Practical implementation in Bayesian statistics

Georgios P. Karagiannis @ MATH3341/4031 Bayesian statistics III/IV (practical implementation)

Back to README

Aim

The handout aims at familiarising students with the statistical package RJAGS, and with more 'sophisticated' Bayesian hierarchical models than those in the Lecture handouts.

Students will be able to:

- use RJAGS package in R, by using the reference material, for the statistical analysis of Bayesian hierarchical models.
- compute MC approximations of the posterior quantities of a given Hierarchical model

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Preview:

- README
- Monte Carlo approximation: An intoduction for practical use in R
- Case study: Space shuttle Challenger disaster
  - Bernoulli model with conjugate priors (questions)
  - Bernoulli model with conjugate priors (solutions)
  - Bernoulli regression model (questions)
  - Bernoulli regression model (solutions)
  - Bernoulli regression model -variable selection (questions)
  - Bernoulli regression model -variable selection (solutions)
- Exercises for practise :
  - Normal model (questions)
  - Normal model (solutions)

Reference list

The material below is not examinable material, but it contains references that students can follow if they want to further explore the concepts introdced.

- References for *RJAGS*:
  - JAGS homepage

  - JAGS R CRAN Repository
  - JAGS Reference Manual
  - JAGS user manual
- Reference for *R*:
  - Cheat sheet with basic commands for *R*
- Reference of *rmarkdown* (optional)
  - R Markdown cheatsheet
  - R Markdown Reference Guide
  - knitr options
- Reference for *Latex* (optional):
  - Latex Cheat Sheet

Setting up the computing environment

CIS computers

From AppHub, load the modules:

1. Google Chrome
2. LaTex
3. rstudio

Your personal computers (Do not do it on CIS computers)

There is not need to do this in CIS computers as the required foftware is (supposed to be) properly installed.

The instructions below are at your own risk...

We recommend the use of LINUX operation system.

Briefly, you need to do the following:

1. Install LaTex (optional but recommended)
   - Source: download it from https://www.tug.org/texlive/acquire-netinstall.html
   - Debian: *apt-get install texlive-full*
   - Fedora: *yum install texlive texlive-latex*
   - windows: download it from https://miktex.org/howto/install-miktex
   - macos: download it from https://www.tug.org/mactex/
2. Install R computing environment version R 2.14.0 or later.
   - Source: download it from here: https://cran.r-project.org/
   - Debian: *sudo apt install r-base*
   - Fedora: *yum install -y R*
   - windows: download it from https://cran.r-project.org/
     - I recomend tyou to install *Rtools* as well, for you to be able to instal R packages.

- macos: download it from https://www.tug.org/mactex/

3. Install the latest Rstudio (recommended)
   - Any OS: Download it from here: https://www.rstudio.com/products/rstudio/download/

Install of JAGS

For any OS:

Details for installing JAGS can be found in:

- http://mcmc-jags.sourceforge.net/
- https://cran.r-project.org/web/packages/rjags/INSTALL

Briefly:

1. Uninstall any existing RJAGS if possible. In R terminal run:
   ```
   > remove.packages("rjags")
   > if (file.exists(".RData")) file.remove(".RData")
   ```
2. Restart R
3. Install RJAGS. In R terminal run:
   ```
   > install.packages("rjags", repos = "https://cloud.r-project.org/", dependencies =
   TRUE)
   ```

This handout

To download this handout, run rstudio, and do the following

1. Go to File > New Project > Version Control > Git
2. In the section *Repository URL* write
   - https://github.com/georgios-stats/Bayesian_Statistics.git
   - ... and complete the rest as you wish
3. Hit *Create a Project*

... this will download some material of the course. This handout is in folder *PracticalHandout*.

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