

Probabilistic thinking, Stan

Urša Zrimšek

UNCERTAINTY

In everyday life we often ask ourselves questions with uncertain answers. We will list some examples and reply first with natural language and then with probabilistic answers. First question has infinitely but countably many answers (non-negative integers), second one has uncountably many answers (non-negative reals) and third one has 2 (yes/no).

- 1) How many people will visit the concert we are organizing on Friday?
 - Around 200.
 - $X \sim \text{Binomial}(2000, 0.1)$
- 2) How many kilometers will we do on a road trip to Spain?
 - From 4000 to 6000, depends on how many climbing areas we will visit.
 - $X \sim \frac{1}{3} \cdot N(4500, 150^2) + \frac{1}{3} \cdot N(5000, 150^2) + \frac{1}{3} \cdot N(5500, 150^2)$
- 3) **Waking up, sleepy, not knowing what day it is** Do I need to go to university today?
 - Probably not, I only need to go twice a week.
 - $X \sim \text{Bernoulli}(\frac{2}{7})$

STAN

We ran the Bernoulli toy example from the installation instructions. On Figure 1 we plotted the posterior distribution of the Bernoulli's distribution parameter.

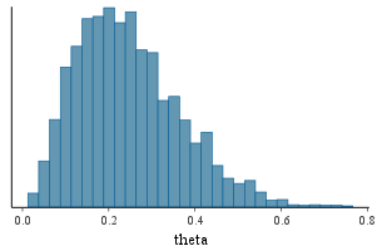


Figure 1. **Posterior distribution of parameter θ .**

With Stan we also easily calculated probabilities

$$P(\theta > 0.3) = 0.292$$

and

$$P(\|\theta - 0.5\| < 0.001) = 0.00125.$$