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Exercise: Mean squared error

(4/4 points)

As in an earlier exercise, we assume that the random variables Θ and X are described by a joint PDF which is uniform on the triangular set defined by the constraints $0 \leq x \leq 1, 0 \leq \theta \leq x$.

a) Find an expression for the conditional mean squared error of the LMS estimator given that $X = x$, valid for $x \in [0, 1]$. Express your answer in terms of x using standard notation .



Answer: $x^2/12$

b) Find the (unconditional) mean squared error of the LMS estimator.



Answer: 0.04167

Answer:


a) We saw that the conditional PDF of Θ is uniform on the range $[0, x]$. Hence, the conditional variance is $x^2/12$.

b) This is given by the integral of the conditional variance, weighted by the PDF of X . The PDF of X is found using the formula for going from the joint to the marginal, and is $f_X(x) = 2x$, for $x \in [0, 1]$. Thus, the mean squared error is


$$\int_0^1 \frac{x^2}{12} \cdot 2x \, dx = \frac{1}{6} \int_0^1 x^3 \, dx = \frac{1}{24}.$$

You have used 1 of 3 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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