BIOS 738
Bayesian and Empirical Bayes Methods

Instructor: Steve Qin, Associate Professor of Biostatistics and Bioinformatics
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Office Hours: By appointment

Description:
Introduction to Bayesian Inference. Bayesian large sample inference, relationship with maximum likelihood. Choice of model, including prior distribution. Bayesian approaches to regression generalized linear models, categorical data, and hierarchical models. Empirical Bayes methods. Comparison with frequentist methods. Bayesian computational methods. Assessment of sensitivity to model assumptions. Emphasis on biomedical applications.

Course objectives:
The goals of this course are to introduce the Bayesian approach to statistical inference and data analysis, describe effective approaches to Bayesian modeling and computation. Topics include:

1. Foundations of Bayesian Inference, the likelihood principle, and various interpretations of probability.
2. Formulation of appropriate models for Bayesian inference and specification of prior densities.
3. Asymptotic distributions of posterior distributions and connections with maximum likelihood estimators.
4. Relations between Bayesian and classical inference and testing procedures.
5. Model selection and diagnosis.
6. Sensitivity analysis.
7. Computational techniques for Bayesian analysis, MCMC.
8. Application of Bayesian inference in real scientific problems.

Evaluation
Three homework assignments 20% each and one final project 40%.

Textbook
Gelman A, Carlin JB, Stern HS and Rubin DB (2004) *Bayesian Data Analysis* (3rd edition).