# Exponential smoothing : a simple example

Exponential smoothing is a time series forecasting technique that produces predictions by assigning exponentially decreasing weights to past observations.

Let $S_t$ be the "smoothed" value (forecast) at time $t$, and $x_t$ the observed value at time $t$. The exponential smoothing formula is given by :

$$S_t = \alpha x_t + (1-\alpha) S_{t-1} \quad , \quad \alpha \in [0,1] \text{ smoothing parameter}$$

Example : $x = (10, 12, 15, 18)$ observation vector

$\alpha = 0.5$ , $S_0 = 10$

$S_1, S_2, S_3$ and $S_4$ can be computed iteratively as such:

$$S_1 = \alpha x_1 + (1-\alpha) S_0 = 10$$

$$S_2 = \alpha x_2 + (1-\alpha) S_1 = 11$$

$$S_3 = \alpha x_3 + (1-\alpha) S_2 = 13$$

$$S_4 = \alpha x_4 + (1-\alpha) S_3 = 15.5$$

Smoothed values $\tilde{x} = (10, 11, 13, 15.5)$

and the forecast at $t=5$ is

$S_4 = 15.5$.