Advanced Data Analysis in R

Bayesian Modeling in R

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Bayesian Modeling in R

A Thought Exercise

You are already Bayesian!

You just didn't know it!

A Coin

What is the probability a given coin is fair?

Frequentist

If you didn't answer 100% or 0% you're Bayesian!

What is Bayes?

- Named after Rev. Thomas Bayes

```
knitr::include_graphics(here::here("bayesian_modeling", "figs",
```

Bayes Theorem

Prior, Likelihood, Posterior Distribution

Prior

Likelihood

Posterior

Frequentist vs Bayesian Inferences

Bayesian Workflow

Doing Bayesian Inferences

Create A Data Generating Process

Define your data generating process

Generate some fake data from it

Write Your Model

Test it! Write a model, run it and test it.

Domain Specific Languages

BUGS
JAGS
Stan
Hand coded samplers

Enter `brms`

`brms` makes Bayesian Modeling Easy

Utilises Hamiltonian Monte Carlo with a No U-Turn Sampler

Specifying a Model in `brms`

Model Family

Run the Model

Posterior Checks

- Convergence
  - Trace Plots `tracplot`
  - Rhat metrics
  - Effective Sample Size
- Posterior Predictive Intervals
  - Was there a good fit between the model and the data

Inferences

Advantages of Bayesian Analysis

- Takes advantage of expert opinion
  - Especially helpful with small samples size studies
  - Reduces possibility of wildly odd results
- Easier communications (more intuitive to discuss probabilities)
- Studies can build on one another
  - Results from one study can be supplied directly as a prior into a replciation or another study

Drawbacks of Bayesian Inference

- Not as widely utilised in major publications
- Computationally intensive
- Picking a prior

References