

Discipline: [Methods]

1. Language

English

2. Title

Bayesian Modeling

3. Lecturer

Thomas Otter, Goethe Universität, Frankfurt

Joachim Büschken, Katholische Universität Eichstätt-Ingolstadt

4. Date and Location

2019, September 23-26

Goethe-University Frankfurt am Main

5. Course Description

5.1 Abstract and Learning Objectives

The past 30 years have seen a dramatic increase in the use of modern Bayesian methods that facilitated the development and estimation of theoretically meaningful empirical models in marketing and other disciplines. This course will focus on recent developments and applications of Bayesian statistical methods in marketing. However, the tools and models discussed apply in a wide context of micro-econometric and psychometric applications.

The course targets students who are interested in Bayesian inference with an eye towards adapting existing micro-econometric and psychometric models or developing and estimating new models. Our goal is to develop computing skills so that you can work somewhat more independently from pre-programmed software that sometimes constrains theory development and testing.

5.2 Schedule and content (including start and end time)

Day 1	Thomas Otter
9:00 – 10:15	Introduction to Bayesian analysis – basic concepts and comparison to frequentist inference
10:15 – 10:45	<i>Assignment 1</i> : Beta-Binomial example (with coffee)
10:45 – 12:00	Model DAGs, conditional posterior distributions, Gibbs-sampling, data augmentation
Lunch	----
13:00 – 13:30	<i>Assignment 2</i> : connect models to DAGs, derive conditional distributions
13:30 – 14:45	Metropolis-Hastings sampling, convergence and sampling efficiency
14:45 – 15:15	<i>Assignment 3</i> : homogenous logit example (with coffee)
15:15 – 16:30	Hamiltonian-Monte-Carlo sampling, NUTS as implemented in STAN
16:30 – 17:00	<i>Assignment 4</i> : homogenous logit example revisited (with coffee)
17:00 – 17:15	Wrap up day 1
Day 2	Joachim Büschken
9:00 – 10:15	Introduction to the (linear) Bayesian regression model and estimation via Gibbs sampling (see supplied R code)
10:15 – 10:45	<i>Assignment 5</i> : simulate data from regression model and run model (with coffee)
10:45 – 12:00	Application of Bayesian data augmentation: ordinal probit regression model
Lunch	---
13:00 – 13:30	<i>Assignment 6</i> : Customer satisfaction analysis
13:30 – 14:45	Discussion of results and model extensions (e.g. scale use)
14:45 – 15:15	<i>Assignment 7</i> : evidence for scale use heterogeneity in the CS data (with coffee)
15:15 – 16:30	Modeling through the prior: the Bayesian variable selection regression model
16:30 – 17:00	<i>Assignment 8</i> : (with coffee): simulate data from variable selection model
17:00 – 17:15	Wrap up day 2

Day 3	Joachim Büschken
9:00 – 10:15	Estimation of the variable selection model
10:15 – 10:45	<i>Assignment 9</i> : what “drives” CS and what not (assignment 6 revisited)? (with coffee)
10:45 – 12:00	Introducing heterogeneity: latent class regression model
Lunch	---
13:00 – 13:30	<i>Assignment 10</i> : simulate data from LC model
13:30 – 14:45	Estimation of the Bayesian LC model
14:45 – 15:15	<i>Assignment 11</i> : heterogeneity in CS drivers? Evidence from the LC model (with coffee)
15:15 – 16:30	The linear hierarchical Bayes regression model
16:30 – 17:00	<i>Assignment 12</i> : simulate data from linear HB model (with coffee)
17:00 – 17:15	Wrap up day 3

Day 4	Thomas Otter
9:00 – 10:15	Hierarchical Bayes models – “The” HB-logit model
10:15 – 10:45	<i>Assignment 13</i> : Estimate HB-logit, compare to MLE (with coffee)
10:45 – 12:00	Flexibility and (economic) faithfulness for the hierarchical prior
Lunch	
13:00 – 13:30	<i>Assignment 14</i> : Compare different hierarchical prior formulations
13:30 – 14:45	Bayesian model comparison
14:45 – 15:15	<i>Assignment 15</i> : Bayesian mediation analysis (with coffee)
15:15 – 16:30	Examples of recent developments
16:30 – 17:00	<i>Assignment 16</i> : (with coffee)
17:00 – 17:15	Wrap up

5.3 Course format / Kursformat

Class sessions will be a mixture of discussion, lecture and demonstration. The main reference is the book Bayesian Statistics and Marketing by Rossi, Allenby and McCulloch (Wiley, 2005).

6. Preparation and Literature

6.1 Prerequisites

We will be using the open source statistical package "R" that can be downloaded and installed freely from the Internet (see <http://www.r-project.org/>). R is a comprehensive data analytical environment. Routines for estimating various models discussed in Rossi et al. (2005) are available in the R-package bayesm. Because modern Bayesian inference is computationally intensive, we will also look into ways to interface R with C++ using RcppArmadillo (see <http://dirk.eddelbuettel.com/code/rcpp.armadillo.html>) to substantially increase computational speeds. Finally, we will also take a look at <http://mc-stan.org/>, a recent attempt at feasible 'automatic' Bayesian inference with an eye towards user friendliness. Previous experience with R is a definite advantage, but not required from course participants. We expect basic statistics/econometrics knowledge from participants. However, see the next point.

6.2 Essential Reading Material

It is a very good idea to work through pages 279-303 and 323-327 in the book by Rossi et al. in preparation for the course. It is also a very good idea to bring a laptop with a working installation of R, the bayesm package, and RStudio.

6.3 Additional Reading Material / zusätzliche Lektüre

Will be distributed as needed during the course.

7. Administration

7.1 Max. number of participants / Maximale Teilnehmerzahl

20

7.2 Exam / Prüfungsleistung

Grading for the course consists of 4 homework assignments. The last of these assignments is a take-home assignment, the other 3 are to be completed over the course of the seminar. All course assignments are individual assignments.

7.3 Credits / Punkte

6 ECTS