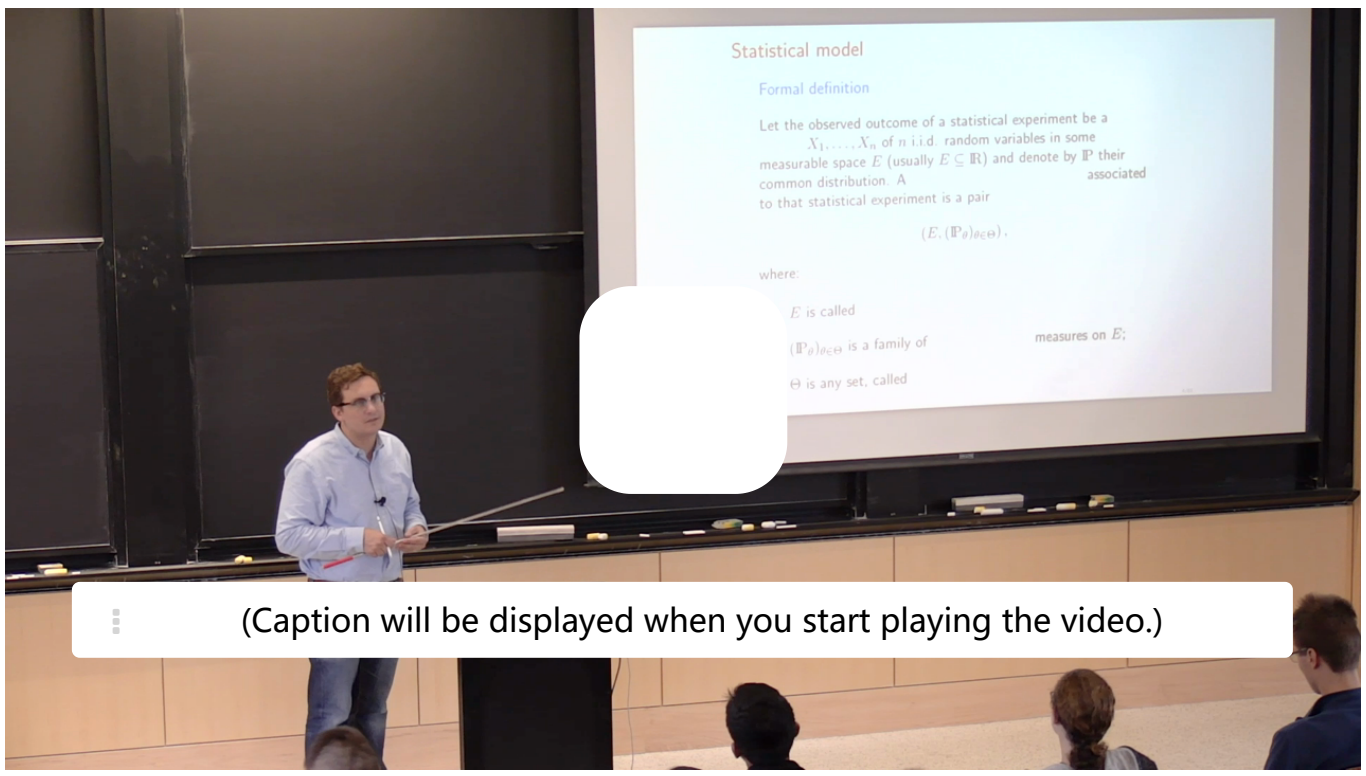
5. Statistical model
Statistical model: definition



Start of transcript. Skip to the end.

So let's talk about a statistical model.
Here I said, you know, I want to replace
my PDF by a particular statistical model, which was
in this case a Poisson model.
A model just means something which
is like slightly simpler than what reality actually
is, but hopefully captures most of it.
Well, that would be a good model.

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A Basic Statistical Model: Sample space

1/1 point (graded)
You have a coin that either lands heads, which you denote by $\mathbf{1}$, or tails, which you denote by $\mathbf{0}$. Let X be a random variable representing this coin flip, with an (unknown) distribution. You run a **statistical experiment** consisting of n iid tosses of the coin and record your data set as $X_1, X_2, X_3, \ldots X_n$.

(It makes sense to assume the coin tosses $X_1, \ldots, X_n$ as identically distributed, since we always toss the same coin; and as independent, since these tosses do not affect each other.)

We now construct a **statistical model** $(E, \{P_\theta\}_{\theta \in \Theta})$ associated with this experiment, where

$$E \text{ is a sample space for } X, \text{ i.e. a set that contains all possible outcomes of } X,$$
$$\{\mathbb{P}_\theta\}_{\theta \in \Theta} \text{ is a family of probability distributions on } E,$$
$$\Theta \text{ is a parameter set, i.e. a set consisting of some possible values of } \theta.$$

What is the **smallest sample space** for X? We can use this as the sample space E in our statistical model.
(Below, $[0, 1]$ denotes the closed interval between 0 and 1. In contrast, $\{0, 1\}$ denotes the set with two elements, 0 and 1.)

- $\{0, 1\}$ ✔
- $[0, 1]$
- $\mathbb{R}$

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- $\mathbb{R}^2$

Solution:

Here the coin is either heads (denoted by 1) or tails (denoted by 0), so $\{0, 1\}$ is the smallest sample space of X. The remaining choices are valid, but not the smallest, sample spaces of X.

提交 你已经尝试了1次（总共可以尝试2次）

Answers are displayed within the problem

A Basic Statistical Model: Family of distributions and Parameter set

2/2 points (graded)

Continuing from the previous problem, which of the following is the smallest family of probability distributions that the distribution of X belongs to? We can use this family as $\{\mathbb{P}_\theta\}_{\theta \in \Theta}$ in our statistical model.

- Bernoulli ✔
- Poisson
- Binomial

The distribution of X is a member of the family with some unknown parameter θ. According to the information given about the experiment, which of the following represents the set of all possible values of the parameter θ? We can use this set as the parameter set Θ in our statistical model.

- $\{0, 1\}$
- $\{0, 1/2, 1\}$
- $[0, 1]$ ✔
- $\mathbb{R}$

Solution:

1. Since the (smallest) sample space of X is $\{0, 1\}$, X follows a Bernoulli distribution.

2. The first and second choices, $\{0, 1\}$ and $\{0, 1/2, 1\}$, place too many restrictions on the distribution of X. Also, be sure to not confuse the space where the parameter θ lives with the sample space, where the random variable X lives! The fourth choice, $\mathbb{R}$, allows for values of θ that do not make sense according to modeling X as $\mathbf{Ber}\,(\theta)$. For example, there is no such thing as $\mathbf{Ber}\,(-1/2)$.
   We are not given any assumptions on the distribution of the coin, so we need to allow θ to take all possible values that make sense according to our modeling assumption. Since θ represents the probability that $X = 1$, we must have $0 \leq \theta \leq 1$. Hence, the third choice, $[0, 1]$, is correct.

Using this problem and the previous one, we can construct the statistical model $(\{0, 1\}, \{\mathbf{Ber}\,(\theta)\}_{\theta \in [0,1]})$ for the distribution of the RV X representing the outcome of the coin flip.

提交 你已经尝试了1次（总共可以尝试3次）

Answers are displayed within the problem

讨论

主题： Unit 2 Foundation of Inference:Lecture 3: Parametric Statistical Models / 5. Statistical model

显示讨论

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