

Welcome

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August 19, 2020

Welcome to Stat. 481 Bayesian Statistics

Today:

- ▶ Overview of the class.
- ▶ What subjective probability? Or credibility?
- ▶ Bayes' Rule
- ▶ Probability Simulation and MCMC
- ▶ Book and Safari
- ▶ R and R Studio

Overview

In this class we will be learning about Bayesian Statistics, which is an alternative way of looking at probability and data analysis.

Bayesian Statistics is based on an alternative interpretation of probability. The interpretation can be thought of as *subjective* rather than based on *long-run relative frequency*.

What is the probability the next flip of a coin is Heads?

What is the probability it will rain tomorrow?

Bayes' Rule

- ▶ The formula

$$P(B|A) = \frac{P(A) \times P(A|B)}{P(A) \times P(A|B) + P(A^c) \times P(A^c|B)}$$

- ▶ Simplified formula

$$P(B|A) \propto P(A) \times P(A|B)$$

The steps of bayesian data analysis

Bayesian analysis of data follows these steps:

- ▶ Identify the data relevant to the research questions. What are the measurement scales of the data? Which data variables are to be predicted, and which data variables are supposed to act as predictors?
- ▶ Define a descriptive model for the relevant data. The mathematical form and its parameters should be meaningful and appropriate to the theoretical purposes of the analysis.
- ▶ Specify a prior distribution on the parameters. The prior must pass muster with the audience of the analysis, such as skeptical scientists.

The steps of bayesian data analysis

- ▶ Use Bayesian inference to re-allocate credibility across parameter values. Interpret the posterior distribution with respect to theoretically meaningful issues (assuming that the model is a reasonable description of the data; see next step).
- ▶ Check that the posterior predictions mimic the data with reasonable accuracy (i.e., conduct a “posterior predictive check”). If not, then consider a different descriptive model.

Zoom

We will be using Zoom for class meetings. I will be posting the lectures after class.

Meet some other students in the class. Introduce yourself to the others in your group.