1. Batch Process and Recursive Process
2. Problem:

Given the measures , find the average of ,

1. Batch process
2. Recursive process

Then

1. Comparison

- (1) needs “n” memories, whereas (2) needs only “2” memories

- To get the result, by (1) it should wait until to get , whereas (2), at time , it may possible to get the

1. Least Square error
2. Consider
3. If exists, there is the unique solution, as
4. If , there exists a solution.
5. If , there is no solution.
6. The best estimator in c) case

Find the best estimator for , such that

1. The best estimator

Let , then the extreme value of can be determined as

Hence

which implies

Example.1

Suppose we measure positions of a moving car as

at time . Find the best the estimator such that

Solution:

Then the best estimator, the least square error estimator, is

1. The Random variable
2. The mean of ,

Where is the probability density function as

1. The variance of ,
2. The best estimator of the random variable

Let a random variable , what is the best estimator of , in the sense of the minimum mean square? i.e.

Sol:

* The best estimator in MMV is

1. Two random variables

The best estimator in MMV of is

where is called the Kalman gain

Example 2. To estimate the travelling distance:

Suppose a car moved for 10 seconds. The distance gauge indicates 1000m whose resolution is 1m. The speed gauge indicates 99m/sec whose resolution is 10m/sec.

Since the variances of the distance and speed gauge are

The best estimate of the travelling distance is

1. The conditional probability

Example.3

Let’s denote the event of active covid-19 as and of the high temperature . And the joint probability as

1. the probability of the temperature high ?

1. the conditional probability ?
2. the conditional probability
3. Analysis

* = 99, hence the temperature is a good indicator for covid
* If you change then the results are quite different.
* So for detection of covid, there are many indicators such as temperature, heart rate and so on. Then the best indicator should be considered the conditional probability.