EST5104 Bayesian Inference
EST5803 Advanced Bayesian Inference

Ricardo Ehlers
ehlers@icmc.usp.br
http://www.icmc.usp.br/~ehlers

Departamento de Matemática Aplicada e Estatística
Universidade de São Paulo

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 techiniques for data analysis and interpretation.

Rationale

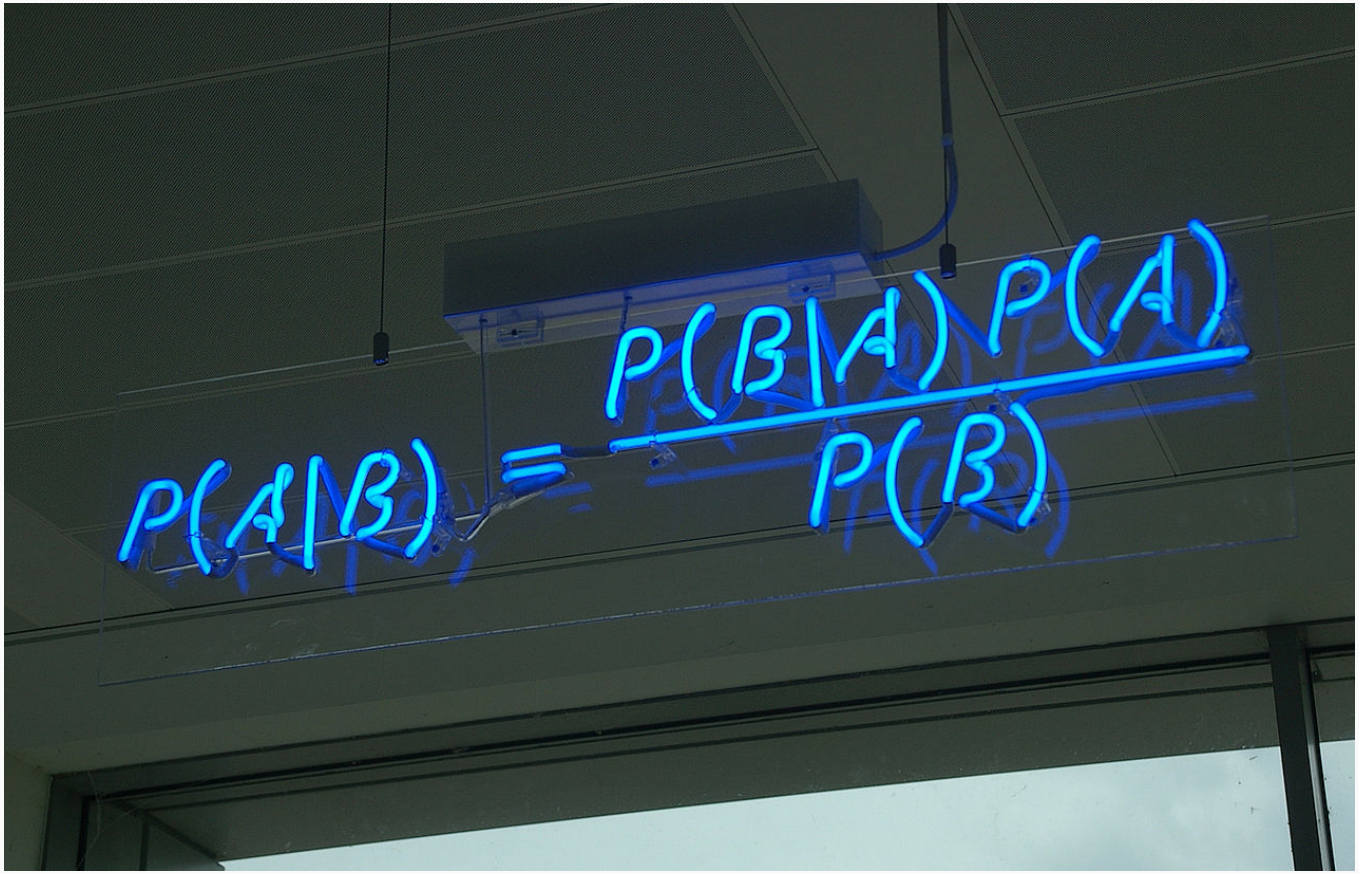
To understand how to combine past and present information to take decisions it is essential to discuss Bayesian principles.

Content

1. Discussion on frequestist and bayesian statistical methods.
2. Basic concepts of the bayesian paradigm: Bayes theorem, prior and posterior probability distributions.
3. Subjective, Jeffreys, hierachical and conjugate prior distributions.
4. Introduction to decision theory: loss functions, posterior decision analysis, bayesian parametric estimators.
5. Bayesian hypothesis tests. Hierarchical models.
6. Bayesian computations. Markov chain Monte Carlo methods.

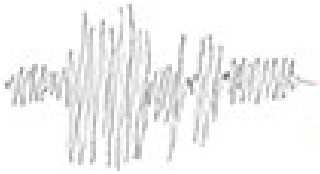
The Reverend Thomas Bayes.

Rev. T. Bayes

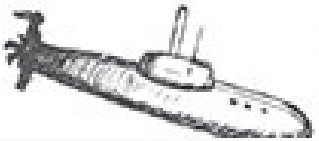

P(A|B) = P(B|A) P(A) / P(B)

the theory 

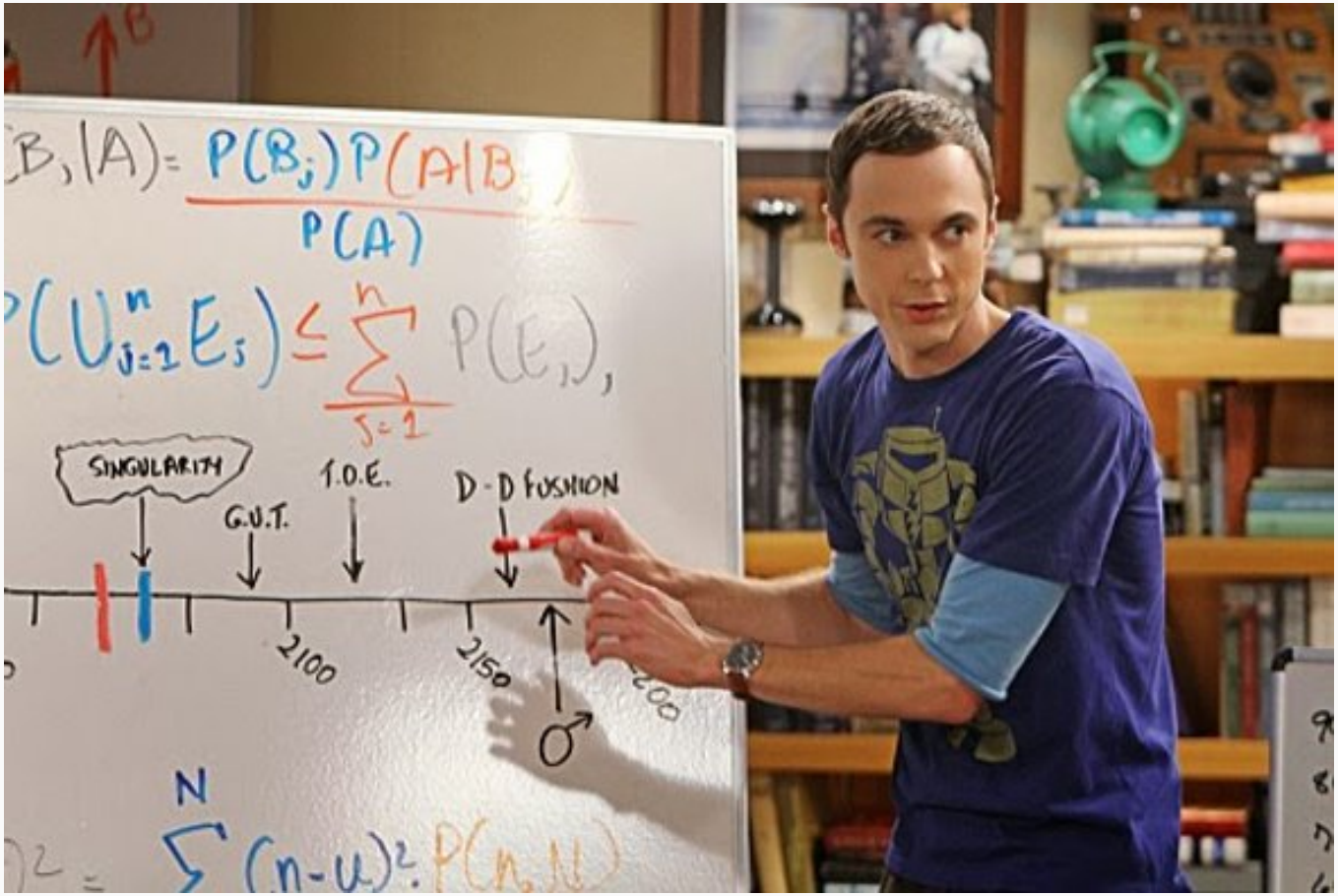
 that would

 not die 

how bayes' rule cracked

 the enigma code,


MAKING MONEY WITH
BAYES THEOREM


SINGULARITY
G.U.T.
T.O.E.
D - D FUSION
2100
2150

Bibliography

BERGER, J.O. Statistical Decision Theory and Bayesian Analysis. 2nd ed. Springer-Verlag. 1985.

Bernardo, J.M., Smith, A.F.M. Bayesian theory. New York: John Wiley and Sons, 1994.

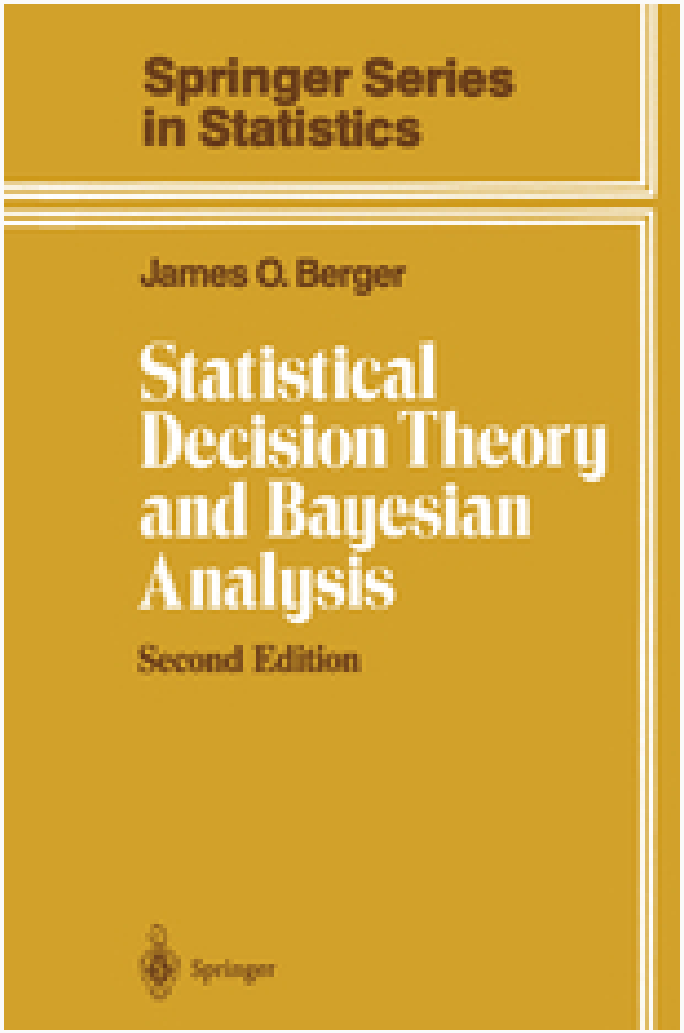
CONGDON, P. Applied Bayesian Modelling. Second Edition. John Wiley & Sons, 2014.

GAMERMAN, D. & LOPES, H.F. Markov Chain Monte Carlo. Chapman & Hall, 2006.

GELMAN, A.; CARLIN, J. B.; STERN, H.S.; RUBIN, D.B. Bayesian Data Analysis. 2nd ed. Chapman & Hall, 2004.

OHAGAN, A. Bayesian Inference. Kendalls Advanced Theory of Statistics, vol. 2B. Arnold, London, 1994.

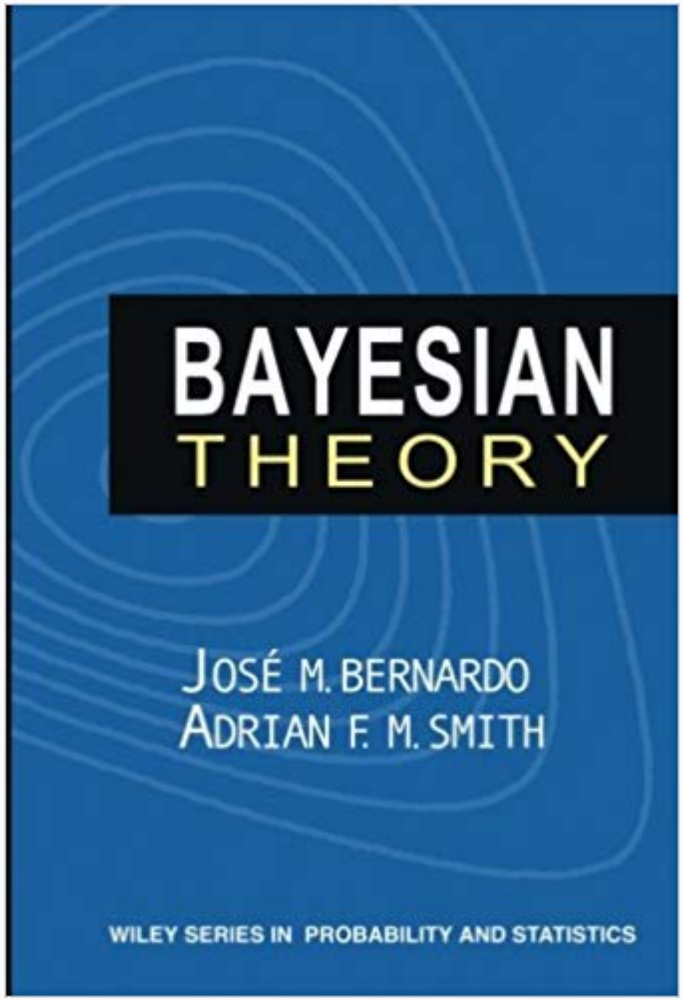
PAULINO, C.D.; TURKMAN, M.A.A. & MURTERA, B. Estatística Bayesiana. Fundação Calouste Gulbenkian – Lisboa, 2003.



James O. Berger
Statistical Decision Theory and Bayesian Analysis Springer, 1985.

Table of contents

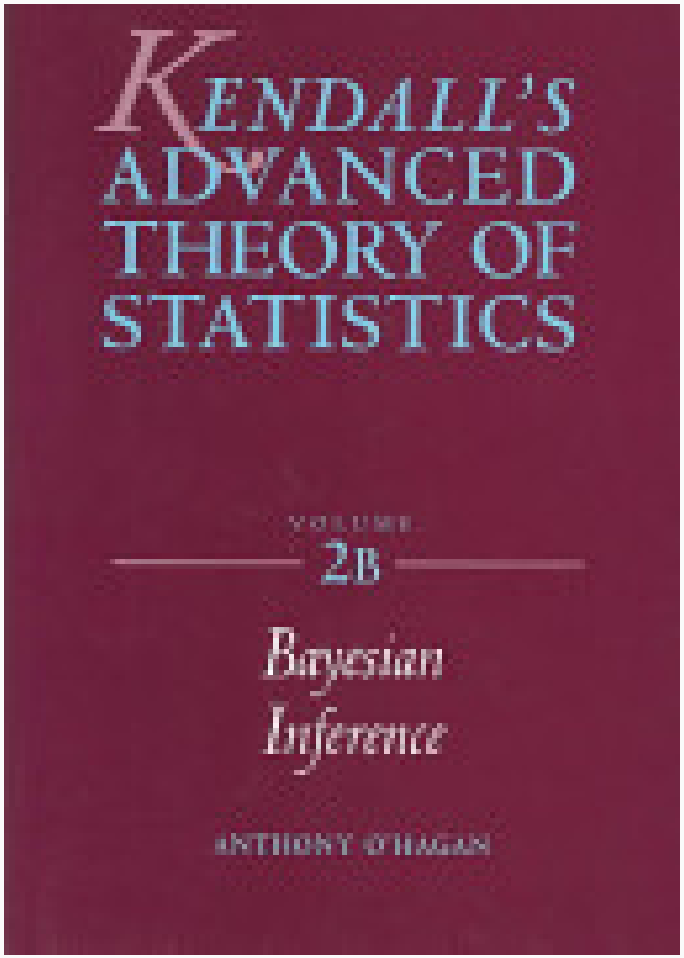
CHAPTER 1: Basic Concepts
CHAPTER 2: Utility and Loss
CHAPTER 3: Prior Information and Subjective Probability
CHAPTER 4: Bayesian Analysis
CHAPTER 5: Minimax Analysis
CHAPTER 6: Invariance
CHAPTER 7: Preposterior and Sequential Analysis
CHAPTER 8: Complete and Essentially Complete Classes



Bernardo, J.M., Smith, A.F.M. Bayesian Theory. New York: John Wiley and Sons, 1994.

Table of contents

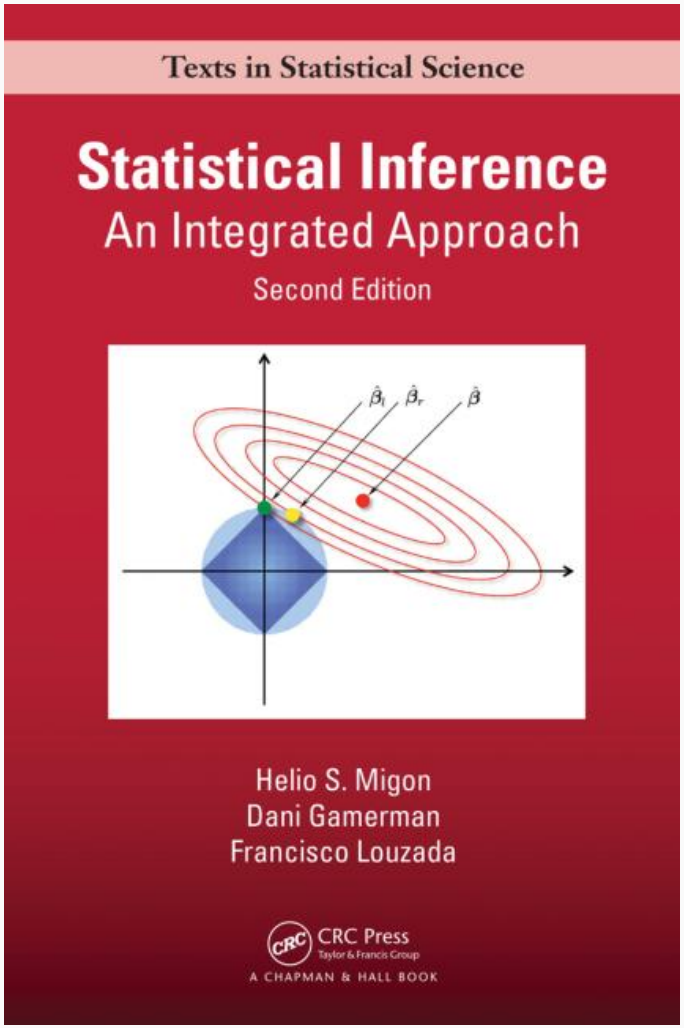
1. INTRODUCTION
2. FOUNDATIONS
3. GENERALISATIONS
4. MODELLING
5. INFERENCE
6. REMODELLING



Anthony O'Hagan
Kendall's Advanced Theory of Statistics: Bayesian inference. Volume 2B, Volume 2,Parte 2 Edward Arnold, 1994

Table of contents

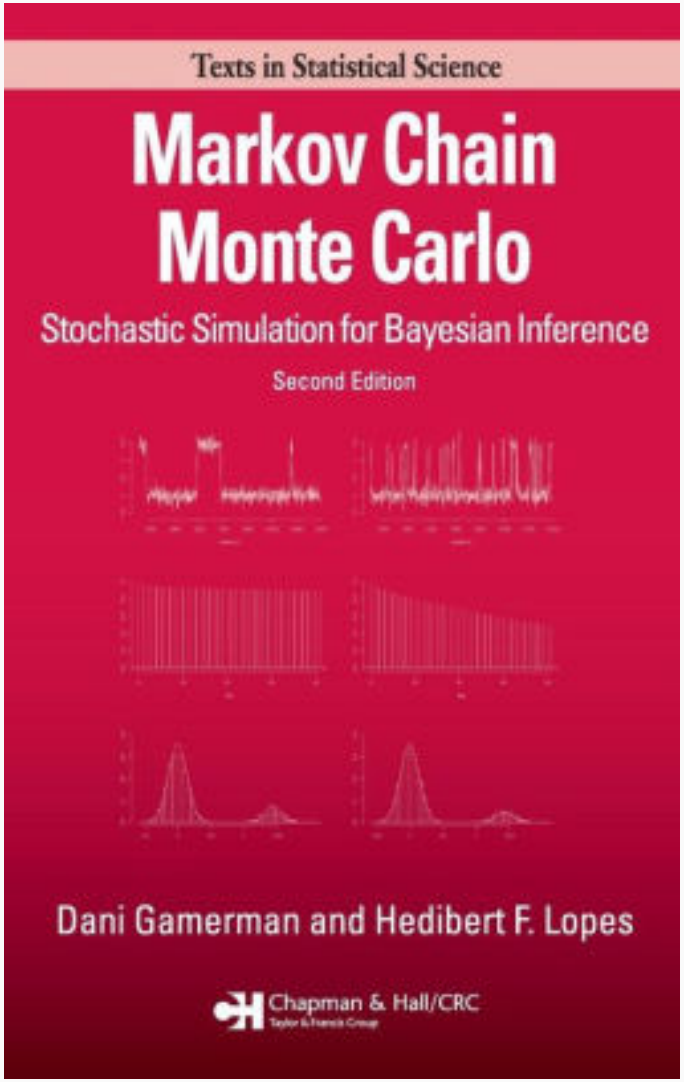
1 The Bayesian method
2 Inference and decisions
3 General principles and theory
4 Subjective probability
5 Non-subjective theories
6 Subjective prior distributions
7 Robustness and model comparison
8 Computation
9 The Linear Model
10 Other Standard Models



Helio S. Migon, Dani Gamerman, Francisco Louzada
Statistical Inference: An Integrated Approach, Second Edition
Chapman and Hall/CRC, 2014

Table of Contents

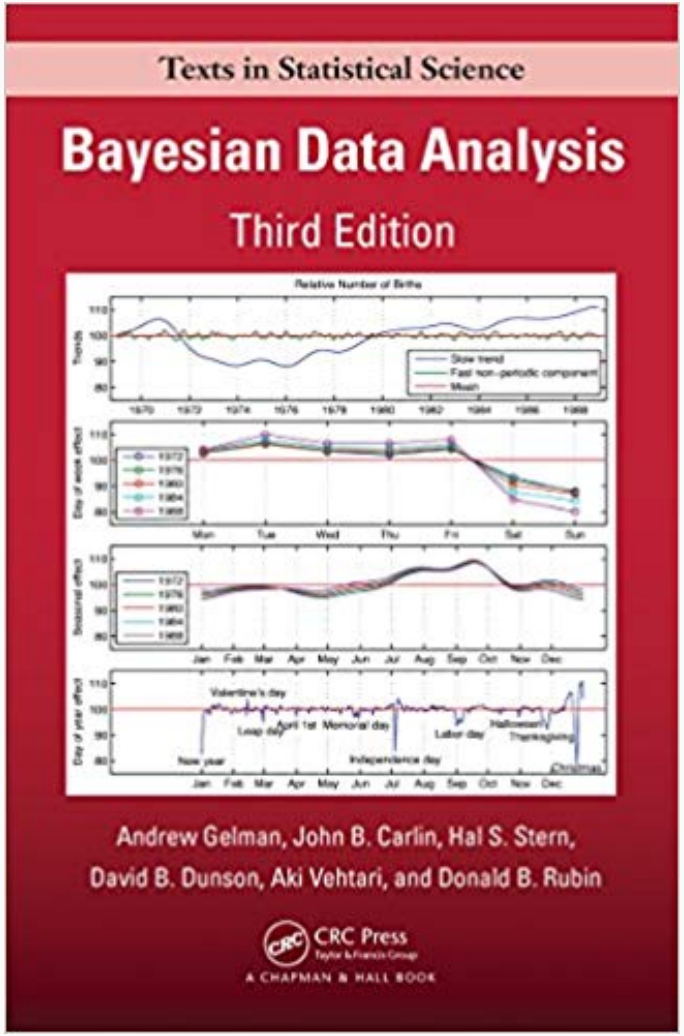
1 Introduction
2 Elements of Inference
3 Prior Distribution
4 Estimation
5 Approximating Methods
6 Hypothesis Testing
7 Prediction
8 Introduction to Linear Models



Dani Gamerman & Hedibert Lopes
Markov Chain Monte Carlo: Stochastic Simulation for Bayesian Inference (Second Edition) Chapman & Hall, 2006

Table of Contents

Chapter 1. Stochastic simulation
Chapter 2. Bayesian inference
Chapter 3. Approximate methods of inference
Chapter 4. Markov chians
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 Bayesian Data Analysis (Third Edition) Chapman and Hall/CRC, 2013

Table of Contents

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

Societies

International Society for Bayesian Analysis

American Statistical Association, Section on Bayesian Statistical Science

Assessment

EST5104 - Bayesian Inference

Credits: 7

2 written examinations, $P1$ and $P2$. Final grade (NF) will be computed as,

$$NF = (2P1 + 3P2)/5$$

EST5803 - Advanced Bayesian Inference

Credits: 10

2 written examinations, $P1$ and $P2$. Final grade (NF) will be computed as,

$$NF = (3P1 + 3P2 + T)/7$$

where T is the average of home works.