

glossary

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1 Glossary

Notation and terms used in time series analysis.

1.1 Notation

Series Characteristics

- X_t - the response variable.
- x_t - the value of X_t at a particular time t .
- a_t - the series white noise.
- μ_t - the mean of all possible realizations of X_t for a given t .
- σ_t - the variance of all possible realizations of X_t for a given t .
- σ_a - the white noise variance of all possible realizations of X_t for a given t .
- γ_k - the autocovariance of X_t for lag of k .
- ρ_k - the autocorrelation of X_t for lag of k .
- $S_x(f)$ - series spectral density.

Periodic Signals

- A - amplitude of the periodic signal.
- f - frequency of a periodic signal.
- ω - angular frequency of a periodic signal.
- ϕ - phase shift of a periodic signal.

$$X_t = A \cos(2\pi ft + \phi)$$

Filtering

- $H(B)$ - transfer function

ARIMA Modeling

- $\phi(B)$ - autoregressive polynomial.

- $\phi(B)$ - moving average polynomial.
- ψ_k - coefficients of model in GLP form.

$$X_t = \frac{\theta(B)}{\phi(B)} a_t$$

Forecasting

- l - a forecast step.
- t_0 - the forecast horizon.
- $\hat{X}_{t_0}(l)$ - the forecast of X_t from t_0 at step l .
- $e_{t_0}(l)$ - the forecast error; the error between $\hat{X}_{t_0}(l)$ and X_{t_0+l} .

1.2 Terms

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- **Alaising:** A signal above the Niquist frequency that appears as a low frequency signal.
 - **Autocovariance:** covariance between the a series and k lags of itself.
 - **Autocorrelation:** The autocovariance normalized by the 0th order lag autocovariance (γ_0).
 - **Ensemble:** The totality of all possible realizations of a time series.
 - **Forecast:** The extrapolation of a model from a given time horizon and steps from the horizon.
 - **Frequency:** The *number of cycles per unit time*.
 - **Niquist frequency:** The highest observable frequency of a signal, which is half of the sampling frequency - $\frac{f_{sample}}{2}$
 - **Period:** The *amount of time for one cycle to complete*.
 - **Poles:** The roots of the autoregressive portion ($\phi(B)$) of an ARIMA model.
 - **Psuedo-periodic Series** having a *similar* shape that repeats in a consistent cycle.
 - **Realization:** The observed time series. There may be many or only one.
 - **Spectral Density:** The frequency components (in the frequency domain) that exist in a time series; the frequency transform of a time series.
 - **Sample Spectral Density:** An estimate of the **Spectral Density** based on periodically sampled data.
 - **Transfer Function:** A ratio of polynomials that transforms a series i.e. $X_t \rightarrow Z_t$.
 - **Zeros:** The roots of the moving average portion ($\theta(B)$) of an ARIMA model.

1.3 References

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- [1] B. Salder, "Stationary", SMU, 2019
 - [2] B. Salder, "Frequency Domain", SMU, 2019