STAT 5364: Hierarchical Modeling

Fall 2014

Instructor:

Name: Dr. Leanna House
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Office Hours: Tuesdays at 2pm-3pm or by appointment using http://www.apps.stat.vt.edu/house/teaching.html

Course Information:

Website: Refer to `Scholar`
Textbooks:

Recommended: Gelman, Andrew and Hill, Jennifer (2007). *Data Analysis: Using Regression and Multilevel/Hierarchical Models*. Cambridge University Press, New York.

Recommended: Gelman, A., Carlin, J.B., Stern, H.S., and Rubin, D.B. (2003) *Bayesian Data Analysis*, second edition. Capman and Hall/CRC, New York.

Times: Tuesday and Thursday, 12:30-1:45
Location: 207 Hutcheson Hall
Prerequisite: This course requires either the completion of graduate level Regression (stat 5044), Probability and Distribution Theory (Stat 5104), and Statistical Inference (stat 5114), or courses that are comparable. A formal Bayesian inference class (e.g., stat 5444) is not a prerequisite, but familiarity with Bayesian concepts will be helpful. Also, proficiency in a programmable, statistical language (e.g., `R`, `S+`, `Matlab`) is required. The students should feel comfortable sampling from various distributions and coding loops, functions, etc.. When code is presented in class, it will be in `R`.

Announcement:

I am presenting at the University of Minnesota September 17-19. Thus, we will not have class on September 18. However, this will be an excellent time to review your skills in `R`. I will provide a tutorial for you.

Objectives:

Primary: Given a dataset and a research question, the students should be able to recognize when the question can be addressed by the data, recognize varying source of uncertainty, and formulate a statistical model that enables useful inference.

Secondary: Hierarchical models enable an intuitive formulation of data uncertainties; via the likelihood and one or more stage(s), hierarchical models may characterize multiple sources of variance and covariance. For example, hierarchical modeling can be useful for analyzing datasets with one of more of the following characteristics:

- Non-normal responses: continuous, discrete, constrained, mixtures, outliers
- Repeated measures: subject, longitudinal, discrete-time survival
- Change points
- Hypothesis testing
- Multivariate responses

Since Bayesian models are inherently hierarchical, Bayesian techniques will be used to assess the models developed in class. Additionally, students will learn to specify subjective or informative prior distributions and Bayes linear methods.

Grading:

The grading will depend on homeworks (30%), a midterm (30%), and class project (40%). We will take the midterm in class to avoid conflicts and give us flexibility. I will give you two weeks of advanced notice of the exam date.

For the project, students will in groups or two or three, choose a topic, and analyze the data using a method discussed in class. The purpose of this project is to demonstrate mastery of concepts from class, and give students practice in writing/presenting research. Thus, the project will be graded on two main deliverables: a paper and short presentation. The paper will be due **Dec. 12, 2014** and should mimc the format of an applied journal article that you read in a standard applied statistics journal (e.g., JASA Applications, Bayesian Analysis, and Annals of Applied Statistiscs). It is possible to publish a paper from this class! The presentation should be planned and clear. It will take place **during the last lectures** of the semester.

Academic Honesty:

The students are expected to abide by Virginia Tech's Community Standard for all work for this course (http://www.honorsystem.vt.edu/). Violations of the Standard will result in a failing final grade for this course and will be reported to the Dean of Students for adjudication. Ignorance of what constitutes academic dishonesty is not a justifiable excuse for violations.

For homework problems, students may work with others, but each student must submit his/her own answers for grading. For exams, the students are required to work alone and during the specified time period.

Changes to Syllabus:

The instructor reserves the right to make changes to the syllabus during the course. Any necessary changes will be announced in class and posted on the course website.

Students:

As supported by Virginia Tech's Principles of Community (http://www.vt.edu/ diversity /principles-of-community.html), all students will be treated equally. Those with special needs can be accommodated easily and should refer to the website http://www.ssd.vt.edu/ for specific questions.