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11. Identifiability exercises

Identifiability of Statistical Models 2

1/1 point (graded)

Let $X_i = Y_i^2$ where $Y_1, \ldots, Y_n \overset{iid}{\sim} \mathcal{U}([0,a])$ 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?

● Yes

○ No

✓

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.

$$\mathbf{P}\left(X \le t\right) = \mathbf{P}\left(Y \le \sqrt{t}\right) = \min\left(\int_0^{\sqrt{t}} \frac{1}{a}\, dy, 1\right) = \min\left(\frac{\sqrt{t}}{a}, 1\right).$$

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

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ℹ Answers are displayed within the problem

Identifiability of Statistical Models 3

1/1 point (graded)

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

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

○ Yes

● No

✓

Solution:

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

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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 $\left((-\infty, \infty), \{P_\theta\}_{\theta \in \mathbb{R}}\right)$ 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 $\theta' \in \mathbb{R}$ such that $\theta' \neq \theta^*$ but P_{θ^*} and $P_{\theta'}$ are the same distribution.

☐ The given statistical model $\left((-\infty, \infty), \{P_\theta\}_{\theta \in \mathbb{R}}\right)$ is well-specified.

☑ The parameter θ is identifiable for the given statistical model.

✓

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2nd question

question posted 6 days ago by **stephenjersey**

What is the meaning of the 'I' in 'Xi=I(Yi>=a/2)'' in the 2nd question 'Identifiability of Statistical Models 3'? Thanks.

This post is visible to everyone.

markweitzman

6 days ago - marked as answer 6 days ago by **ya_mukhin** (Staff)

Indicator function.

@stephenjersey, does that help or would a more detailed explanation be useful?

posted 6 days ago by **ya_mukhin** (Staff)

That's clear! Thanks!

posted 6 days ago by **stephenjersey**

Can it be assumed that a > 0 since the interval [0,a] and Y ~ U([0, a]) only makes sense iff a >0, so we can rule out the possibility of a non-positive zero?

posted 4 days ago by **sandipan_dey**

Yes, that seems a reasonable assumption.

posted 3 days ago by **mrBB**

Thank you @mrBB, so I guess we can assume the same for the 1st question too, right?

posted about 12 hours ago by **sandipan_dey**

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