statistical methods or advanced machine learning algorithms, such as building COVID-19 prediction models, predicting presidential election results, or analyzing stock and cryptocurrency data.

Few examples of where time series data can be found:

* Business: Marketing planning, Inventory management, Product Demand Planning, Resource Planning, Churn analysis
* Finance: Stock analysis, Budget forecasting, Sales forecasting, Volatility Modeling
* Government: Election forecast, Economic forecasting, Gross Domestic Product (GDP), Unemployment Rate, Population migration rate, Birth Rate
* Science: Weather forecasting, Earthquake prediction, Air Quality, Species population growth
* Medical: Infectious disease transmission, Electrocardiogram monitoring (ECG or EKG), Healthcare cost prediction, Blood glucose monitoring, Hospital capacity
* Engineering: Predictive maintenance, Signal processing, Production decline analysis, Traffic volume forecasting
* Technology: Log Data, Web Traffic, Internet of Things (IoT), Server Utilization Demand
* Prevention: Credit card anomaly and fraud detection, Non-technical power loss detection, Crime rates

When working with time series data we usually have two goals: time series analysis (descriptive), and time series forecasting (predictive). In time series analysis we strive to extract a better understanding and deeper intuition into the underlying phenomenon captured in our data using statistical methods. In time series forecasting, we aim to create a predictive model that extends from our data into the unforeseeable future and hence the term forecasting.

Time series data differs from the typical data used in machine learning in the classical sense due to the dependence on time, serial correlation, and dependence.

In this book, we cover a variety of recipes for both analysis and forecasting of time series data and pragmatic approach to handling the complex nature of time series data.