

Introduction to the Bayesian Exercises

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Schedule

Monday:

14:40 - 15:30: Lecture part I

Tuesday:

9:00 - 10:15: Lab part I

10:45 - 12:00: Lecture part II

13:00 - 14:15: Lecture part III

14:15 - 16:30: Lab part II

Lab part I:

- Get everyone set up with R and RStudio (If not done yet)
- Introduction to R
- Start with the exercises (In particular conjugate analysis)

Lab part II:

- Continue with the exercise (Finishing conjugate, MCMC methods)

All materials (Bayes lecture slides, Introduction to R, Exercises To Do, Solutions) are available and ready to download at :

<https://github.com/WolfgangWaltenberger/oeawai/tree/master/Bayes>

Setting up R and RStudio

Download and install R depending on your system from:
<https://cran.r-project.org>

Download and install the **free** RStudio depending on your system from:
<https://www.rstudio.com/products/rstudio/download/#download>



Download and installation takes around 10-15 minutes but no more software is needed!

Necessary R packages and further software

Make sure to install the following R packages before you knit the R Markdown files:

- bookdown
- pscl
- invgamma
- MASS
- truncnomr
- rjags
- coda

Further (for exercise 8) make sure to download and install JAGS from:
<https://sourceforge.net/projects/mcmc-jags/>

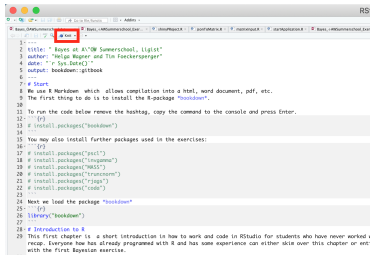
Set up of the lab

Three R Markdown files:

- 1 Bayes_OeAWSummerschool_IntroR.Rmd:
Introduction to R and how to code in R
- 2 Bayes_OeAWSummerschool_Exercises_ToDo.Rmd:
Bayes exercises on conjugate analysis and MCMC methods
accordingly to what was shown in the lecture
- 3 Bayes_OeAWSummerschool_Exercises_Solutions.Rmd:
Solution of the exercises

Let's get started:

- 1 Open "Bayes_OeAWSummerschool_IntroR.Rmd"
- 2 Install the packages by deleting the `#` and running the code
- 3 After installing add the `#` to each line again (otherwise you cannot knit the file)
- 4 To compile the R Markdown press *knitr*



```
1 title: "Bayes at AWSummerschool, I list"
2 author: "Helge Wagner and Tim Foerckersperger"
3 date: "r Sys.Date()"
4 output: bookdown::gitbook
5 ---
6 #> Start
7 # We use R Markdown which allows compilation into a html, word document, pdf, etc.
8 The first thing to do is to install the R-package "bookdown".
9
10 To run the code below remove the hashtag, copy the command to the console and press Enter.
11
12 # install.packages("bookdown")
13
14 You may also install further packages used in the exercises:
15
16 #> {r}
17 # install.packages("paci")
18 # install.packages("linguama")
19 # install.packages("WASS")
20 # install.packages("rstanarm")
21 # install.packages("rjags")
22 # install.packages("coda")
23
24 Next we load the package "bookdown"
25
26 #> {r}
27 library("bookdown")
28
29 # Introduction to R
30 This first chapter is a short introduction to how to work and code in RStudio for students who have never worked
31 recap. Everyone who has already programmed with R and has some experience can either skip over this chapter or enter
32 with the first Bayesian exercise.
```

Exercises Overview

The file of the exercise is

Bayes_OeAWSummerschool_Exercises_ToDo.Rmd. Questions are asked and chunk of codes are to be filled in. The solutions can be found in *Bayes_OeAWSummerschool_Exercises_Solutions.Rmd*.

Conjugate Analysis:

- Exercise 1: Posterior inference for the Binomial model
- Exercise 2: Posterior inference for the Poisson model
- Exercise 3: Normal model with known variance
- Exercise 4: Normal model, mean and variance unknown

MCMC methods:

- Exercise 5: Gibbs sampling - Linear regression analysis
- Exercise 6: Gibbs sampling with data augmentation- Probit model
- Exercise 7: Metropolis-Hastings for sampling from a Student-distribution
- Exercise 8: Metropolis-Hastings sampling- Logit model

Have fun and don't hesitate if you got questions :-)