



Bookmarks

- ▶ Unit 0: Overview
- ▶ Entrance Survey
- ▶ Unit 1: Probability models and axioms
- ▶ Unit 2: Conditioning and independence
- ▶ Unit 3: Counting
- ▶ Unit 4: Discrete random variables
- ▶ Exam 1
- ▶ Unit 5: Continuous random variables
- ▶ Unit 6: Further topics on random variables
- ▼ Unit 7: Bayesian inference

Unit 7: Bayesian inference &gt; Lec. 15: Linear models with normal noise &gt; Lec 15 Linear models with normal noise vertical4

Bookmark

## Exercise: The mean-squared error

(1/1 point)

In this exercise we want to understand a little better the formula

$$\frac{1}{\sum_{i=0}^n \frac{1}{\sigma_i^2}}$$

for the mean squared error by considering two alternative scenarios.

In the first scenario,  $\Theta \sim N(0, 1)$  and we observe  $X = \Theta + W$ , where  $W \sim N(0, 1)$  is independent of  $\Theta$ .

In the second scenario, the prior information on  $\Theta$  is extremely inaccurate:  $\Theta \sim N(0, \sigma_0^2)$ , where  $\sigma_0^2$  is so large that it can be treated as infinite. But in this second scenario we obtain two observations of the form  $X_i = \Theta + W_i$ , where the  $W_i$  are standard normals, independent of each other and of  $\Theta$ .

The mean squared error is

- ☐ smaller in the first scenario.
- ☐ smaller in the second scenario.
- ☒ the same in both scenarios. ✓

Answer:


We use the formula for the mean squared error. For the second scenario, we set  $\sigma_0^2 = \infty$ . In the first scenario, we obtain

## Unit overview


## Lec. 14:

## Introduction to


## Bayesian inference

Exercises 14 due Apr  
06, 2016 at 23:59 UTC 


**Lec. 15: Linear  
models with  
normal noise**

Exercises 15 due Apr  
06, 2016 at 23:59 UTC 


## Problem Set 7a

Problem Set 7a due  
Apr 06, 2016 at 23:59  
UTC 


**Lec. 16: Least  
mean squares  
(LMS) estimation**

Exercises 16 due Apr  
13, 2016 at 23:59 UTC 

**Lec. 17: Linear  
least mean  
squares (LLMS)  
estimation**

Exercises 17 due Apr  
13, 2016 at 23:59 UTC 

## Problem Set 7b

Problem Set 7b due  
Apr 13, 2016 at 23:59  
UTC 

## Solved problems

**Additional  
theoretical  
material**

## Unit summary

$$\frac{1}{\frac{1}{1} + \frac{1}{1}} = \frac{1}{2},$$

and in the second scenario, we obtain the same mean squared error:

$$\frac{1}{\frac{1}{\infty} + \frac{1}{1} + \frac{1}{1}} = \frac{1}{2}.$$

This suggests the following interpretation: the prior information on  $\Theta$  in the first scenario is, in a loose sense, exactly as informative as having no useful prior information but one more observation, as in the second scenario.

*You have used 1 of 1 submissions*

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