

## SBI Toolbox: Idea: recap

### Bayesian approach to parameter estimation

$$p(\theta|X = x) = \frac{p(x|\theta)p(\theta)}{p(x)}$$

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### Bayesian approach to parameter estimation

$$p(\theta | X = x) = \frac{p(x|\theta)p(\theta)}{\int p(x, \theta) d\theta}$$

→ Numerically expensive

## SBI Toolbox: Idea: recap

### “Likelihood-free” approach to parameter estimation

$$p(\theta | X = x) = \frac{p(x|\theta)p(\theta)}{\int p(x, \theta) d\theta}$$

Unknown

Numerically expensive

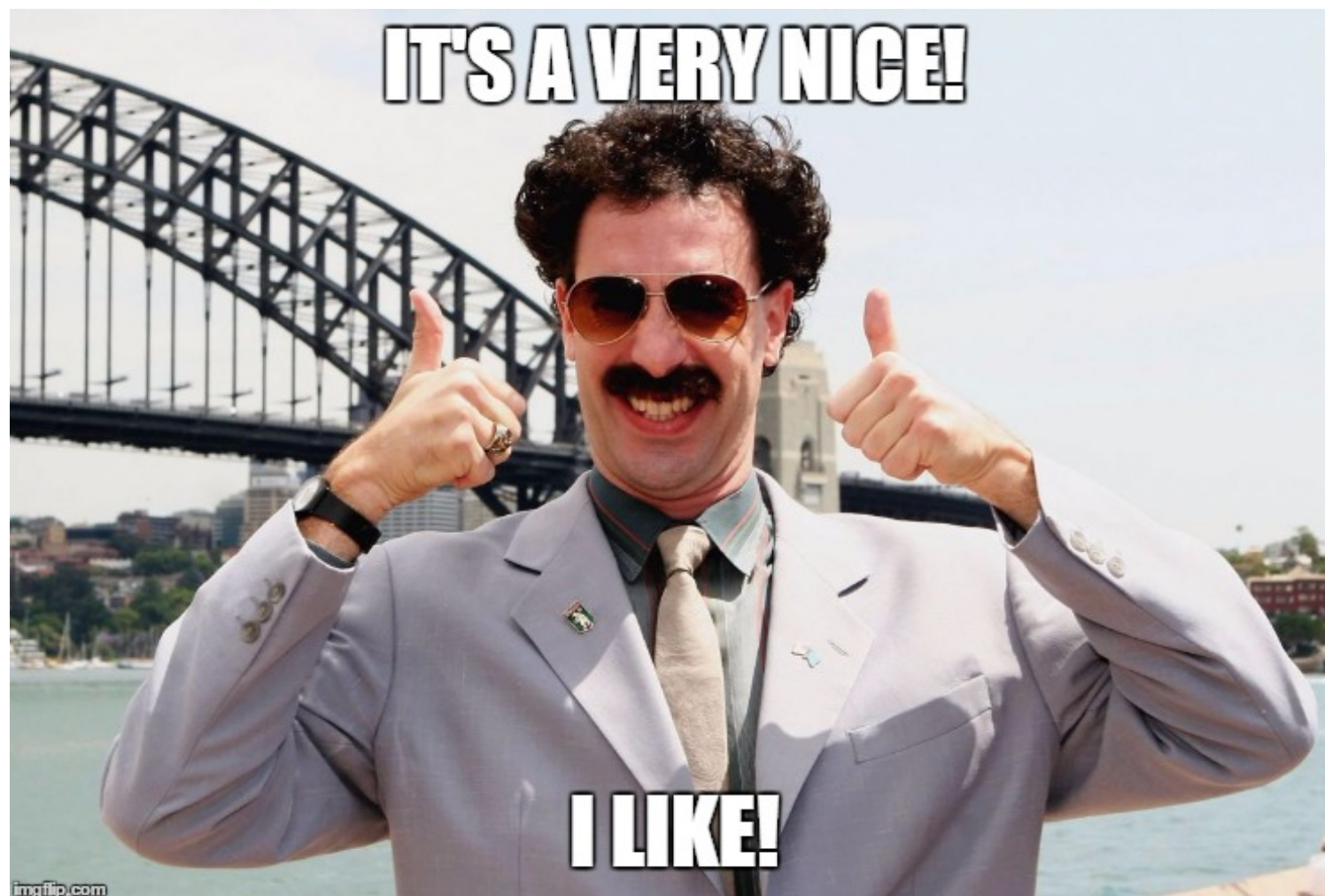
## SBI Toolbox: Idea: recap

### “Likelihood-free” approach to parameter estimation

$$p(\theta|X = x) = \frac{p(x|\theta)p(\theta)}{\int p(x, \theta)d\theta}$$

Unknown ←

→ Numerically expensive



## SBI Toolbox: Idea: recap

### “Simulation-based” approach to parameter estimation

(redefined)

$$p(\theta | X = x) = \frac{p(x|\theta)p(\theta)}{\int p(x, \theta) d\theta}$$

**Simulate** ←

→ **Numerically expensive**

The diagram illustrates the SBI equation  $p(\theta | X = x) = \frac{p(x|\theta)p(\theta)}{\int p(x, \theta) d\theta}$ . A red box highlights the term  $p(x|\theta)$  in the numerator, with a red arrow pointing to the word "Simulate". Another red box highlights the denominator  $\int p(x, \theta) d\theta$ , with a red arrow pointing to the phrase "Numerically expensive".

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### “Likelihood-free” approach to parameter estimation

$$p(\theta|X = x) = \frac{p(x|\theta)p(\theta)}{p(x)}$$

Unknown

Numerically expensive

The diagram illustrates the formula for the posterior probability  $p(\theta|X = x)$ . The numerator consists of the likelihood  $p(x|\theta)$  and the prior  $p(\theta)$ . The denominator is the marginal likelihood  $p(x)$ . A red box is drawn around  $p(x|\theta)$  in the numerator, with a red arrow pointing from it to the word "Unknown". Another red box is drawn around  $p(x)$  in the denominator, with a red arrow pointing from it to the phrase "Numerically expensive".

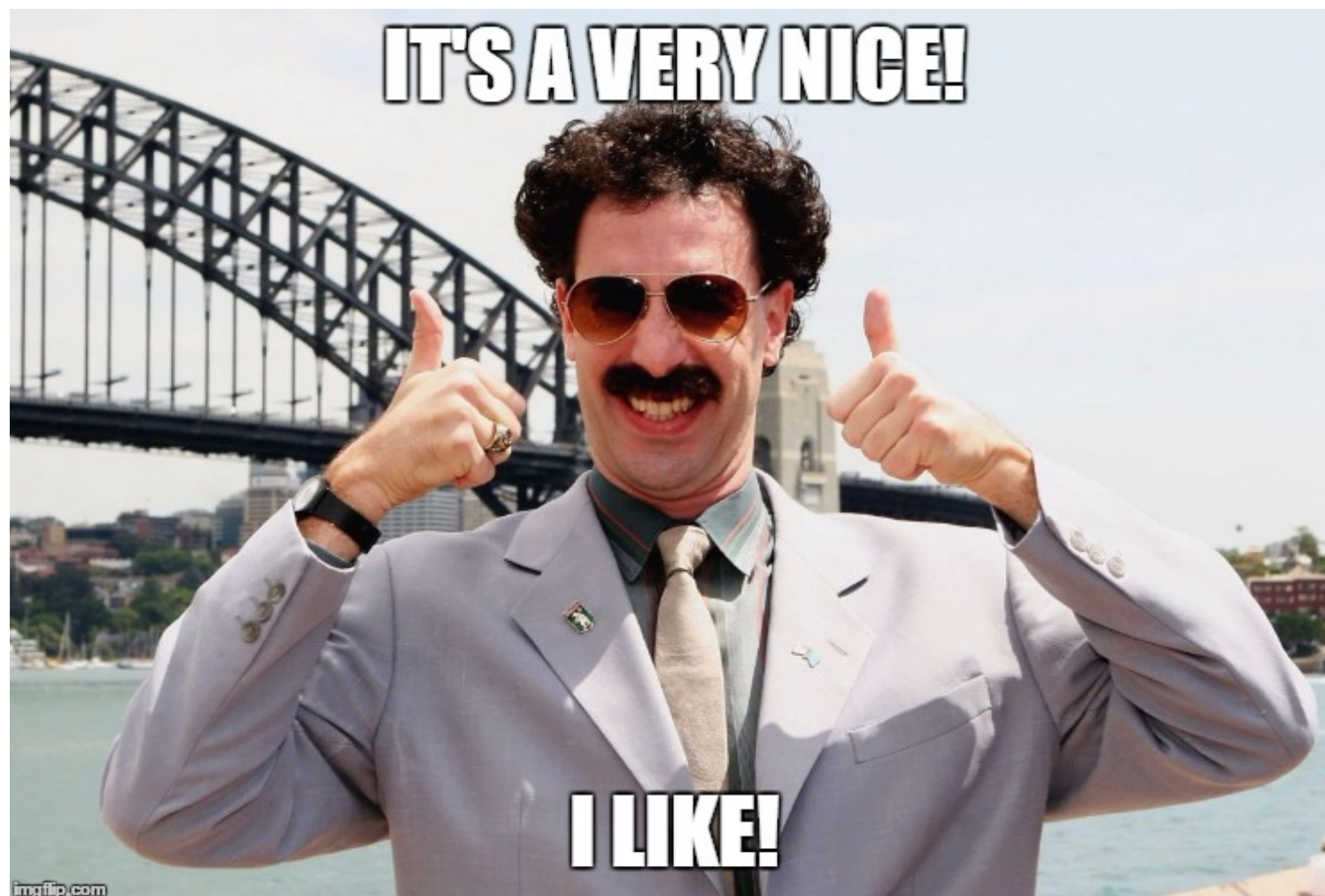
## SBI Toolbox: Idea: recap

### “Likelihood-free” approach to parameter estimation

$$p(\theta|X = x) = \frac{p(x|\theta)p(\theta)}{p(x)}$$

Unknown ←

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### “Simulation-based” approach to parameter estimation

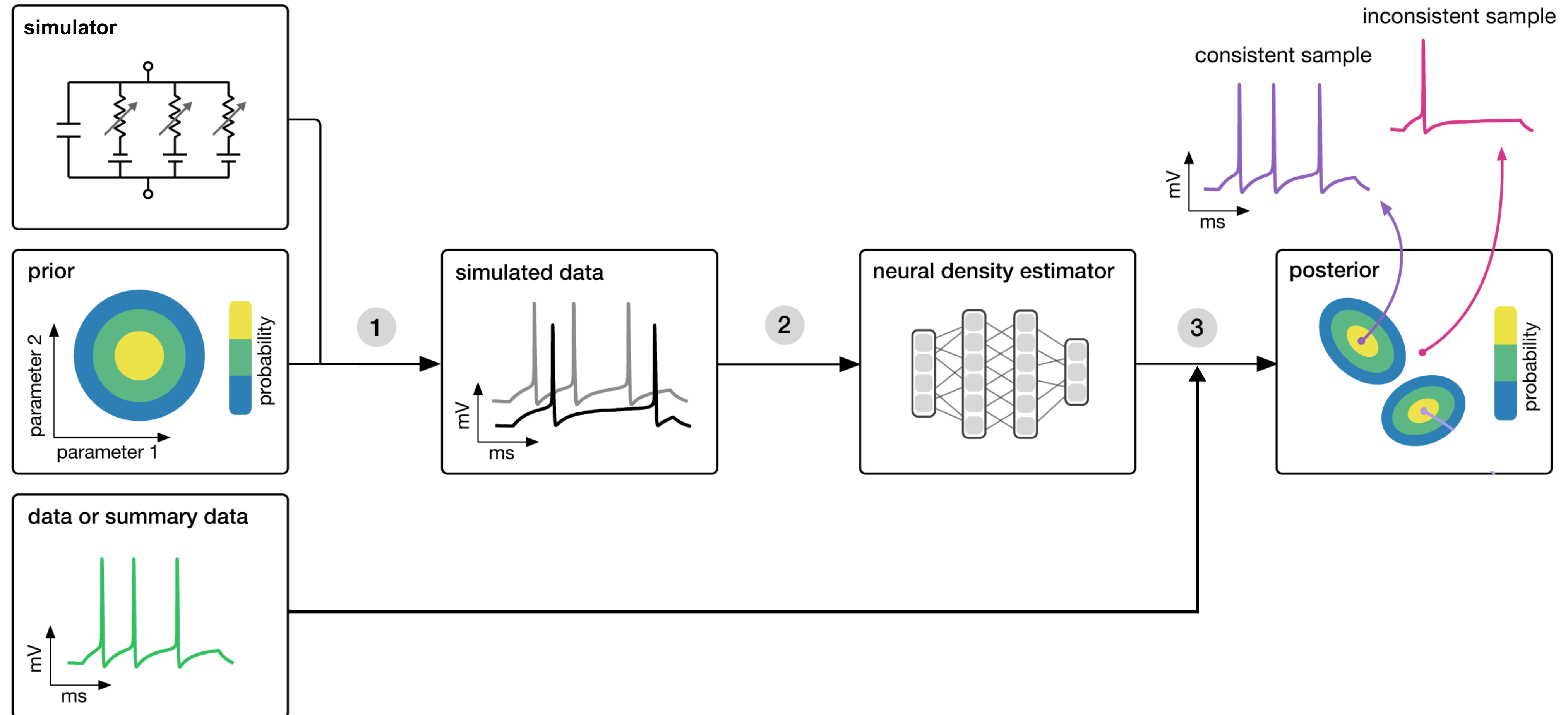
(redefined)

$$p(\theta | X = x) = \frac{p(x|\theta)p(\theta)}{p(x)}$$

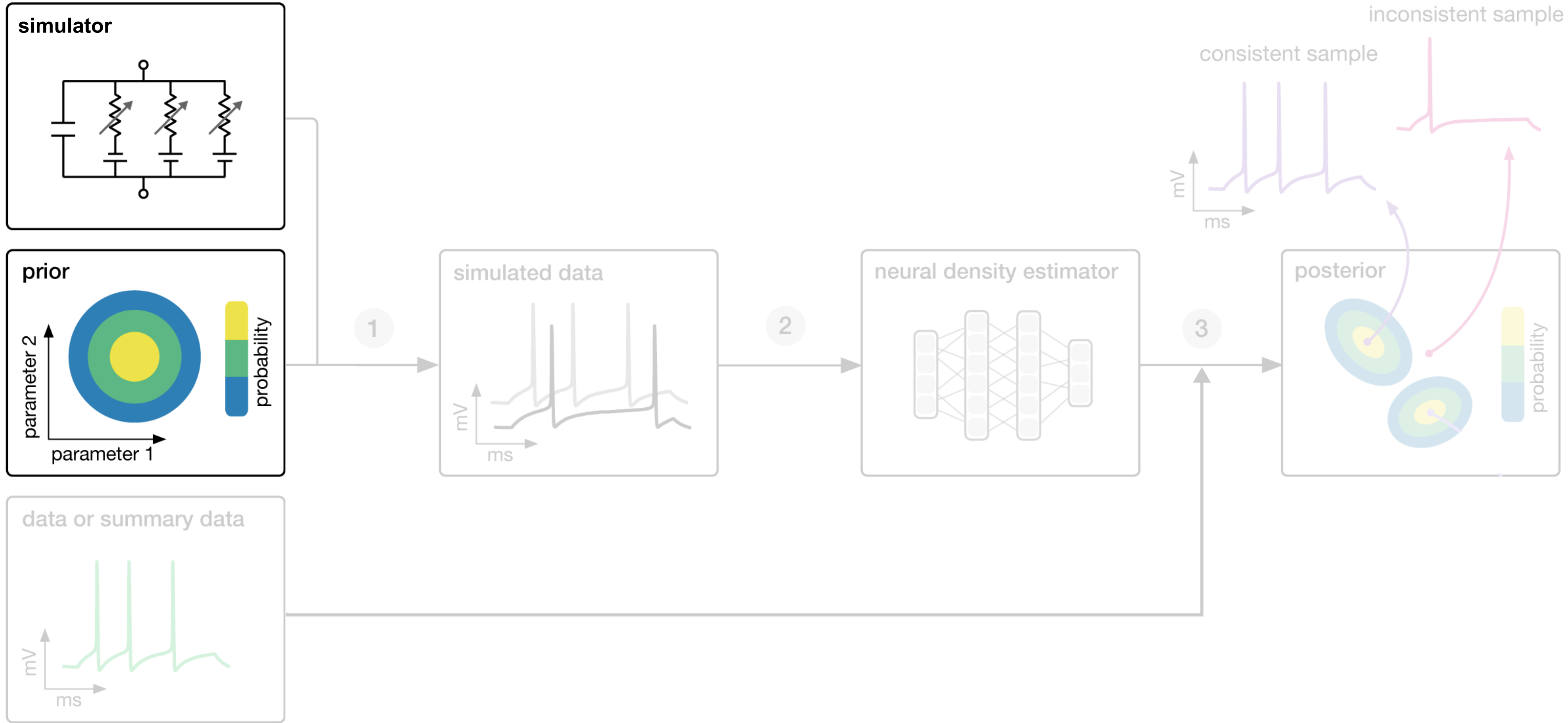
**Simulate** ←

→ **Numerically expensive**

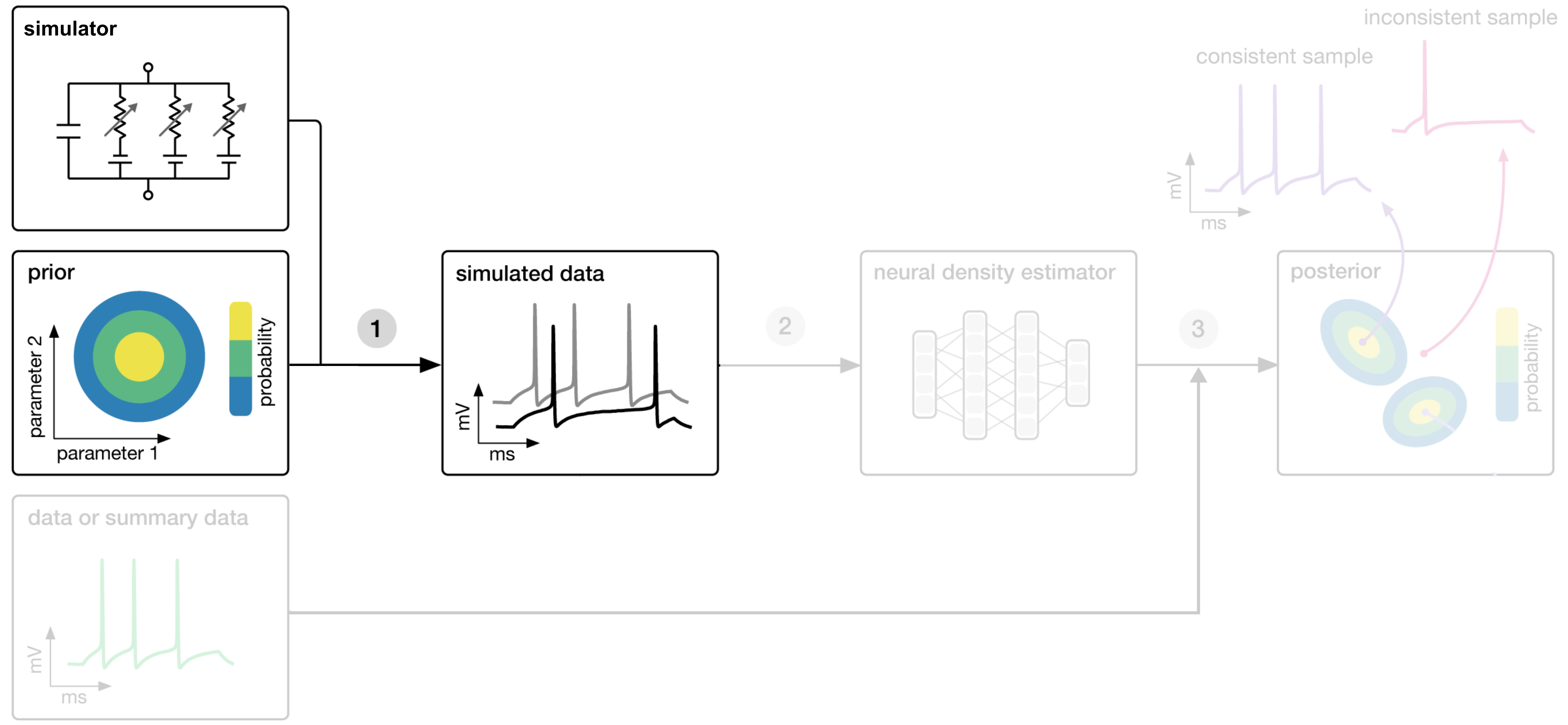
# SBI Toolbox: overview



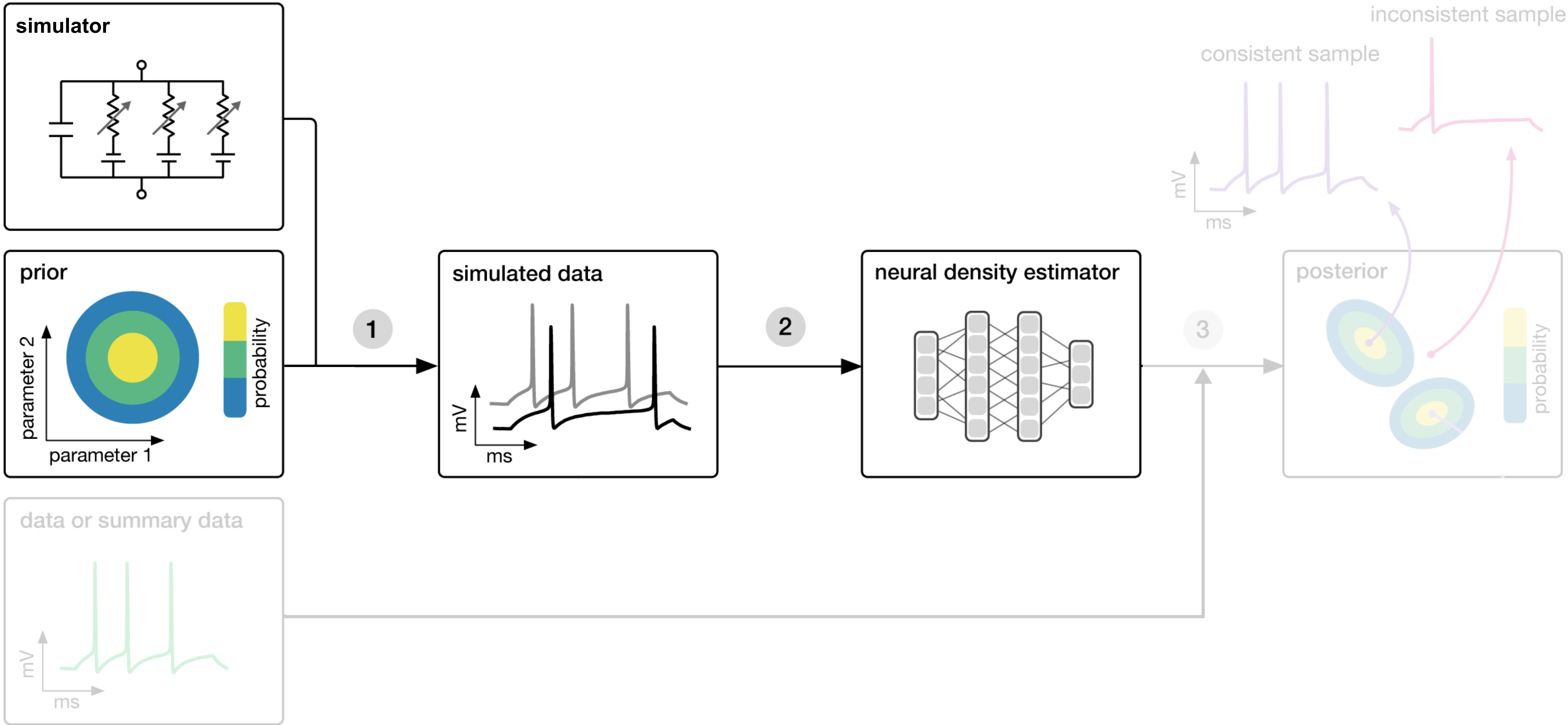
0. Basic ingredients 🍰



# 1. Simulate data

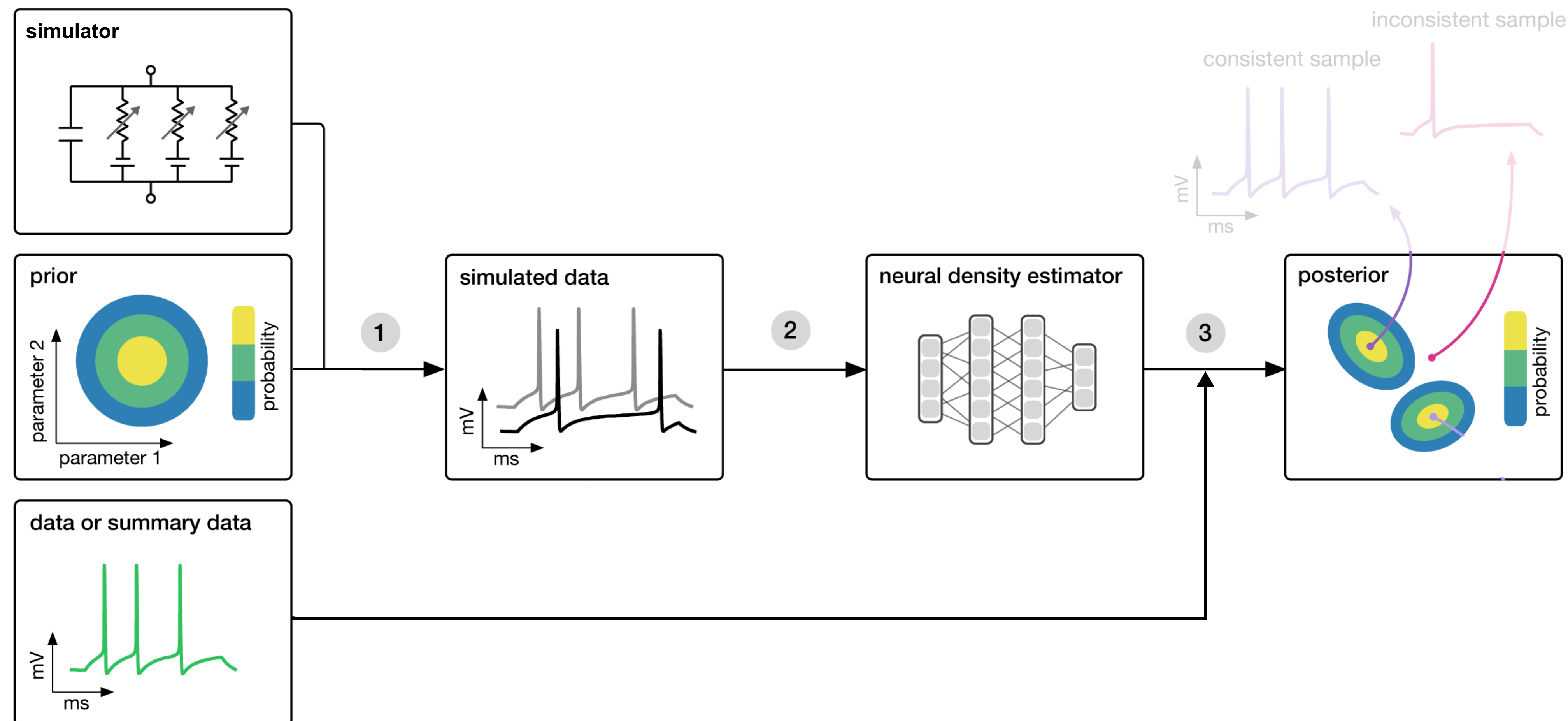


# 2. Pass the simulated data to the inference object



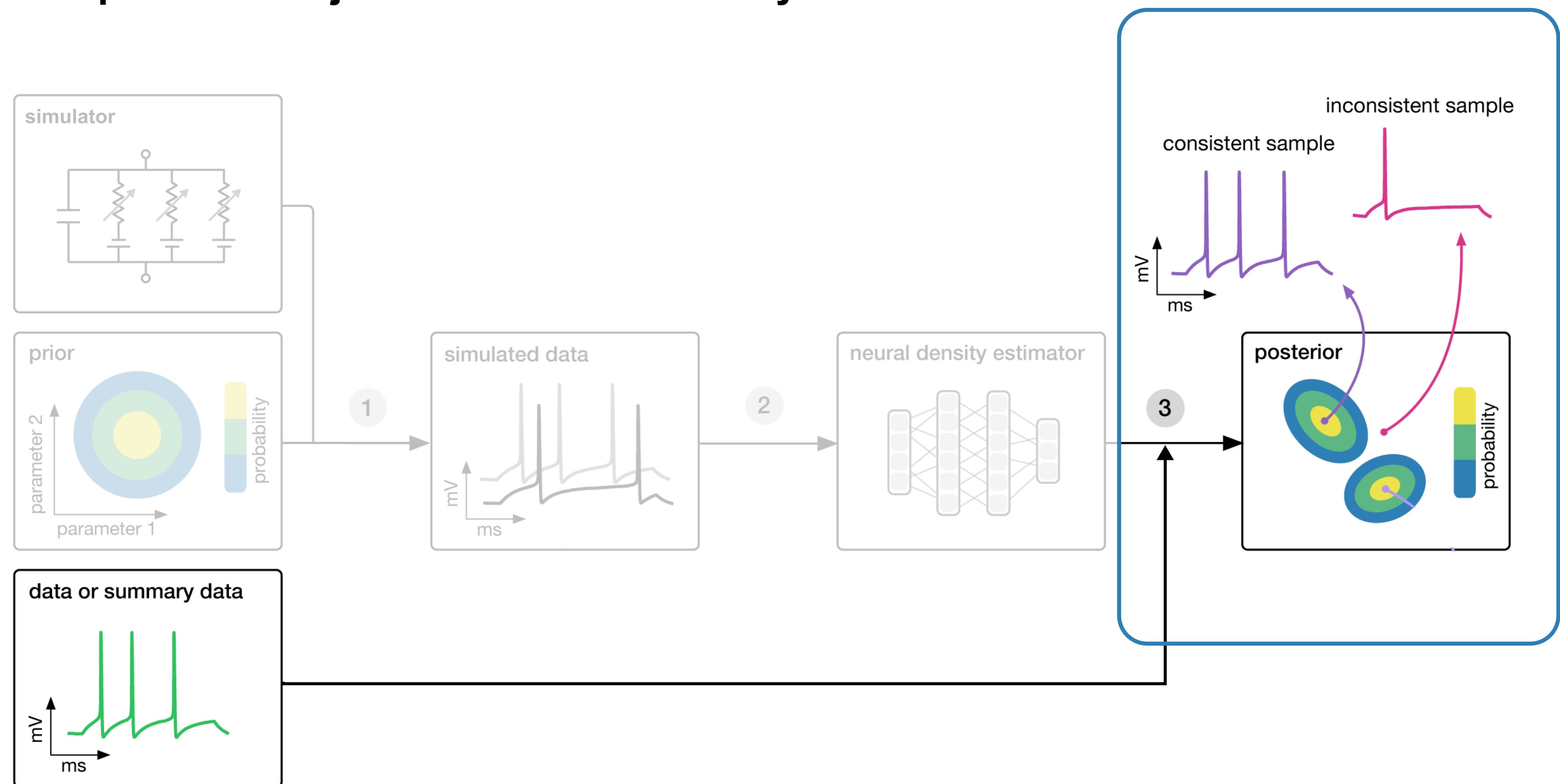


# 3. Build the posterior object from trained density

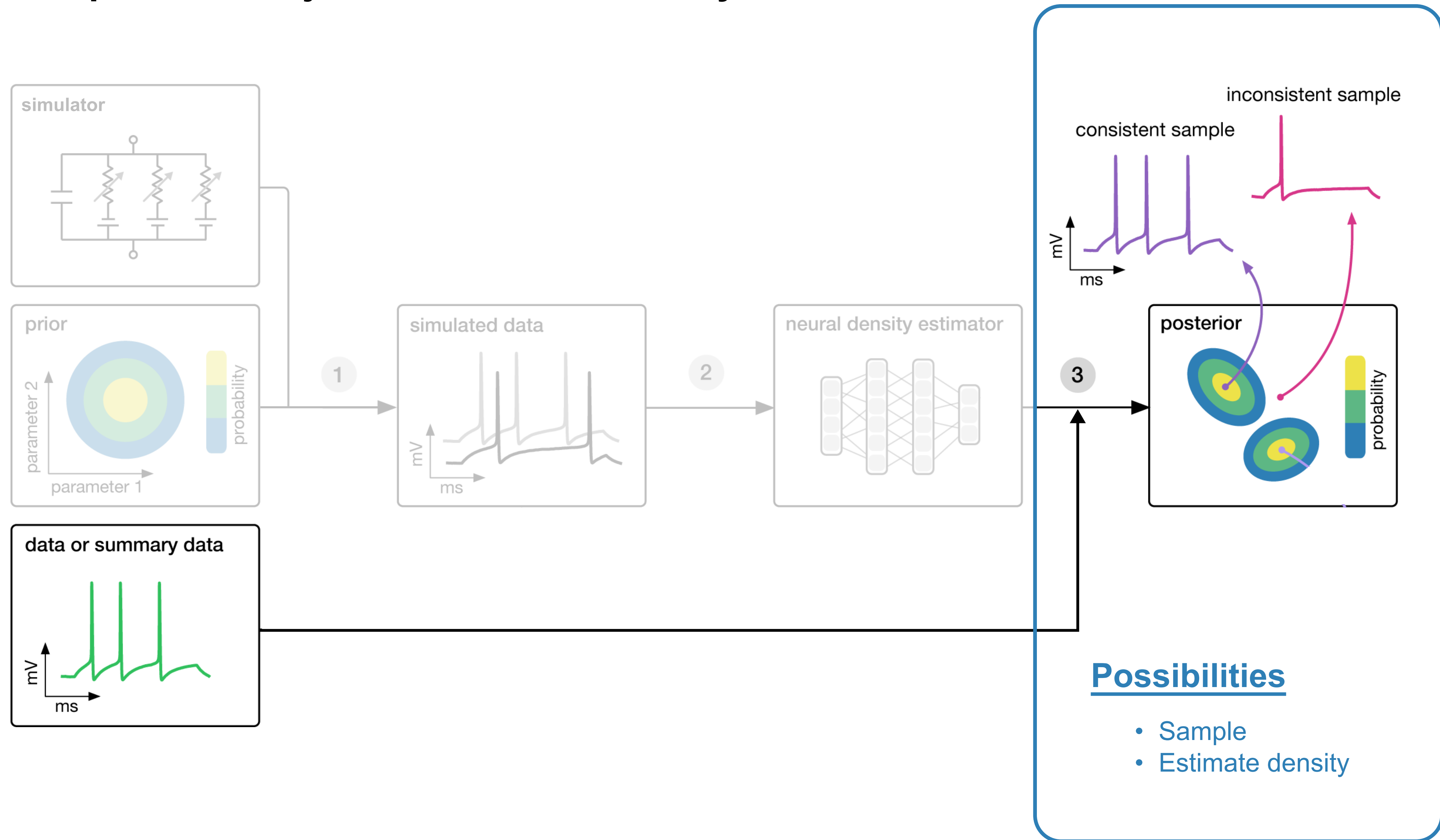




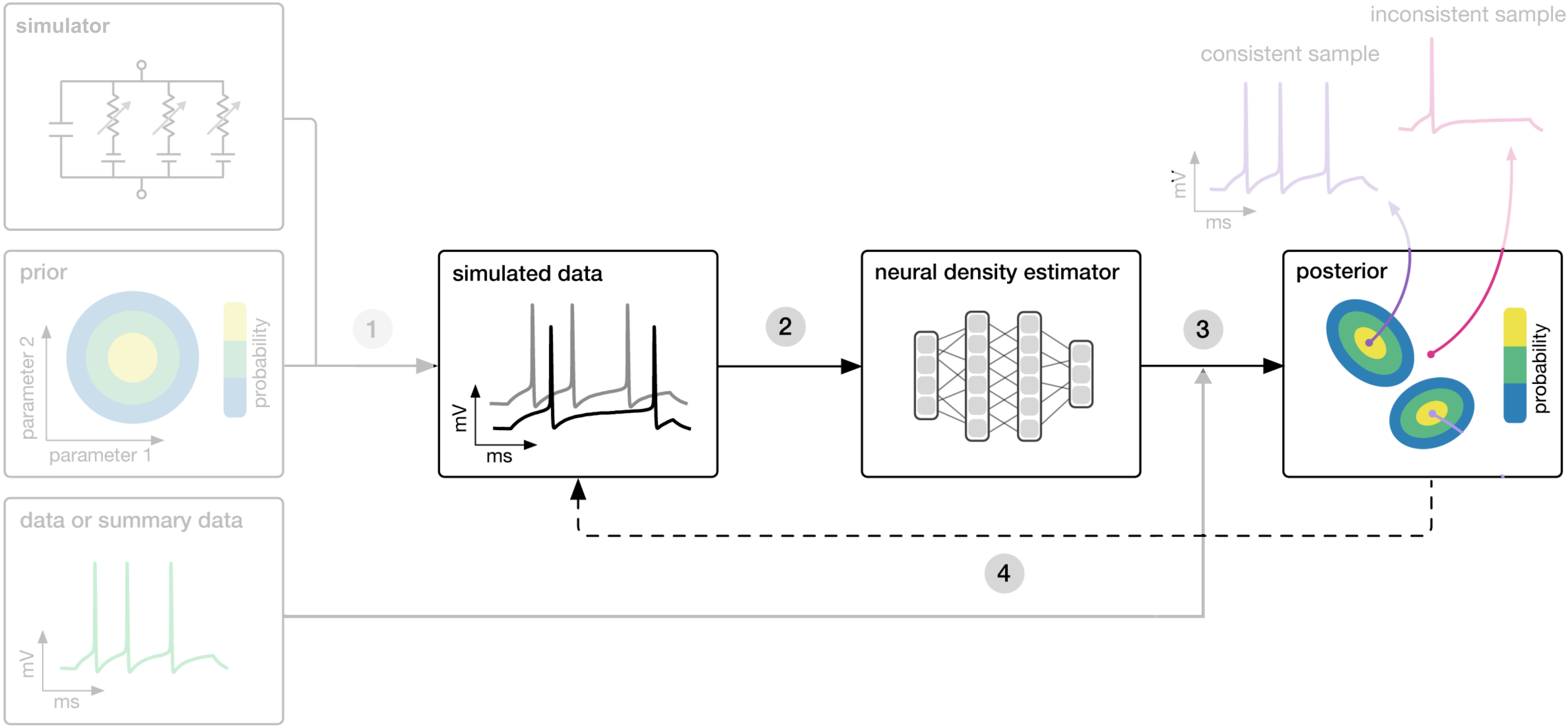
# 3. Build the posterior object from trained density

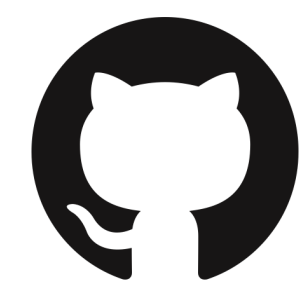


### 3. Build the posterior object from trained density



# 4. Multiround





**<https://github.com/sbi-dev/sbi>**

