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Lecture 3: Parametric Statistical

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> 11. Identifiability exercises

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11. Identifiability exercises

Identifiability of Statistical Models 2

1/1 point (graded)

Let $X_i=Y_i^2$ where $Y_1,\ldots,Y_n\stackrel{iid}{\sim}\mathcal{U}([0,a])$ for some unknown parameter a. We observe the i.i.d. samples X_1,\ldots,X_n , but not the Y_i 's themselves.

Hint: Compute the cdf of X_i .

Is the parameter a identifiable from the common distribution the X_i 's?

|--|





Solution:

Write $X_i \sim X$ and note that X is supported on the interval $[0,a^2]$. Let us compute the CDF of X in terms of a.

$$\mathbf{P}\left(X \leq t
ight) = \mathbf{P}\left(Y \leq \sqrt{t}
ight) = \min\left(\int_{0}^{\sqrt{t}} rac{1}{a} \, dy, 1
ight) = \min\left(rac{\sqrt{t}}{a}, 1
ight).$$

For different values of a, the CDF of X are different; hence a is identifiable.

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You have used 1 of 1 attempt

• Answers are displayed within the problem

Identifiability of Statistical Models 3

1/1 point (graded)

Let $X_i = \mathcal{I}\left(Y_i \geq a/2\right)$ where $Y_1, \dots, Y_n \overset{iid}{\sim} \mathcal{U}([0,a])$ for some unknown parameter a. We observe the independent samples X_1, \dots, X_n but not the Y_i 's themselves.

Is the parameter a identifiable from the common distribution of the X_i 's?



Yes





Solution:

Note that X is a Bernoulli random variable with parameter $p := P\left(\mathcal{I}\left(Y_i \geq \frac{a}{2}\right) = 1\right) = P\left(Y_i \geq \frac{a}{2}\right)$.

For any choice of a, we have by the distribution of Y_i that $p = P(Y_i \ge a/2) = 1/2$. Hence, for any choice of a, the random variable X is distributed as $\mathrm{Ber}\,(1/2)$. The parameter a is not identifiable.

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You have used 1 of 1 attempt

Answers are displayed within the problem

Review of terminology

1/1 point (graded)

You have access to samples $X_1,\ldots,X_n \overset{iid}{\sim} P_{\theta^*}$ where $\theta^* \in \mathbb{R}$ is a true, unknown parameter specifying the distribution. You construct a statistical model $((-\infty,\infty),\{P_\theta\}_{\theta\in\mathbb{R}})$ for this statistical experiment. Your goal is to uncover the true parameter θ^* .

Imagine that somehow you are able to figure out the true distribution P_{θ^*} . Which assumptions (individually, each on its own) below are sufficient to recover the true parameter θ^* from the distribution? (Choose all that apply.)

- There is another value $heta'\in\mathbb{R}$ such that $heta'
 eq heta^*$ but $P_{ heta^*}$ and $P_{ heta'}$ are the same distribution.
- igcap The given statistical model $((-\infty,\infty)\,,\{P_{ heta}\}_{ heta\in\mathbb{R}})$ is well-specified.
- ightharpoonup The parameter heta is identifiable for the given statistical model.



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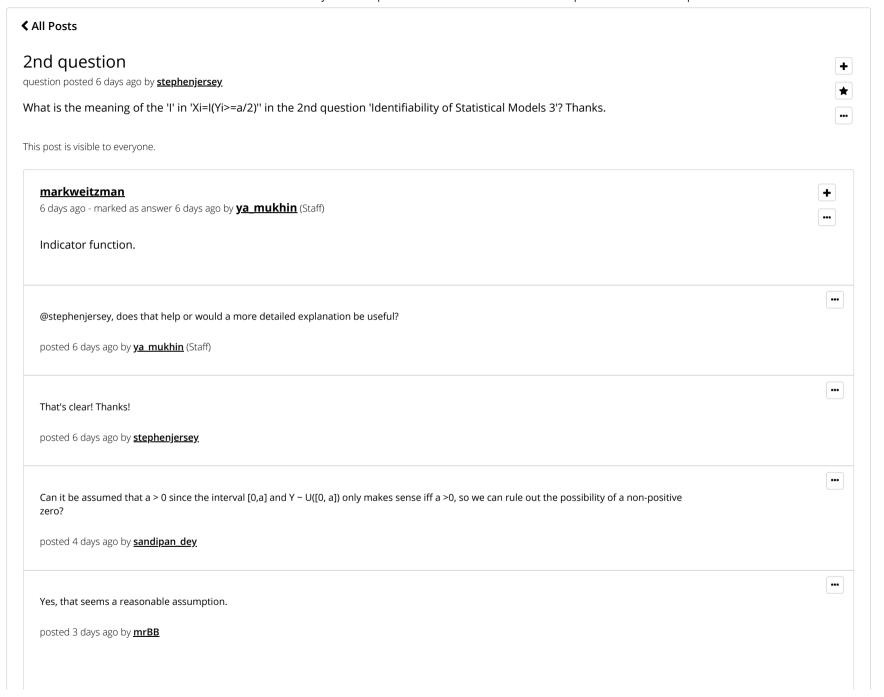
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