Laboratory 6: GIBBS sampling

Introduction

We must be confident with the GIBBS sampler – this is at the heart of JAGS (Just Another Gibbs Sampler) and OpenBUGS (Open Bayesian inference Using Gibbs Sampling).

Please look very carefully at all exemplar code provided as part of the course.

Objectives:

1. Perfect understanding of transition probabilities for a multistate model.
2. Perfect 2 variable GIBBS sampling

Each lab has at least one file to download from Janux. Sometimes I will include a second R file

Create an R file in RStudio that is well hash commented. Call it Lab6.R

Lastly construct an Rmd file and knit together html and pdf documents – make sure there is a toc. Any mathematical code should be put into Latex in Rmd.

You may use past code supplied as help if you need to. Your code should be well hash commented.

Task 1: Make a function that creates a Posterior from vector h in a multistate discrete MCMC simulation

1. Your job is to create a function that carries out MCMC simulation using a vector h made of the prior*likelihood.
2. This question is completely open ended in order that I can see how much you understand from the material we have covered.
3. Suppose that $\theta =$ seq(0,1,length =length(h))
4. Suppose we only have vector h.
5. q will be a uniform proposal.
6. You may assume the usual Metropolis formulae $\alpha_{ij} = \min\left(1, \frac{h_j}{h_i}\right), p_{ij} = q_j \alpha_{ij}, i \neq j$
7. Call the function `mydmcmc()`:
    a. You must decide on the input parameters.
    b. The function MUST produce P the transition matrix
    c. It MUST produce the Posterior created from the posterior sample.
    d. It MUST produce the Posterior calculated from the vector h.
    e. It MUST produce at least 3 other NON – TRIVIAL plots. (You could use a package like ggplot2 – see my code)
    f. All plots must be finished! (Titled, appropriately colored etc)

Task 2: Make a GIBBS sampler for a Bivariate Normal

1. Using the following result make a Gibbs sampler for the bivariate Normal $f(X,Y)$

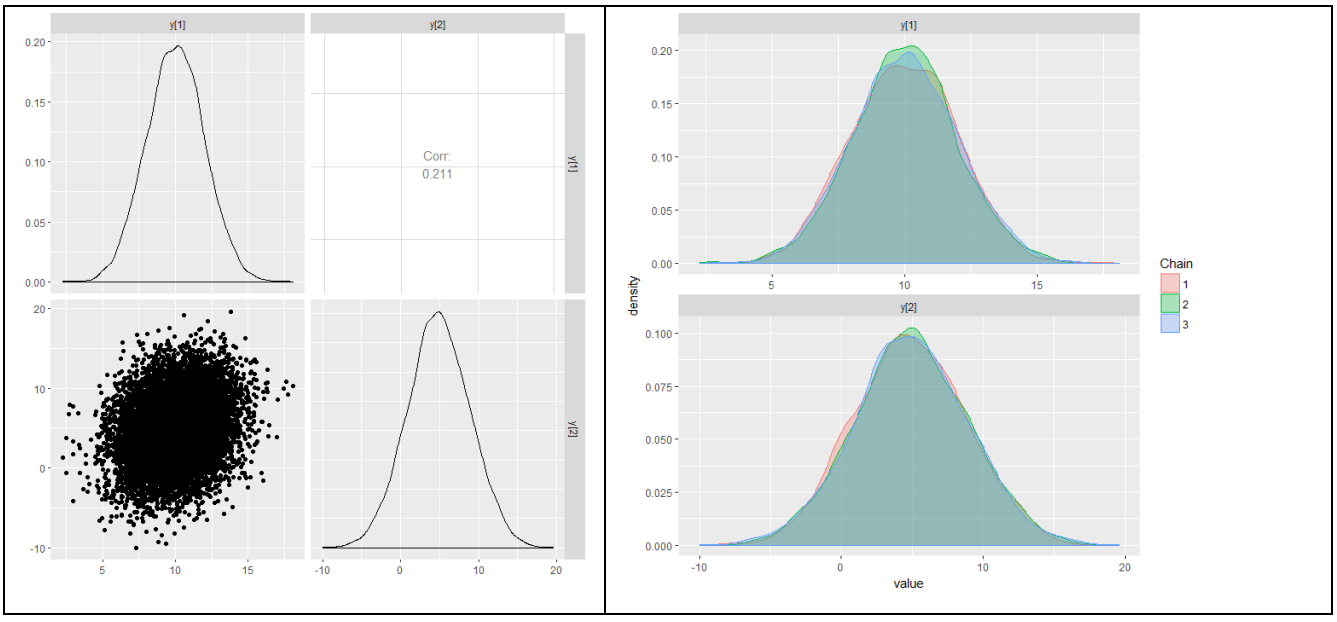
$$Y|X = x \sim N\left(\mu_Y + \frac{\rho\sigma_Y}{\sigma_X}(X - \mu_X), \sigma_Y^2(1-\rho^2)\right)$$

2. See https://onlinecourses.science.psu.edu/stat414/node/118
3. Call your function `myngibbs()`
4. Use appropriate parameter inputs.
5. Your function must produce the following output:
    a. Command line:
        i. MCMC chains for Y and X
        ii. Initial values
    b. Plots:
        i. Bivariate MCMC plots
        ii. Marginals for X and Y
6. Using 10,000 iterations call your function with $\rho = 0.2, \mu_y = 5, \mu_X = 10, \sigma_x = 2, \sigma_y = 4$ and create your plots through the Rmd document by calling the function -- make sure it knits!

Task 3: GIBBS in Jags

Create the following output for the same problem above using Jags and the code supplied – please place this code in the same folder as all of JK's scripts since it will call other functions in the same folder. You will need a new library(ggmcmc)

The file used is called Jags-ExampleScript-lab6.R



Bayesian Data Science:

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