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Exercise: LLMS with multiple observations

(3/3 points)

Suppose that Θ , X_1 , and X_2 have zero means. Furthermore,

$$\text{var}(X_1) = \text{var}(X_2) = \text{var}(\Theta) = 4,$$

and

$$\text{cov}(\Theta, X_1) = \text{cov}(\Theta, X_2) = \text{cov}(X_1, X_2) = 1.$$

The LLMS estimator of Θ based on X_1 and X_2 is of the form $\hat{\Theta} = a_1 X_1 + a_2 X_2 + b$. Find the coefficients a_1 , a_2 , and b . *Hint:* To find b , recall the argument we used for the case of a single observation.

$a_1 =$



Answer: 0.2

$a_2 =$



Answer: 0.2

$b =$



Answer: 0

Answer:

By the same argument as in the case of a single observation, we will have $b = \mathbf{E}[\Theta - a_1 X_1 - a_2 X_2] = 0$. Using the variance and covariance information we are given, the expression we want to minimize is

$$\mathbf{E}[(a_1 X_1 + a_2 X_2 - \Theta)^2] = 4a_1^2 + 4a_2^2 + 4 + 2a_1 a_2 - 2a_1 - 2a_2.$$

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

Because of symmetry, we see that the optimal solution will satisfy $a_1 = a_2 = a$, so the expression is of the form $8a^2 + 4 + 2a^2 - 4a$. By setting the derivative to zero, we find that $20a = 4$, or $a = 1/5$.

You have used 1 of 2 submissions

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