Markov Chain Monte Carlo Methods Interactive Web Learning Tool

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Introduction to a Shiny App

- Interactive web application made with R
- Don't need to know HTML, CSS, or Javascript to make
- Allows for instant changes when the user modifies the input
- App can be hosted on `shinyapps.io` to share with the community

MCMC Methods

Bayesian statistics allows us to update our prior beliefs of some parameter of interest with new collected data to form a posterior distribution. These distributions are functions and it's their integrals we want. Sometimes we can find them and other times we cannot.

Markov chain Monte Carlo methods allow us to find information about those distributions which we can't solve.

1. Markov Chains
   - $Pr(\theta_{n+1}|\theta_1, ..., \theta_n) = Pr(\theta_{n-1}|\theta_n)$
2. Monte Carlo Methods

Algorithms

The two algorithms the app focuses on are the

1. Metropolis-Hasting Algorithm
   a. Pick a random value based on the previous value and with some probability, we either accept or reject that value.
   b. Tuning Parameter: The proposal distribution's variance
2. Hamiltonian Monte Carlo Algorithm
   a. Randomly generate a value for the momentum variable which then moves around in the distribution of interest to give us a value for the position variable.
   b. Tuning Parameter: The proposal distribution's variance, the number of steps, and the size of the steps.

Actual App

▸ Link