Advanced Methods: Bayesian Statistics with R

Constituting Session

Oliver Lindemann

Erasmus University Rotterdam, NL

Introduction to Bayesian Statistics with R

- Dr. Oliver Lindemann
  - Email: lindemann@essb.eur.nl
- Workshop
  - 19. Feb.–23. Feb. 2018 (9:00–15:00)
  - Room: 2.14.0.18
  - Website: `http://bit.ly/bayes2018`

What is Bayesian Statistics?

Procedure

Theory → **Hypothesis** → Experiment → **Data** → Statistics

What does now the *p*-value tell us?

$$p(\text{Data}|\neg\text{Hypothesis})$$

But what do we actually what to know from the data?

$$p(\text{Hypothesis}|\text{Data})$$

But… $p(\text{Hypothesis}|\text{Data}) \neq p(\text{Data}|\neg\text{Hypothesis})$

Thomas Bayes (1701 – 1761)

Bayes Theorem

$$p(H|D) = \frac{p(D|H)\ p(H)}{p(D)}$$

Aims of this Course

- Recent developments in behavioral statistics
  - critical view on frequentist interference (i.e., *classical* statistics)
- Basic principles of Bayes statistics
  - understanding the some mathematical principles
  - Markov-chain-Monte-Carlo (MCMC) sampling
- **Hands on experiences in conducting Bayesian analyses**
  - Using R and the sampling software JAGS (later more)

Outline

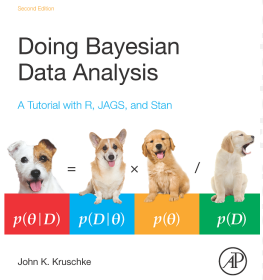
1. Bayesian analysis of beliefs and probabilities
   - mathematical and procedural basics
   - MCMC sampling
   - coin flips, coin flips, coin flips …
2. Bayesian Data analysis for psychologist
   - Bayesian *t*-test
   - Bayesian ANOVAs
   - Bayesian regressions
   - Bayesian confidence intervals
   - Bayesian model comparison
3. Maybe
   - Bayesian Cognitive Processes Models
   - Hierarchical Linear Model/Linear Mixed Models

Key readings

Kruschke, John K.(2015) *Doing Bayesian Data Analysis* (2nd Edition), Academic Press, Amsterdam.

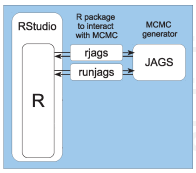
~ 45 Euro via `http://bit.ly/2D6vGPR`

Further literature will be provide during the course



Technical Requirements

- preferable: own laptop
- Only free software
- Bayesian Modelling
  - **R 3.1**
  - **RStudio OpenSource Edition**
  - **JAGS 3.4**
- "SPSS"-like statistical software package
  - Jasp



Links

R	`http://cran.us.r-project.org/`
RStudio	`http://www.rstudio.com/products/rstudio/download/`
JAGS	`https://sourceforge.net/projects/mcmc-jags/files/JAGS/4.x/`
Jasp	`https://jasp-stats.org/`