Sampling, confidence intervals, likelihood and Bayesian inference

Inference: from samples to population

We rarely measure the whole **population**, but take **samples**.

Then we make inferences from sample to population.

If we sample 30 trees in our neighbourhood...

Can we extrapolate results to

- whole neighbourhood?
- whole city?
- whole country?
- the world?

What's the **suitable population** to make inferences given this sample?

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- To read more: Morey et al (2015)

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- but still 5% of CIs will NOT contain true mean!

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https://pollev.com/franciscorod726

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- If we repeated the experiment, 95% of the CIs would contain the true value of X
- The probability that X is greater than 0 is at least 95%
- The probability that X equals 0 is smaller than 5%

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Bayesian credible intervals

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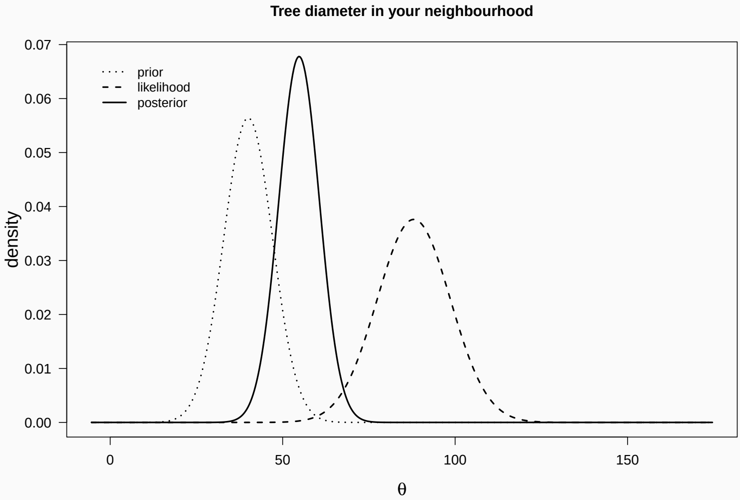
- Frequentist CIs and Bayesian credible intervals can be similar, but not always.

Bayesian inference: prior, posterior, and likelihood

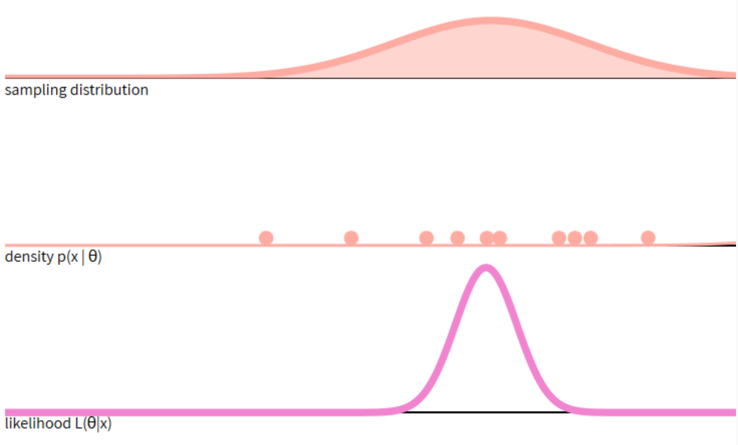
$$P(H|D) \propto P(D|H) \cdot P(H)$$

$$Posterior \propto Likelihood \cdot Prior$$



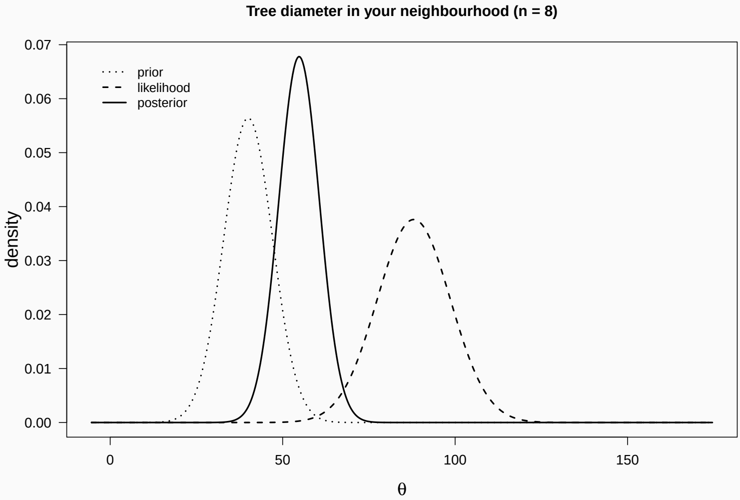
What is the likelihood?

$L(\theta|x) = P(x|\theta)$

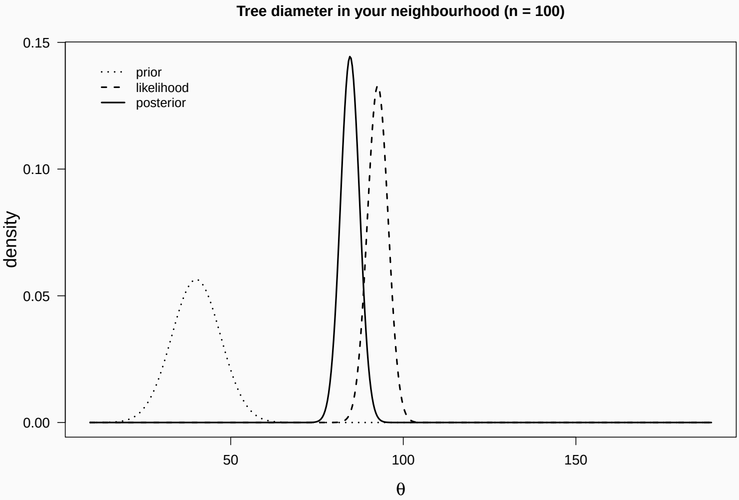


https://seeing-theory.brown.edu/bayesian-inference/index.html

Bayesian inference: prior and likelihood produce posterior



With increasing sample size, likelihood dominates prior



More apps to introduce Bayesian inference

- Bayesian Demo

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- Bayesian inference for a population mean

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- Bayesian t-test

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- Uncertainty / Propagate errors