5. Exercise: LLMS without a constant term

Exercises due Apr 15, 2020 05:29 IST *Completed*

Exercise: LLMS without a constant term

2.0/2.0 points (graded)

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

c/d ✔ **Answer:** c/d

Solution:

The mean squared error is

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

By setting to zero the derivative with respect to a, we find that

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

Submit You have used 2 of 3 attempts

Answers are displayed within the problem

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My approach was to remove b from the minimization and then expand all the Expectations. I was able to...

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