7. Exercise: Bias and MSE

Exercises due May 1, 2020 05:29 IST *Completed*

Exercise: Bias and MSE

1/2 points (graded)

We estimate the unknown mean θ of a random variable X with unit variance by forming the sample mean $M_n = (X_1 + \cdots + X_n)/n$ of n i.i.d. samples X_i and then forming the estimator

$$\widehat{\Theta}_n = \frac{1}{3} \cdot M_n.$$

Your answers below can be functions of θ and n. Follow standard notation and use 'theta' to indicate θ.

The bias $\mathbf{E}\left[\widehat{\Theta}_n\right] - \theta$ of this estimator is:

-(2/3)*theta ✔ **Answer:** -2*(theta)/3

The mean squared error of this estimator is:

(9+(4*theta^2*n))/(9*n) ✖ **Answer:** 1/(9*n)+4*(theta)^2/9

STANDARD NOTATION

Solution:

Since $\mathbf{E}\left[M_n\right] = \theta$, we have $\mathbf{E}\left[\widehat{\Theta}_n\right] = \theta/3$, and the bias is $-2\theta/3$.

The variance of $\widehat{\Theta}_n$ is $1/9$ times the variance of M_n, which is $1/n$. The mean squared error is the sum of the variance and the square of the bias: $1/(9n) + (4\theta^2/9)$.

Submit You have used 3 of 3 attempts

Answers are displayed within the problem

Discussion

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Topic: Unit 8: Limit theorems and classical statistics:Lec. 20: An introduction to classical statistics / 7. Exercise: Bias and MSE

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Possible bug The system classifies an incorrect response as correct (In my first attempt i mistakenly used wrong varia...	4
MSE: what am I doing wrong? As I understand, to calculate MSE we need to derive Var(Θ^n) and then add to it squared bias, where bia...	4
Practical Side	3
Much harder? I'm finding it much harder to wrap my head around Classical statistics than around the Bayesian stuff. A...	4
Why bias not zero? I am not following why the bias is not zero as in the example of lecture 20, item 5. Any suggestions? Tha...	6
Hint I did the calculation twice, and I believe I'm missing something. Can anyone give me some hint?	5
sigma? Where do we get the variance for the mean squared error?	5