



MITx: 6.041x Introduction to Probability - The Science of Uncertainty



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 > Lec. 17: Linear least mean squares (LLMS) estimation > Lec 17 Linear least mean squares LLMS estimation vertical1



Bookmark

Exercise: LLMS without a constant term

(2/2 points)

Suppose that instead of estimators of the form $\mathbf{a}\mathbf{X} + \mathbf{e}$, we consider estimators of the form $\hat{\Theta} = \mathbf{a}\mathbf{X}$ and ask for the value of \mathbf{a} that minimizes the mean squared error. Mimic the derivation you have just seen and find the optimal value of \mathbf{a} . Your answer should be an algebraic expression involving some of the constants \mathbf{b} , \mathbf{c} , \mathbf{d} , where $\mathbf{b} = \mathbf{E}[\Theta^2]$, $\mathbf{c} = \mathbf{E}[\Theta\mathbf{X}]$, $\mathbf{d} = \mathbf{E}[\mathbf{X}^2]$.

c/d



Answer: c/d

Answer:

The mean squared error is


$$\mathbf{E}[(\Theta - \mathbf{a}\mathbf{X})^2] = \mathbf{E}[\Theta^2] - 2\mathbf{a}\mathbf{E}[\Theta\mathbf{X}] + \mathbf{a}^2\mathbf{E}[\mathbf{X}^2].$$

By setting to zero the derivative with respect to \mathbf{a} , we find that


$$\mathbf{a} = \frac{\mathbf{E}[\Theta\mathbf{X}]}{\mathbf{E}[\mathbf{X}^2]} = \frac{\mathbf{c}}{\mathbf{d}}.$$

You have used 1 of 2 submissions


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**

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