AMS 274: Generalized Linear Models  
Winter 2008

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Web page: http://www.soe.ucsc.edu/classes/ams274/Winter08/

Lectures: Tue,Thu 10-11:45am (Baskin Engineering 165)  
Office hours: Mon 2-3pm, Thu 12-1pm (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. We will use the statistical software R to illustrate the methods with examples and case studies.

Knowledge of standard probability theory, distribution theory, and basic concepts of likelihood estimation and inference will be assumed. AMS 205 or AMS 256 provide this background. Background on Bayesian modeling and inference (at the level of AMS 207 and/or AMS 206) would be desirable.

Grading: The course grade will be based on:
* Homework assignments (40%)
* Midterm exam (30%)
* Final exam (30%)
The midterm will be assigned during the 4th or 5th week of classes. 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 family of distributions (definitions, properties, examples, extensions)  
   * Components of a GLM, examples of GLMs

2. 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)  
   * Bayesian inference for GLMs

3. Normal linear models  
   * General (normal) linear models in the context of GLMs  
   * Multiple regression, analysis of variance and analysis of covariance models
4. Regression models for categorical responses and count data
- Models for binary responses (dose response modeling, probit and logit models)
- Models for categorical responses with more than two categories
- Nominal and ordinal logistic regression
- Modeling for contingency tables
- Poisson regression and log-linear models

5. Survival analysis
- Analysis of failure time (censored) data
- Survival, hazard and cumulative hazard functions
- Accelerated failure time and proportional hazards regression models

In addition, and as time permits, we will cover topics from

Analysis of longitudinal and clustered data
Case-control studies
Generalized additive models
Spatial generalized linear models
Nonparametric approaches for GLMs

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: