Bayesian Statistics
Introduction

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About Instructor

- Professor at GaTech, shared appointment between ISyE and BME
- Joined GaTech in 2000
- Developed ISyE6420 in 2004
- Prior to 2000, faculty at Duke
- As a graduate student took courses at Purdue in Bayesian Statistics (Jim Berger and Jayanta K Ghosh) and ``declared'' as Bayesian
- Currently conducting research in wavelets and their bio-related applications

About the Course

An Introduction to Bayesian Statistical Inference and Applications

- Necessary theoretical coverage
- Focus on Bayesian statistical models
- Software (WinBUGS)

Prerequisites

- Introductory Statistics course
- Basic programming proficiency
- Calculus

Course Goals

- Bayesian ``literacy''
- Statistical models and procedures from Bayesian point of view
- Hands on approach
- A range of practical applications covered

Course Resources

Web page with Supplementary material
https://www2.isye.gatech.edu/~brani/isye6420/

- All programs/codes/data used
- All Homework with hints
- Extra Exercises (solutions for 50%)

Course Expectations

- Two exams: midterm and final
- Class project and homework
- The details about the distribution of points and timing of assignments provided in the Syllabus

Topics Covered

UNIT 1:

- Introduction

UNIT 2:

- Historic Overview
- Bayesian vs. Classical Statistics
- FDA Recommendations

UNIT 3:

- A Review of Necessary Probability
- Conditioning
- Bayes Formula

Topics Covered cont.

UNIT 4:

- Bayes Theorem
- Bayesian Inference in Conjugate Cases
- Prior Elicitation

UNIT 5:

- Bayesian Computation

UNIT 6:

- Graphical Models.
- Advanced WinBUGS

Topics Covered cont.

UNIT 7:

- Hierarchical Models
- Bayesian Linear Models

UNIT 8:

- Missing Data
- Censored Data

UNIT 9:

- Model Building and Selection
- Model Checking

Topics Covered cont.

UNIT 10:

- Applications and Case Studies
- My Own Bayesian Data Analysis

UNIT 11:

- Conclusions and Overview

Software

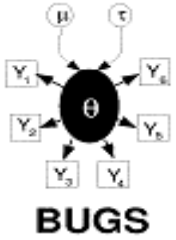
BAYESIAN

- WinBUGS
- OpenBUGS
- MultiBUGS
- JAGS

NUMBER CRUNCHING

- MATLAB
- Octave
- Python
- R

Example



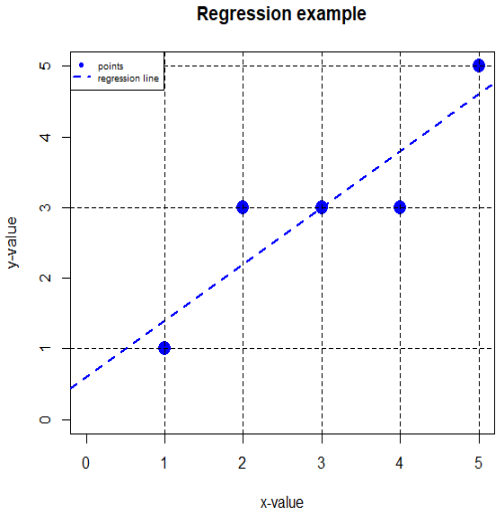
Regression1.odc

winbugs19.pdf

data={(1,1),(2,3),(3,3),(4,3),(5,5)}

$$y = 0.6 + 0.8\,x$$

$$y = 3 + 0.8\,(x - \bar{x})$$



Summary