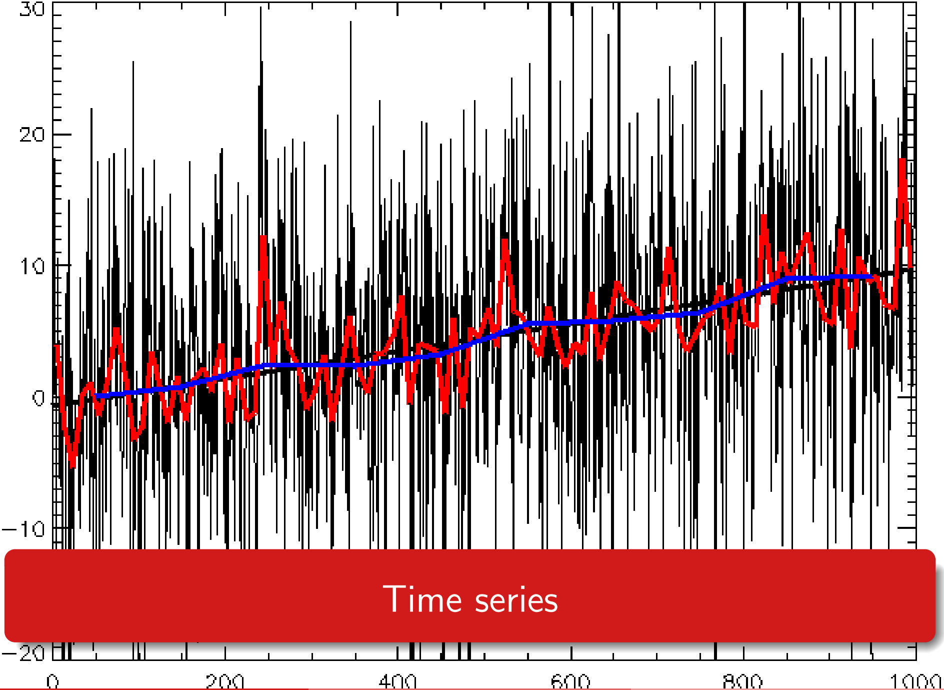

Time series

Time series definition [1]

Informal definition

A time-series is a set of observation x_t each one being recorder at a specific time t.

Formal definition

A time series model for the observed data x_t is a specification of the joint distribution (or possibile only the mens covariance) of a sequence of random variable X_t of which x_t is postulated to be a realization

A binary process

Consider the sequence of iid random variables, with $P[X_t = 1] = p$ and $P[X_t = -1] = 1 - p$

Random walk

The random walk is obtained by cumulatevely summing iid random variables. Thus a random walk with zero mean is obtained by defining

Stationarity, autocovariance and autocorrelation[1]

Mean Function

Let X_t be a time series with $E(x_t^2 < \infty$ The mean function of X_t is $\mu_X(t) = E(X_t)$. The covariance function of X_t is $\gamma_X(r,s) = Cov(X_r, X_S) = E[(X_r - \mu_X(r))(X_s - \mu_X(s))] \quad \forall r, s$

Weakly stationary TS

X_t is weakly stationary if i) $\mu_X(t)$ is indipendent from time t and ii) $\gamma_X(t+h)$ is indipendent of t $\forall h$

Autocovariance function

At lag h the autocovariance function is defined as $\gamma_X(h) = Cov(X_{t+h}, X_t)$

Autocorellation function

At lag h the autocorrelation function is defined as

$$\rho(h)_X = \frac{\gamma_X(h)}{\gamma_X(0)} = Cor(X_{t+h}, X_t)$$

Bibliography I

[1] Peter J Brockwell e Richard A Davis. *Introduction to time series and forecasting*. Springer, 2002.