

Seminar: Neuro-cognitive models for reasoning and memory

Organizer: Marco Ragni

Assistant: Julia Wertheim

Blockseminary: 06.02.2017 – 07.02.2017 09:00-16:00 at Technical Faculty

First meeting (assignment of topics): **24.10.2016 16:00** at Technical Faculty

Rooms: Can be soon found under www.cc.uni-freiburg.de/teaching

Objective: This seminar gives a technical introduction to basic techniques for stochastic and computational modeling of cognitive processes. We will work through the book by

Michael D. Lee and Eric-Jan Wagenmakers (2013):

Bayesian Cognitive Modeling: A Practical Course

Cambridge University Press

The first two parts of the book can be found online:

https://webfiles.uci.edu/mdlee/LeeWagenmakers2013_Free.pdf

Background knowledge: You should have a basic understanding of (or read about):

1. Probability distribution (e.g., to be found in the book above)
2. Graph structures (some basics)
3. Working memory, e.g., http://www.scholarpedia.org/article/Working_memory

Requirements:

(1) Read the first two chapters above

(2) Present your selected topic

- a. **each student needs to present at least 30 Minutes + 5-10 Minutes questions):** Teach all other participants methods and fundamental knowledge for one of the topics below. Select the material and be as instructive as possible
- b. **Present the respective code and cognitive model in your talk**
(Code can be found here: <http://bayesmodels.com/>)

(3) Write a short summary/tutorial of the papers and the model

(2-3 pages, about 2500 words: What is the result? Can there be improvements? Are there any specifics worth mentioning? etc.)

(4) Send everything no later than January 17, 2017 to

Julia Wertheim <ju.wertheim@googlemail.com>

Topics (Part 3 in the book above):

Chapter 7: Bayesian model comparison

- Scheibehenne, B., Rieskamp, J., & Wagenmakers, E.-J. (2013). Testing adaptive toolbox models: A Bayesian hierarchical approach. *Psychological Review*, 120, 39–64. <http://scheibehenne.de/ScheibehenneRieskampWagenmakers2013.pdf>
- Wagenmakers, E.-J., Lodewyckx, T., Kuriyal, H., & Grasman, R. (2010). Bayesian hypothesis testing for psychologists: A tutorial on the Savage–Dickey method. *Cognitive Psychology*, 60, 158–189. <https://lirias.kuleuven.be/bitstream/123456789/277829/1/CP.pdf>

Chapter 8: Comparing Gaussian means

E.g.,

- Wetzels, R., Raaijmakers, J. G. W., Jakab, E., & Wagenmakers, E.-J. (2009). How to quantify support for and against the null hypothesis: A flexible WinBUGS implementation of a default Bayesian t test. *Psychonomic Bulletin & Review*, 16, 752–760.
<http://www.raaijmakers.edu.fmg.uva.nl/PDFs/Wetzels%20et%20al%20PBR%202009.pdf>

Chapter 9: Comparing binomial rates

E.g.,

- Wagenmakers, E.-J., Lodewyckx, T., Kuriyal, H., & Grasman, R. (2010). Bayesian hypothesis testing for psychologists: A tutorial on the Savage-Dickey method. *Cognitive Psychology*, 60, 158–189.
<https://lirias.kuleuven.be/bitstream/123456789/277829/1/CP.pdf>

Chapter 10: Memory retention

E.g.,

- Shiffrin, R. M., Lee, M. D., Kim, W., & Wagenmakers, E.-J. (2008). A survey of model evaluation approaches with a tutorial on hierarchical Bayesian methods. *Cognitive Science*, 32, 1248–1284.
<https://webfiles.uci.edu/mdlee/ShiffrinEtAl2008.pdf>

Chapter 11: Signal detection theory

E.g.,

- Lee, M. D. (2008). BayesSDT: Software for Bayesian inference with signal detection theory. *Behavior Research Methods*, 40, 450–456.
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.335.3052&rep=rep1&type=pdf>
- Lee, M. D. (2008). Three case studies in the Bayesian analysis of cognitive models. *Psychonomic Bulletin & Review*, 15, 1–15.
<http://www.socsci.uci.edu/~mdlee/Lee2008.pdf>

Chapter 13: Extrasensory perception

E.g.,

- Wagenmakers, E.-J., Wetzels, R., Borsboom, D., van der Maas, H. L. J., & Kievit, R. A. (2012). An agenda for purely confirmatory research. *Perspectives on Psychological Science*, 7, 627–633.
<http://www.fon.hum.uva.nl/paul/methoden/lit/Wagenmakers2012.pdf>

Chapter 14: Multinomial processing trees

E.g.,

- Matzke, D., Dolan, C. V., Batchelder, W. H., & Wagenmakers, E.-J. (in press). Bayesian estimation of multinomial processing tree models with heterogeneity in participants and items. *Psychometrika*.
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.715.9459&rep=rep1&type=pdf>

Chapter 15: The SIMPLE model of memory

E.g.,

- Shiffrin, R. M., Lee, M. D., Kim, W., & Wagenmakers, E.-J. (2008). A survey of model evaluation approaches with a tutorial on hierarchical Bayesian methods. *Cognitive Science*, 32, 1248–1284.
<https://webfiles.uci.edu/mdlee/ShiffrinEtAl2008.pdf>

Chapter 16: The BART model of risk taking

E.g.,

- van Ravenzwaaij, D., Dutilh, G., & Wagenmakers, E.-J. (2011). Cognitive model decomposition of the BART: Assessment and application. *Journal of Mathematical Psychology*, 55, 94–105.
<http://ejwagenmakers.com/2011/vanRavenzwaaijEtAl2011BART.pdf>

Chapter 17: Generalized context model

E.g.,

- Lee, M. D. & Wetzels, R. (2010). Individual differences in attention during category learning. In R. Catrambone & S. Ohlsson (Eds.), *Proceedings of the 32nd Annual Conference of the Cognitive Science Society*, pp. 387–392. Austin, TX: Cognitive Science Society.
<http://csjarchive.cogsci.rpi.edu/proceedings/2010/papers/0065/paper0065.pdf>
- Bartlema, A., Lee, M., Wetzels, R., & Vanpaemel, W. (2014). A Bayesian hierarchical mixture approach to individual differences: Case studies in selective attention and representation in category learning. *Journal of Mathematical Psychology*, 59, 132-150.
<https://ppw.kuleuven.be/okp/pdf/Bartlema2014ABHMA.pdf>

Chapter 18: Heuristic decision-making

E.g.,

- Lee, M. D. & Newell, B. R. (2011). Using hierarchical Bayesian methods to examine the tools of decision-making. *Judgment and Decision Making*, 6, 832–842.
<http://www.socsci.uci.edu/~mdlee/LeeNewell2011.pdf>

Chapter 19: Number concept development

E.g.,

- Lee, M. D. & Sarnecka, B. W. (2010). A model of knower-level behavior in number-concept development. *Cognitive Science*, 34, 51–67.
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.717.4009&rep=rep1&type=pdf>
- Lee, M. D. & Sarnecka, B. W. (2011). Number knower-levels in young children: Insights from a Bayesian model. *Cognition*, 120, 391–402.
<http://cogsci-dev.ss.uci.edu/cogdev/Sarnecka/LeeSarnecka2011.pdf>