Bayesian Statistical Methods.
SSC384
Fall 2009
TTH 3-5
(note time change from previous posting)

Instructor: Dr. Maggie Myers myers@cs.utexas.edu
Office hours: W 11,1:30 and extra hours as announced
Office: PAI 5.48 **Phone:** 471-9533
TA: Aline Orr
Text: Gelman, Carlin, Stern, and Rubin. ***Bayesian Data Analysis***, 2nd ed. Chapman and Hal,Inc. 2004.
Optional: Gelman and Hill. ***Data Analysis Using Regression and Multilevel/Hierarchical Models.*** Cambridge. 2006.

Intended audience: Masters and Ph.D. students in machine learning, data mining, computational biology, engineering, psychology, geography, business, statistics, mathematics and other fields in need of advanced statistical tools.

Prerequisites: Previous experience in probability, statistics, and linear algebra including computational components is ideal.

Evaluation: Grades will be based on exercises, quiz/attendance/participation, a project, and a midterm (50/20/20/10). Attendance is mandatory. If you don't show to lecture, you're not going to learn. Also, probability and statistics is not a spectator sport. You will need to roll up your sleeves and work some exercises. To dig deeper into your areas of interest and capitalize on integrating probability and statistics tools with your strengths, you will complete and present a project. Projects can be done individually or with a team. Of course, I am always available for advise and support.

Assignments: Exercises will be assigned and expected to be completed by the following Tuesday. You are permitted to turn in two late assignments without any penalties, but these late assignments should be submitted before the next set of exercises is due. I ask your permission to share your solutions with classmates, posting them on Blackboard.

Support groups: Please organize yourselves into support groups to discuss the exercises. The ideal model to follow is first to work independently, then to discuss issues with your fellow students, and then to prepare the final write-up. In addition, support groups will be responsible advising and providing practice runs for presentations of the projects at the semesters end.

This course is intended to illustrate current approaches in Bayesian modeling and computation in statistics. It will combine theory and practice. Students will use R and Bugs to analyze data and draw conclusions.

Content

Fundamentals of Bayesian Inference
Setting up probability models
Priors and Prediction
Bayesian Approaches for Standard Univariate Models
Bayesian Approaches for Multivariate Models
Inference from Large Samples and Comparison with non-Bayesian Methods

Fundamentals of Bayesian Analysis
Hierarchical Models/ Estimating Population Parameters from Data
Model Checking and Improvement
Accounting for Data Collection and Missing Data

Advanced Computation
Uses of Simulations
MCMC and BUGS

Regression Models
Linear regression from a Bayesian Perspective
Hierarchical Linear Models
Generalized Linear Models
As time permits and student interest—Mixture Models, Multivariate Modeling, Nonlinear Models, Missing Data.

These concepts will be illustrated using applications drawn from a variety of contexts. Students will apply techniques to data sets using R (and other appropriate packages) for single and multi-parameter models for Bayesian inference, including simulation of posterior distributions, Markov chain Monte Carlo methods, and hierarchical models.