

Fundamental mathematical concepts of ML (Linear & Non-Linear Models)

October 21, 2017

Model equations are given as follows:

Model name	Equation
AR(p)	$\hat{x}[t] = \sum_{i=1}^p (\alpha_i \times x_{t-i}) + \epsilon_t$
MA(q)	$\hat{x}[t] = \mu + \epsilon_t + \sum_{i=1}^q (\beta_i \times \epsilon_{t-i})$
ARMA(p, q)	$\hat{x}[t] = \sum_{i=1}^p (\alpha_i \times x_{t-i}) + \sum_{i=1}^q (\beta_i \times \epsilon_{t-i}) + \epsilon_t$
ARIMA(p, q, d)	$\hat{x}[t] = x_t - x_{t-1}$ (details omitted)
ARCH(q)	$\epsilon_t = s_t z_t$ (details omitted)
DARCH(p, q)	$y_t = x'_t + \epsilon_t$ (details omitted)
Neural Network (sigmoid SLP)	$f(x) = \begin{cases} 1 & \text{if } \sigma(\sum_i^m w_i x_i + b) > 0 \\ 0 & \text{otherwise} \end{cases}$
Gradient Descent	solve $\nabla C(x, y)$ to find $\frac{\partial C}{\partial w}(w) = 0$

where

- ϵ is gaussian white noise (GWN)
- α & β are model coefficients
- μ is the expected value of x
- σ is the sigmoid function
- w are the weights of the neuron
- $C(x, y)$ is the cost function