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Least mean squares LMS estimation vertical5

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Exercise: Theoretical properties

(1/2 points)

Let $\hat{\Theta}$ be an estimator of a random variable Θ , and let $\tilde{\Theta} = \hat{\Theta} - \Theta$ be the estimation error.

a) In this part of the problem, let $\hat{\Theta}$ be specifically the LMS estimator of Θ . We have seen that for the case of the LMS estimator, $\mathbf{E}[\tilde{\Theta} \mid X = x] = 0$ for every x . Is it also true that $\mathbf{E}[\tilde{\Theta} \mid \Theta = \theta] = 0$ for all θ ? Equivalently, is it true that $\mathbf{E}[\hat{\Theta} \mid \Theta = \theta] = \theta$ for all θ ?

Yes ▼

✗ Answer: No

b) In this part of the problem, $\hat{\Theta}$ is no longer necessarily the LMS estimator of Θ . Is the property $\text{var}(\Theta) = \text{var}(\hat{\Theta}) + \text{var}(\tilde{\Theta})$ true for every estimator $\hat{\Theta}$?

No ▼

✓ Answer: No


Answer:

a) There is no reason for this relation to be true. For an example, suppose that Θ is a Bernoulli random variable. With a noisy measurement, $\hat{\Theta}$ will be somewhere in between 0 and 1, and therefore will never be equal to the true value of θ , which is either 0 or 1 exactly.


b) There is no reason for this to be the case. In fact, the variance of $\hat{\Theta}$, for a poorly chosen estimator, can be larger than the variance of Θ . For an example, consider the usual model of an observation $X = \Theta + W$ and the estimator $\hat{\Theta} = 100X$.

You have used 1 of 1 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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