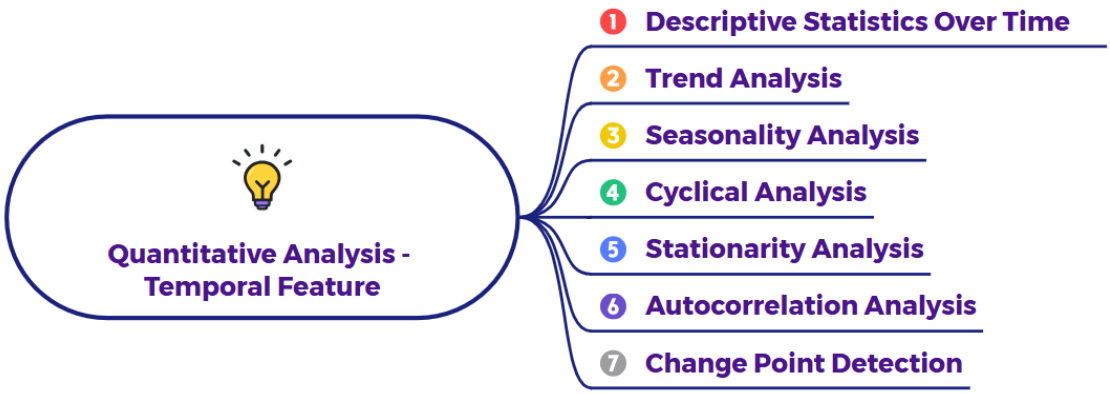
Different types of Quantitative analysis for Temporal Features



let's explore Quantitative Analysis specifically for **Univariate Temporal Features**. When we analyze a single variable that changes over time (like daily stock prices, monthly sales figures, or hourly temperature readings), we focus on understanding its patterns, trends, and stability over that period. Here are some key types of quantitative analysis for univariate temporal data:

- **Descriptive Statistics Over Time:** We can calculate standard descriptive statistics (mean, median, standard deviation, range, etc.) on the temporal data. However, instead of just one set of values for the entire dataset, we might calculate these statistics for different time windows (e.g., monthly averages, yearly standard deviations) to see how the central tendency and spread of the variable change over time.
- **Trend Analysis:** This involves identifying the long-term direction of the time series data. Is it generally increasing, decreasing, or staying relatively constant over the observed period? Techniques include visual inspection of line plots, moving averages (to smooth out short-term fluctuations and reveal the underlying trend), and fitting trend lines (e.g., linear, polynomial).
- **Seasonality Analysis:** Many temporal datasets exhibit recurring patterns at fixed intervals (e.g., daily, weekly, monthly, yearly). This involves identifying and quantifying these seasonal patterns. Techniques include visual inspection (identifying repeating patterns), calculating seasonal indices (to measure the magnitude of the seasonal

effect), and decomposing the time series into its trend, seasonal, and residual components.

- **Cyclical Analysis:** Unlike seasonality, cycles are longer-term fluctuations that are not of a fixed period (e.g., business cycles). Analyzing cyclical patterns involves identifying these upswings and downswings, which can be more challenging than seasonality due to their irregular nature.
- **Stationarity Analysis:** A key concept in time series analysis is stationarity. A stationary time series has statistical properties (like mean and variance) that remain constant over time. Many time series models assume stationarity. Analyzing stationarity involves visual inspection (looking for trends or changing variability) and statistical tests (like the Augmented Dickey-Fuller test) to determine if a time series is stationary or needs to be transformed (e.g., differencing) to achieve stationarity.
- **Autocorrelation Analysis:** This examines the correlation between a time series and its past values (lags). It helps determine if previous values of the variable have a predictive power for future values. Autocorrelation functions (ACF) and partial autocorrelation functions (PACF) are key tools for this analysis. Significant autocorrelation can indicate underlying patterns or dependencies in the data.
- **Change Point Detection:** This involves identifying specific points in time where the statistical properties of the time series (e.g., mean, variance, trend) undergo a significant and abrupt change. Various statistical methods can be used for this.

These quantitative methods help us to understand the behavior of a single variable as it evolves over time, revealing underlying patterns and characteristics that are crucial for forecasting and decision-making.