# Moving Average Model

Imagine that there is a monthly party and every month we are in charge of bringing pancakes. Let's say on average we always bring 10 pancakes.

$\mu = 10$ , $\phi_1 = 0'5$

The thing is that the person who count this pancakes is not as good at math and usually count them wrong! So, let's say:

$$\varepsilon_t \sim N(\underset{0}{\mu_\varepsilon}, \underset{1}{\sigma_\varepsilon})$$

So, the prediction function could be something like this:

$$\hat{f}(t) = \mu + \phi_1 \cdot \varepsilon_{t-1}$$

This is quite interesting. Why should be $\hat{f}(t)$ a good estimation function?

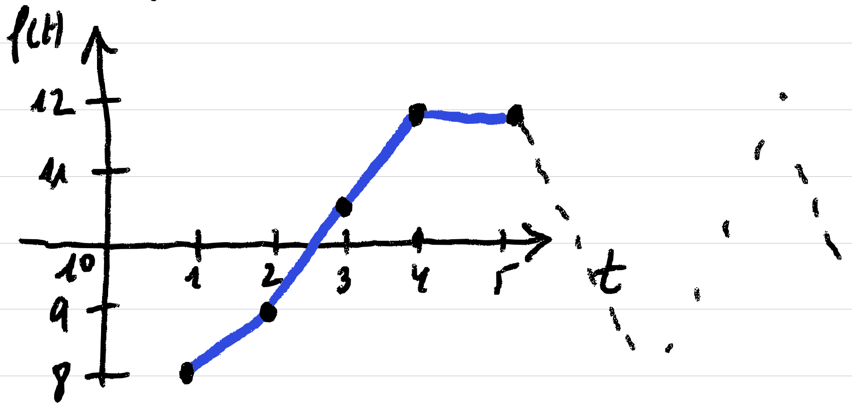
Well, actually it makes a lot of sense. We are considering $\mu$ as a constant value (we bring every month 10 pancakes) at every month we are adjusting the second term of the function based on how wrong it was on the previous time period to make a better estimation for the current time.

| $t$ | $\hat{f}_t$ | $\varepsilon_t$ | $f_t$ |
|---|---|---|---|
| 1 | 10 | -2 | 8 |
| 2 | 9 (*) | 1 | 10 |
| 3 | 10'5 | 0 | 10'5 |
| 4 | 10 | 2 | 12 |
| 5 | 11 | 1 | 12 |

Actual nº of pancakes I would need (Adding the corresponding error that obviously I didn't know while I was predicting)

(*) $\hat{f}(t) = \mu + \phi_1 \cdot \varepsilon_{t-1} = 10 + 0'5 \cdot (-2) = 9$

Let's plot this:




MA(1)

This is why it is called MA model, it is alway moving around the average value which is $\mu = 10$.

We have more MA models, for example a MA(2) model, that uses 2 time periods before than the current one to predict it:

$$\begin{cases} \hat{f}(t) = \mu + \phi_1 \cdot \varepsilon_{t-1} + \phi_2 \cdot \varepsilon_{t-2} \quad \text{and} \\ f(t) = \mu + \phi_1 \cdot \varepsilon_{t-1} + \phi_2 \cdot \varepsilon_{t-2} + \varepsilon_t \end{cases}$$

MA(2)