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Web page: http://www.soe.ucsc.edu/classes/ams274/Spring09/  

Lectures: Tue,Thu 4-5:45am (Cowell 222)  
Office hours: Wed 2-3:30pm (or by appointment)  

Course description and background: This is a graduate-level course on the theory, methods and applications of Generalized Linear Models (GLMs). Emphasis will be placed on statistical modeling, building from standard normal linear models, extending to GLMs, and going beyond GLMs. With regard to inference for GLMs, we will cover both likelihood and Bayesian approaches. In particular, within the Bayesian modeling framework, we will discuss practically important hierarchical extensions of the standard GLM setting. We will use the statistical software R to illustrate the methods with data examples. 
Knowledge of distribution theory, basic concepts of likelihood inference, and Bayesian modeling and computing will be assumed. AMS 205, 206 and 207 provide this background.  

Grading: The course grade will be based on:  
* Homework assignments (40%)  
* Midterm exam (30%)  
* Final exam (30%)  
The final exam will be take-home. The midterm will be assigned during the 5th or 6th week of classes, and may be in-class or take-home. Details for both exams will be provided at a later time.  

Tentative syllabus: We will cover topics from the following.  

1. Introduction to GLMs  
* Statistical modeling in the context of GLMs  
* Exponential dispersion family of distributions (definitions, properties, examples, extensions)  
* Components of a GLM, examples of GLMs  

2. Likelihood inference for GLMs  
* Likelihood estimation (method of scoring, iterative weighted least squares) and inference (asymptotic interval estimates)  
* Model diagnostics (residuals for GLMs, model comparison criteria)  

3. Regression models for categorical responses and count data  
* Models for binary responses (dose-response modeling, probit and logit models)  
* Poisson regression and log-linear models
Basic ideas for modeling of contingency tables
* Multinomial response models for nominal or ordinal responses

4. Bayesian GLMs
* General setting, examples, priors for GLMs
* Markov chain Monte Carlo posterior simulation methods for GLMs
* Bayesian residual analysis and model choice
* Hierarchical GLMs, overdispersed GLMs, generalized linear mixed models

In addition, and as time permits, we will cover topics from
* Analysis of longitudinal and clustered data
* Generalized additive models
* Accelerated failure time and proportional hazards regression models for survival analysis data

**Reading/References:** The lectures will be based on material taken from books and articles from the related literature. There is no required textbook. The course webpage will include relevant references as needed. Some handouts and notes will be provided.

Books that will be used for the lectures include:

Further references include: