# BDA Project: Shiny Hastings

Zarah Weiß

10.02.16

## Outline

## Metropolis Hasting

## Proposal Densities

## Timeline

# Outline

What?

- illustrate efficiency of MH algorithm given different proposal densities

Why?

- trains intuition for choice of proposal density

How?

- use a Shiny App for visualization of the algorithm

# Metropolis Hasting

## Recap

- approximate Bayesian posterior distributions $P(\theta|D)$
- sample large amount of $\theta$ values ($P(\theta)$) from posterior distribution
- estimate posterior's central tendency, HDI, etc.
- belongs to Markov chain Monte Carlo methods
- was introduced in class with Island Hopping example

# Metropolis Hasting

## Requirements

- be able to draw random sample from posterior distribution
- be able to get $P(\theta)$ from posterior distribution for any proposed $\theta$
- be able to generate random value from uniform distribution
- does not need normalized posterior distribution

# Metropolis Hasting

## Algorithm

- current state at $\theta_{cur}$ (initialized randomly)
- propose transition to another state $\theta_{pro}$ based on **proposal distribution**
  - consists of range of possibly proposed transitions
  - consists of probabilities for each proposed transition
- decide whether to accept or reject proposal
  - if $P(\theta_{pro}) > P(\theta_{cur}) : P_{move} = 1$
  - else $P_{move} = \frac{P(\theta_{pro})}{P(\theta_{cur})}$
- draw random sample $s$ from uniform distribution in interval $[0, 1]$
  - if $0 > s \geq P_{move}$: move
  - else: stay
- repeat

# Proposal Densities



Class Example

- had only two values in Kurschke's Island Hopping example
- had probability 0.5 for each value

$\rightarrow$ might have better choices for proposal densities

Random-walk Metropolis

- uses proposal density based on current state $+ \epsilon$
- has different possible densities for $\epsilon$
- is quite popular

Independence Metropolis

- uses proposal density not depend on current state
- has therefore less serial dependence
- might be more efficient

# Timeline

- read up on background by February 22nd
- choose proposal densities to implement by February 26th
- learn Shiny app basics by February 26th
- program Shiny app by March 5th
- write paper / documentation by March 10th
- buffer for too optimistic planning: 5 days