%%% Scalar Kalman gain.

* 1. Conditional Estimate of a Gaussian Random Vector with Additive Gaussian Noise
* Modelling
* %% I will notify means is independent.
* Problem: find
* Solution



where



1. Weighting factor in (3.14)
   1. weighting:
2. smoothing / filtering: signal processing

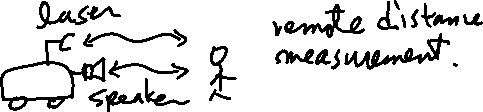
Given . What is the average of .

1. Simple mean:

The weighting is equal to each measurement.

1. Weighted mean:
2. Multiple Random variables

Ex.)



Remote distance measurements: two sensors

Problem: good resolution and robust in weather conditions

1. Laser distance measurement:

-. pros: good resolution

-. cons: poor in rainy or foggy weather condition

1. Acoustic distance measurement:

-. pros: robust in weather conditions

-. cons: poor resolution

c) need two sensors. How to estimate the distance , given two measurements

(?

* Method 1: simple mean
* Method 2: Weighted mean
* Comparison Method 1 to Method 2
* The mean of Method 1 is the same of Method 2
* The variance of Method 1 is greater than that of Method 2
* Conclusion:

Using Method 2, the estimator of the distance is better than using Method 1. In fact the minimum variance estimator is the Method 2 estimator.

* 1. Scalar case of Kalman estimator

From (3.14),

From (3.13)

which is similar to Method 2

1. Batch and real time process

Consider . What is the average of ?

* 1. batch process:
  2. real time process:

Define

Hence

The previous value is

Subtract (7) from (6) to each side,

Implies

We get

* 1. Comparison

In batch Process we need “n” memories compared to “2” memories in real time process

We may call the real time process as an iterative calculation process

1. Stability / controllability / Observability
   1. Stability
2. A discrete linear time invariant system is stable iff
3. A discrete linear system is stable iff

, satifies the Lyapunov equation,

1. A continuous linear system is stable iff

, satifies the Lyapunov equation,

* 1. Controllability / Observability