20. Exercise: Discrete unknown, continuous measurement

Exercises due Mar 13, 2020 05:29 IST *Past Due*

Exercise: Discrete unknown, continuous measurement

1 point possible (graded)

Let K be a discrete random variable that can take the values 1, 2, and 3, all with equal probability. Suppose that X takes values in $[0,1]$ and that for x in that interval we have

$$f_{X|K}(x \mid k) = \begin{cases} 1, & \text{if } k = 1, \\ 2x, & \text{if } k = 2, \\ 3x^2, & \text{if } k = 3. \end{cases}$$

Find the probability that $K = 1$, given that $X = 1/2$.

Answer: 0.36364

Solution:

Using the appropriate form of the Bayes rule, we have

$$p_{K|X}(1 \mid 1/2) = \frac{p_K(1)\, f_{X|K}(1/2 \mid 1)}{f_X(1/2)} = \frac{(1/3)\cdot 1}{f_X(1/2)} = \frac{1/3}{11/12} = 4/11.$$

To find $f_X(1/2)$, we used the total probability theorem:

$$\begin{aligned} f_X(1/2) &= \sum_k p_K(k)\, f_{X|K}(1/2 \mid k) \\ &= (1/3)\cdot 1 + (1/3)\cdot(2\cdot(1/2)) + (1/3)\cdot(3\cdot(1/2)^2) \end{aligned}$$

$= 11/12.$

Submit You have used 0 of 3 attempts

Answers are displayed within the problem

Discussion

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Topic: Unit 5: Continuous random variables:Lec. 10: Conditioning on a random variable; Independence; Bayes' rule / 20. Exercise: Discrete unknown, continuous measurement

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? Answer was deemed incorrect 2
i put the answer which i calculated correctly for the question but it was returned as incorrect and when i ...

? Marginal distribution of X? 5
I'm confused about what the marginal distribution of X is. If X is a Uniform Continuous RV on [0,1], isn't f...

Some hints 4

? Why is f(X|K) not equal to zero? 5
If k=1, then x=1, so isn't it impossible for x to be anything other than 1 if we're conditioning on k=1?

? Clarificaiton needed 3
Could anyone give me some clarification on the experiment? My understanding is that 1. I draw a "k" (1,...