Hierarchical models

Hierarchical models

=

Multi-level models

Hierarchical models

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Multi-level models

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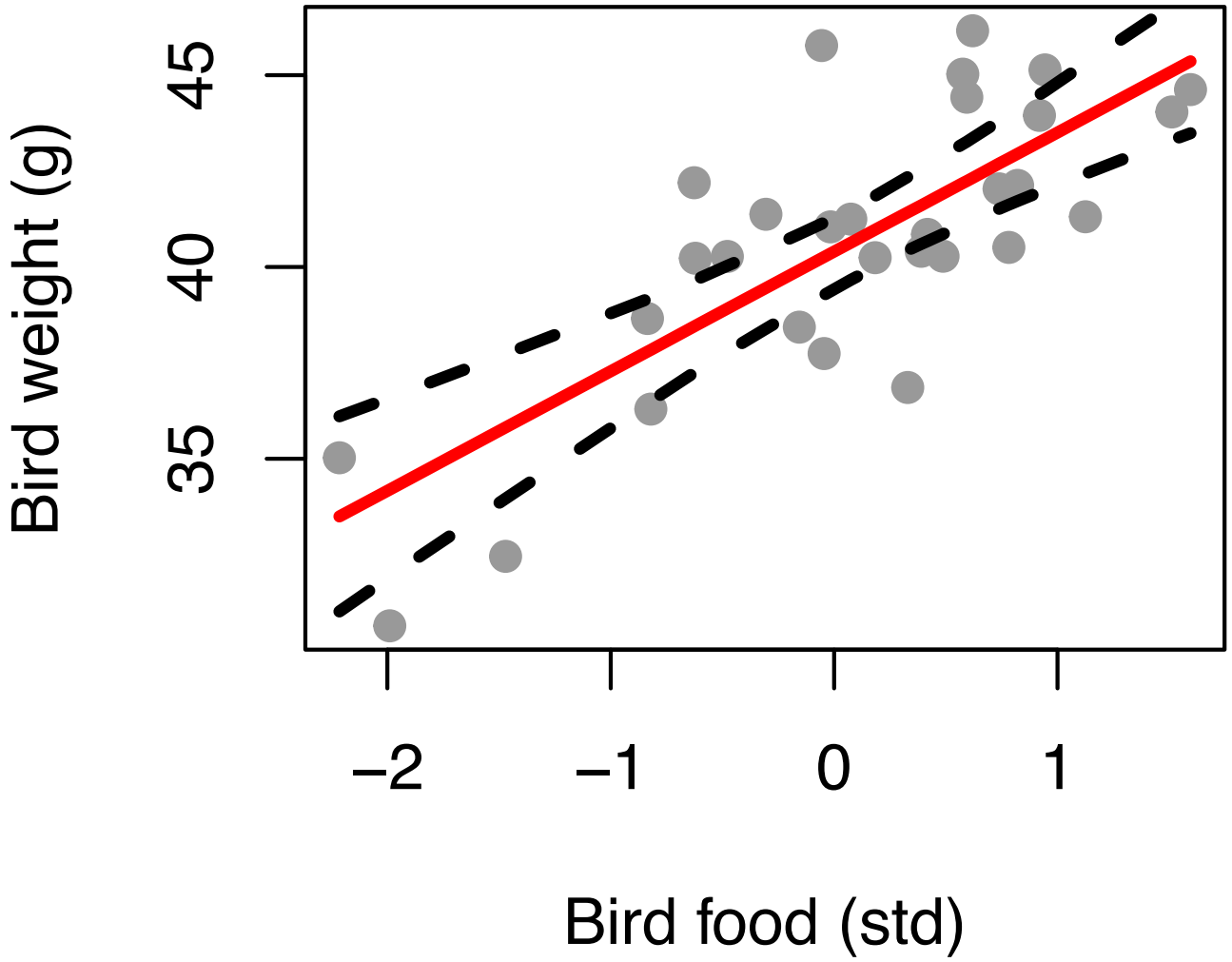
(sometimes)

‘Random effects’ or
‘Mixed effects’ models

http://mfviz.com/hierarchical-models/


Bird weight (g)
35
40
45
−2
−1
0
1
Bird food (std)

$$y_i \sim Normal(\mu_i, \sigma)$$
$$\mu_i = \alpha + \beta \times x_i$$
$$\alpha \sim Normal(50, 15)$$
$$\beta \sim Normal(0, 10)$$
$$\sigma \sim HalfNormal(0, 10)$$

$$y_i \sim Normal(\mu_i, \sigma)$$
$$\mu_i = \alpha_j + \beta \times x_i$$

$$y_i \sim Normal(\mu_i, \sigma)$$
$$\mu_i = \alpha_j + \beta \times x_i$$
$$\alpha_j \sim Normal(50, 10)$$

$$y_i \sim Normal(\mu_i, \sigma)$$

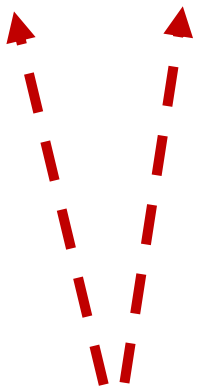
$$\mu_i = \alpha_j + \beta \times x_i$$

$$\alpha_j \sim Normal(50, 10)$$

$$y_i \sim Normal(\mu_i, \sigma)$$

$$\mu_i = \alpha_j + \beta \times x_i$$

$$\alpha_j \sim Normal(\mu_\alpha, \sigma_\alpha)$$



Hyperparameters

$$y_i \sim Normal(\mu_i, \sigma)$$
$$\mu_i = \alpha_j + \beta \times x_i$$
$$\alpha_j \sim Normal(\mu_\alpha, \sigma_\alpha)$$
$$\mu_\alpha \sim Normal(50, 10)$$
$$\sigma_\alpha \sim HalfNormal(0, 10)$$

$$y_i \sim Normal(\mu_i, \sigma)$$
$$\mu_i = \alpha_j + \beta \times x_i$$
$$\alpha_j \sim Normal(\mu_\alpha, \sigma_\alpha)$$
$$\mu_\alpha \sim Normal(50, 10)$$
$$\sigma_\alpha \sim HalfNormal(0, 10)$$
$$\beta \sim Normal(0, 10)$$
$$\sigma \sim HalfNormal(0, 10)$$

5-var-int-simulation.R

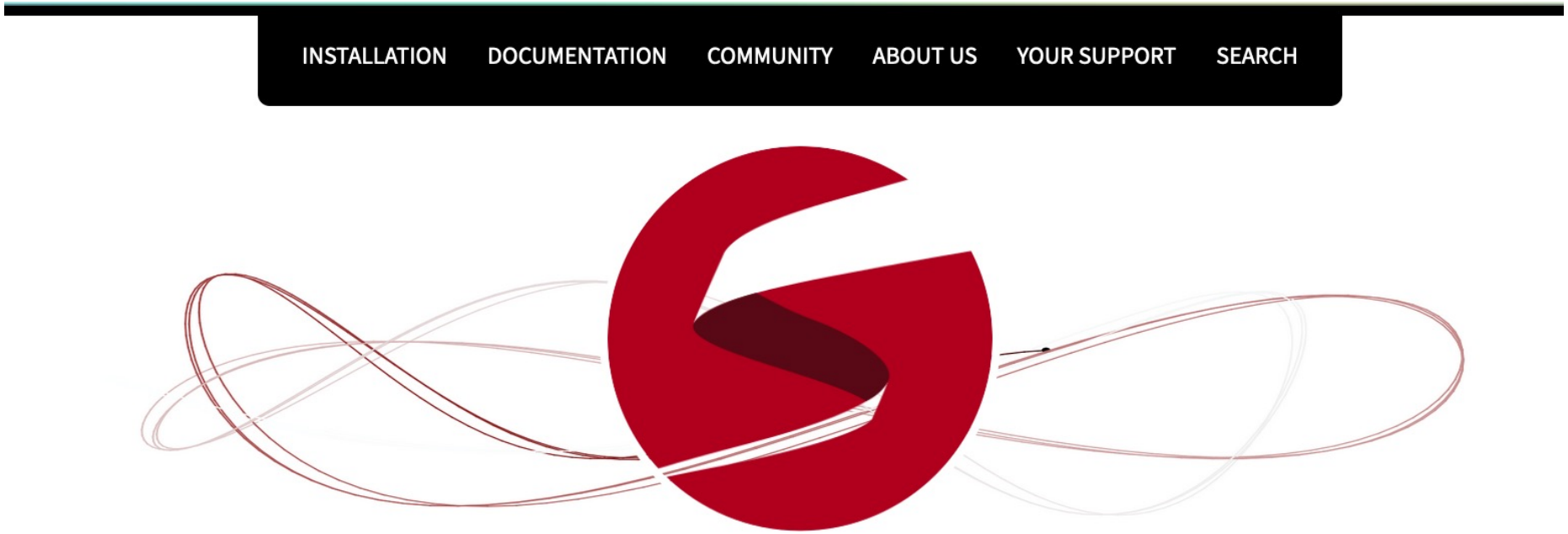
6-var-int-bird-model.stan
6-var-int-bird-model.R

Walk through model

5-var-int-simulation.R

6-var-int-bird-model.stan

6-var-int-bird-model.R

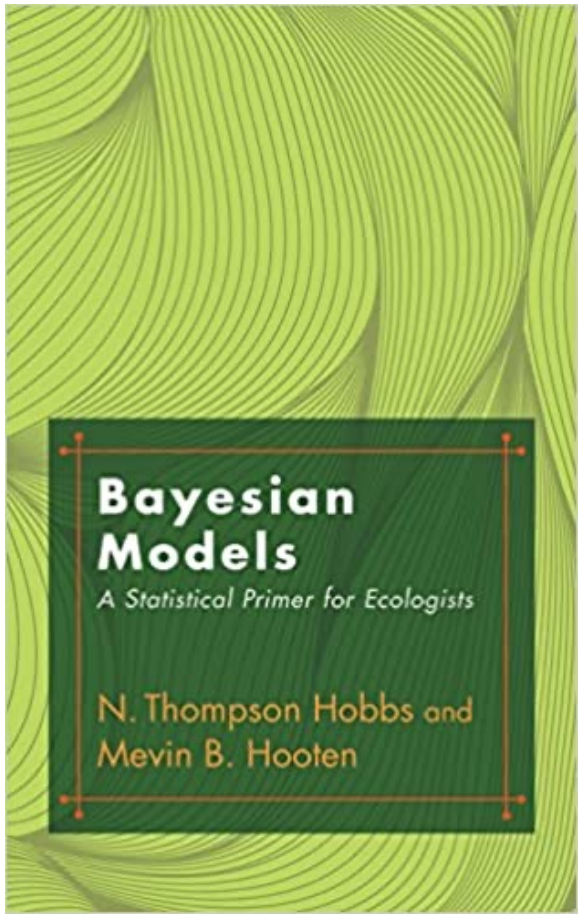


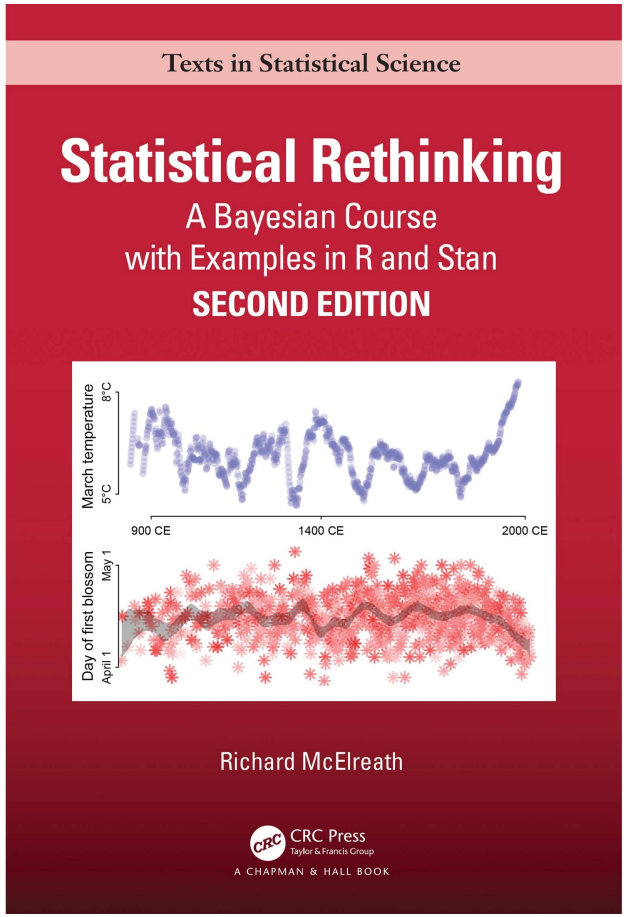
Documentation

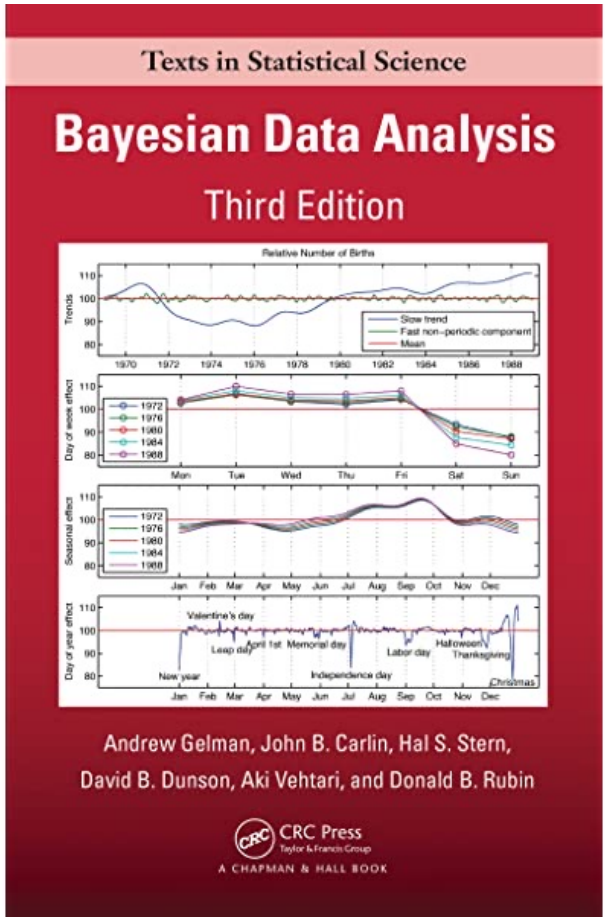
https://mc-stan.org/users/documentation/

rstanarm

brms


Bayesian Models
A Statistical Primer for Ecologists
N. Thompson Hobbs and
Mevin B. Hooten


Texts in Statistical Science
Statistical Rethinking
A Bayesian Course
with Examples in R and Stan
SECOND EDITION
March temperature
8°C
5°C
900 CE
1400 CE
2000 CE
Day of first blossom
May 1
April 1
Richard McElreath
CRC Press
Taylor & Francis Group
A CHAPMAN & HALL BOOK


Texts in Statistical Science
Bayesian Data Analysis
Third Edition
Relative Number of Births
Trends
Slow trend
Fast non-periodic component
Mean
Day of week effect
Seasonal effect
Day of year effect
Valentine's day
Leap day
April 1st
Memorial day
Labor day
Halloween
Thanksgiving
New year
Independence day
Christmas
Andrew Gelman, John B. Carlin, Hal S. Stern,
David B. Dunson, Aki Vehtari, and Donald B. Rubin
CRC Press
Taylor & Francis Group
A CHAPMAN & HALL BOOK

Workshop Survey - Part 1

https://forms.gle/FH7i3Q9LncYd5oLSA

Time (PST)	Presentation title (speaker)
09:00 AM – 09:05 AM	Welcome and Introduction
09:05 AM – 12:00 PM	Intro to hierarchical Bayesian modeling using Stan (Instructor: Youngflesh)
12:00 PM – 01:00 PM	Lunch break
01:00 PM – 04:00 PM	Hierarchical Bayesian modeling for spatial data science (Instructor: Banerjee)