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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 $M_n=\left(X_1+\cdots+X_n\right)/n$ of n i.i.d. samples X_i and then forming the estimator

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

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

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

✓ Answer: -2*(theta)/3

The mean squared error of this estimator is:

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

STANDARD NOTATION

Solution:

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



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: $1/(9n) + (4\theta^2/9)$.

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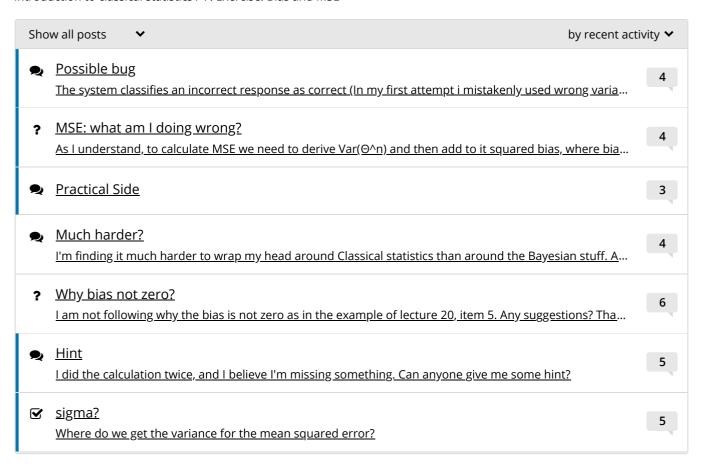
You have used 3 of 3 attempts

1 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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