Kalman Filter

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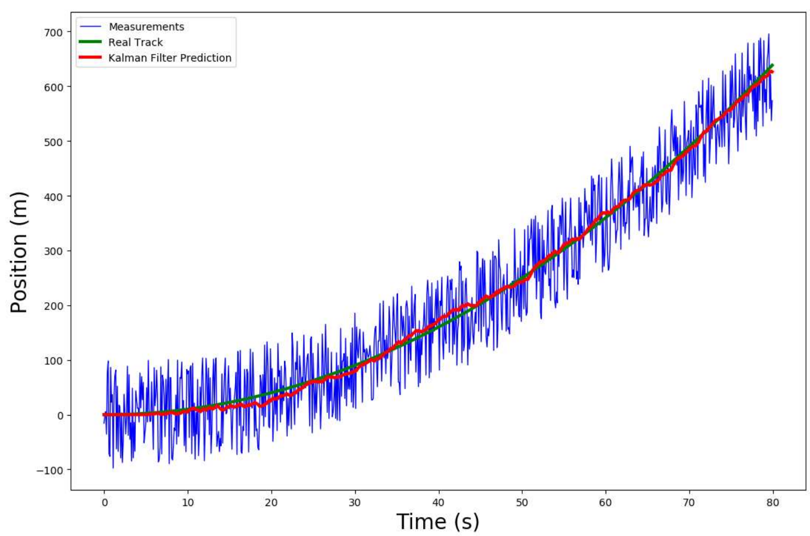
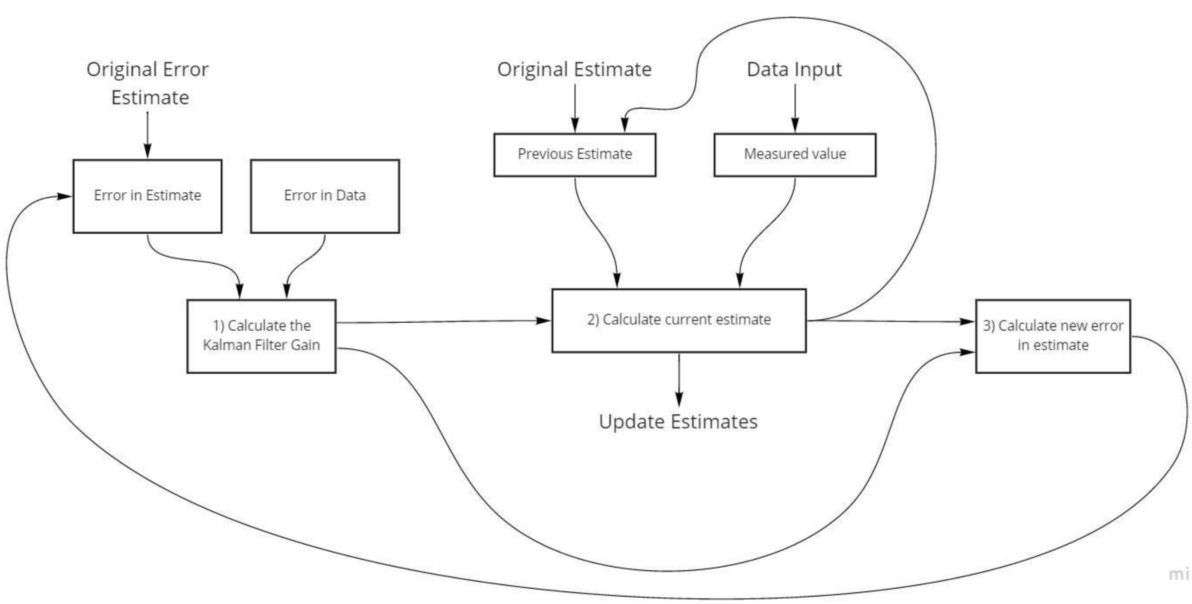
Concept:
The Kalman Filter is an iterative math process to predict the correct values with the measured data of the sensors , it estimates the mean of the data distribution.

Example of Kalman filter for tracking a moving object in 1-D



Flowchart:



Equations :

$$KG = \frac{E_{EST}}{E_{EST} + E_{MEA}}$$

$\mathrm{EST}_t = EST_{t-1} + KG[MEA - EST_{t-1}]$

$E_{EST_t} = [1 - KG](E_{EST\,t-1})$

Where:
KG: Kalman Filter Gain
EST: Estimate
MEA: Measure
EST_{t-1}: Previous Estimate

Example:
If we try to predict the position of an airplane with a radar, first we need a cinematic model to predict the position of the airplane , we can use the movement newton equation to predict it.

$$x = x_0 + v_0\Delta t + \frac{1}{2}at^2$$

The state parameters of the Kaltman filter in this expression are the following:
$[x_0, v_0, a]$

The movement newton equation in this case is the dynamic model of the system previously mentioned, so now that we have the cinematic model we can predict the position of the airplane , but it is not too easy than it appears because we have to take in account the uncertainly in the random variable , this could be the time difference between each measurement , the calibration of the sensor, environment variables, or other variables that could affect the final result, this is called measurement noise, for this reason we use Kalman filter to estimate the likelihood of the distribution.

Type equation here.

References:
[kalman.pdf (upm.es)]
[El Filtro de Kalman (kalmanfilter.net)]