EST5104 Bayesian Inference
EST5803 Advanced Bayesian Inference

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Presentation

Start date: 06/08/2018
End date: 05/12/2018

Monday 14:00 - 16:00 ICMC-USP (Room 5-104)
Wednesday 14:00 - 16:00 ICMC-USP (Room 5-104)

Objectives

Develop Bayesian techniques for data analysis and interpretation.

Rationale

To understand how to combine past and present information to take decisions it is essential to discuss Bayesian principles.
Content

1. Discussion on frequentist and bayesian statistical methods.
2. Basic concepts of the bayesian paradigm: Bayes theorem, prior and posterior probability distributions.
3. Subjective, Jeffreys, hierarchical and conjugate prior distributions.
4. Introduction to decision theory: loss functions, posterior decision analysis, bayesian parametric estimators.
5. Bayesian hypothesis tests. Hierarchical models.
The Reverend Thomas Bayes.
\[ P(A|B) = \frac{P(B|A) P(A)}{P(B)} \]
the theory that would not die how Bayes’ rule cracked the enigma code,
Bibliography


James O. Berger
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CHAPTER 1: Basic Concepts
CHAPTER 2: Utility and Loss
CHAPTER 3: Prior Information and Subjective Probability
CHAPTER 4: Bayesian Analysis
CHAPTER 5: Minimax Analysis
CHAPTER 6: Invariance
CHAPTER 7: Preposterior and Sequential Analysis
CHAPTER 8: Complete and Essentially Complete Classes
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3. GENERALISATIONS  
4. MODELLING  
5. INFERENCE  
6. REMODELLING
Anthony O’Hagan
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4 Subjective probability
5 Non-subjective theories
6 Subjective prior distributions
7 Robustness and model comparison
8 Computation
9 The Linear Model
10 Other Standard Models
Helio S. Migon, Dani Gamerman, Francisco Louzada
Chapman and Hall/CRC, 2014
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Dani Gamerman & Hedibert Lopes
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Chapter 1. Stochastic simulation
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Chapter 3. Approximate methods of inference
Chapter 4. Markov chains
Chapter 5. Gibbs sampling
Chapter 6. Metropolis-Hastings algorithms
Chapter 7. Further topics in MCMC
Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, Donald B. Rubin
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**Part I: Fundamentals of Bayesian Inference**
1. Probability and inference  
2. Single-parameter models  
3. Introduction to multiparameter models  
4. Asymptotics and connections to non-Bayesian approaches  
5. Hierarchical models  

**Part II: Fundamentals of Bayesian Data Analysis**
6. Model checking  
7. Evaluating, comparing, and expanding models  
8. Modeling accounting for data collection  
9. Decision analysis  

**Part III: Advanced Computation**
10. Introduction to Bayesian computation  
11. Basics of Markov chain simulation
12 Computationally efficient Markov chain simulation
13 Modal and distributional approximations

Part IV: Regression Models
14 Introduction to regression models
15 Hierarchical linear models
16 Generalized linear models
17 Models for robust inference
18 Models for missing data

Part V: Nonlinear and Nonparametric Models
19 Parametric nonlinear models
20 Basis function models
21 Gaussian process models
22 Finite mixture models
23 Dirichlet process models
Computational Resources

The R Project for Statistical Computing

The Stan Project for high-performance statistical computation

JAGS Just Another Gibbs Sampler
Assessment

**EST5104 - Bayesian Inference**

Credits: 7

2 written examinations, $P_1$ and $P_2$. Final grade ($NF$) will be computed as,

$$NF = (2P_1 + 3P_2)/5$$

**EST5803 - Advanced Bayesian Inference**

Credits: 10

2 written examinations, $P_1$ and $P_2$. Final grade ($NF$) will be computed as,

$$NF = (3P_1 + 3P_2 + T)/7$$

where $T$ is the average of home works.