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

To get the solution, we need

1. Since are gaussians, is a gaussian
2. , and are correlated.
3. How to find given ?

* Solution

where

* The minimum variance estimator of

= the conditional expectation given

~ mean of x + (scale) (measurement – mean of x)

* Uncertainty: if the variance of a RV is large, the uncertainty is large.
* How to find ?

-first find : He use a trick. Define a new RV as

-second find : This is simple. As you know

* Tip: (3.5) Matrix inverse

Verify the inverse in (3.5) 🡺

And 🡨 You may try

* Tip.
  + 1. Simplification of the Argument of the Exponential
    2. Simplification of the Coefficient of the Exponential
    3. Processing Measurements Sequentially
* Batch process / real time process(sequential measurement)
* Extension of (3.2): Sequentially measuring of
* Goal: find sequential the conditional mean of given the sequential measurements

Where in (3.32) means corresponding to in (3.13) indexed n.

* Solution

With the sequential measurements, construct it as a batch model

Since

Hence

* Think of (3.21)

Since is increased as is increased

* as n is increasing, the conditional variance given

is decreasing

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Substituting (3.21) and (3.20) into (3.14) gives

Multiplying (3.22) through by gives

where a new variable defined as

And define additional terms as

We get

For iteration calculation, define new variables at measurement

And



* Iteration with at time step

Multiplying by then

* Important:

1. With the last measurement , the conditional mean of can be calculated by (3.14) or (3.32)
2. To get the , in the batch process you need more memory compared to the real time process
3. In general, .Hence we need recursively using (3.28)