Kalman Filter

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Low-pass Filter in Time

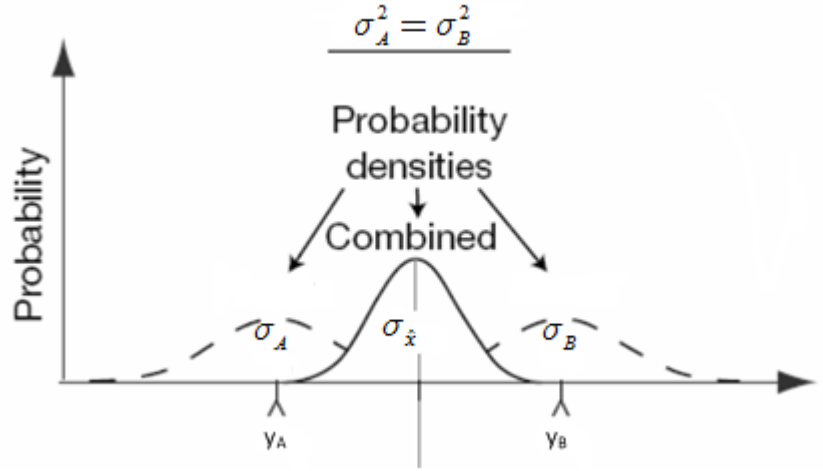
New data x_k comes in

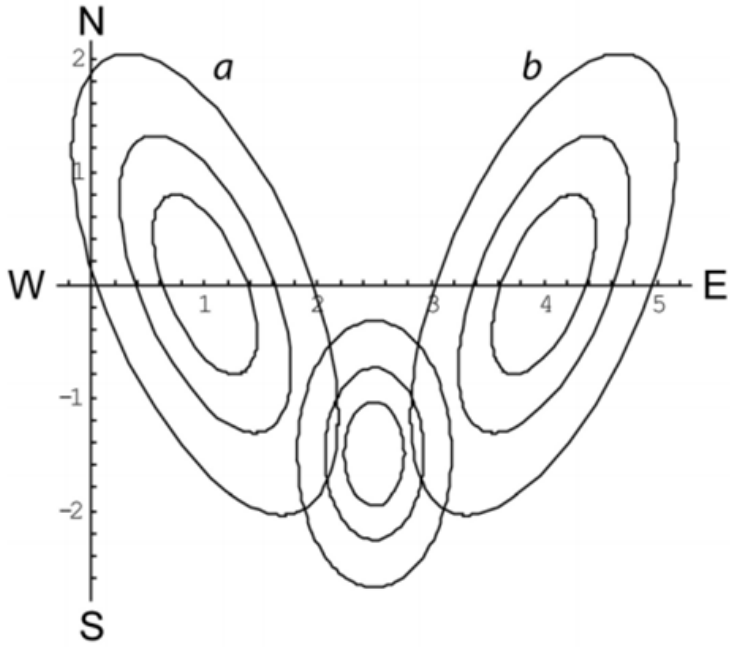
$$\bar{x}_k = \frac{x_1 + x_2 + \cdots + x_{k-1} + x_k}{k}$$

Recursive

$$\begin{aligned} \bar{x}_k &= \frac{k-1}{k}\bar{x}_{k-1} + \frac{1}{k}x_k \\ &= \alpha\bar{x}_{k-1} + (1-\alpha)x_k, \qquad \alpha = \frac{k-1}{k} \end{aligned}$$

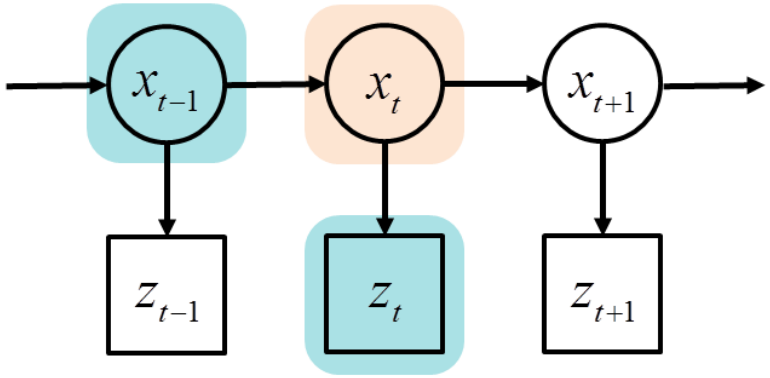
Sensor Fusion (Two Measured Observations)





Kalman Filter

- Linear dynamical system of motion
- *A, B, C* ?
- Continuous State space model
  - For filtering and control applications
  - Linear-Gaussian state space model
  - Widely used in many applications:
    - GPS, weather systems, etc.
- Weakness
  - Linear state space model assumed
  - Difficult to apply to highly non-linear domains



$$x_{t+1} = Ax_t + Bu_t$$
$$z_t = Cx_t$$

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