36-463/663: Multilevel & Hierarchical Models

Introduction

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Outline

- Introduction
- Syllabus Stuff
- R!
- Example
- Q&A…
- HW01
- Special Office Hours This Week

Introduction – about us

- Instructor
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Introduction – about the course

- *Most common*: linear regression and generalized linear regression (logistic regression) models
- *Next most common*: hierarchical and multilevel models
- Situations…
  - Clustered sampling
  - Growth curves and random coefficient models
  - Grouped experimental trials
    - multicenter clinical trials in medicine
    - group-randomized trials in education

Introduction – about you

- Stat Theory (36-226) and Matrix Algebra (36-240 or 36-241) are prereq's. We need to talk like statisticians!
- Regression with R (36-401) is also a prereq
  - Seniors (36-463) will have had 36-401/402
  - Graduate Students (36-663) have varying experience with regression, ***wide*** range of experience with R
- All different levels of regression and R experience
  - Learn on your own! Help each other!
  - Ask Nick and me!

Syllabus Stuff – course materials

- ***BUY***: Gelman & Hill, *Data analysis using regression and multilevel/hierarchical models.*
- ***Think about***: Lynch, *Applied Bayes for Social Scientists*
- Main software tools are R, JAGS and "rube".
  - Install latest version of R (3.3.1).
  - Install **jags** from http://mcmc-jags.sourceforge.net/
  - Install **R2jags** from http://cran.r-project.org/
  - Install **rube** from http://www.stat.cmu.edu/~hseltman/rube/
  - All free software; all very flexible and general
- Almost everything else is online – see http://www.stat.cmu.edu/~brian/463-663

…and get used to Googling!

Syllabus Stuff – work & rules

- 40%: HW and quizzes
  - Please feel free to work with each other on hw; BUT you must list who you worked with.
  - Quizzes will be unannounced, mainly spot-check understanding.
- 15%: Midterm … 15%: Final
  - Both likely involve a take-home part
  - Both must be your individual work
- 20%: Project
- 10% "class participation" – be noticed…
- Credit where credit is due
  - Please list any *person* or any *source* you consulted in doing your work, at the beginning of your written assignment
- All hw will be submitted via Blackboard
  - *Class is too big to accept late hw or late take-homes…*

R!

- Some people learning R for the first time; others have done extensive data analysis projects in R.
- Some references on R and BUGS/JAGS:
  - http://www.cookbook-r.com
  - Chang, W. (2013). *The R Graphics Cookbook*. Sebastopol, CA: O'Reilly Media.
  - Lunn, D., Jackson, C., Best, N., Thomas, A., & Spiegelhalter, D. (2012). *The BUGS Book: A Practical Introduction to Bayesian Analysis*. NY: Chapman & Hall/CRC.
- If you have not used R before…
  - http://www.cs.cmu.edu/~10702/R2/Rintro.pdf provides a good start
  - Let's look at the first part of it now…

A first look at R…

- http://www.cs.cmu.edu/~10702/R2/Rintro.pdf is a good place to start…
  - If you are new to R, type into R all the commands and examples in rintro.pdf
  - If you have worked with R before, read through rintro.pdf and try to predict what would happen with each command. If you are not sure, type in that command/example.
- We'll get started, with rintro-commands.r, which has the commands/examples from the first part of rintro.pdf

Example

- Goldstein et al (1993) try to rank schools in London to distinguish the "best" from the "worst" of them.
- 01-london-schools.r

A Take-Home "Quiz"…

- Go to http://www.cmu.edu/blackboard/
- Go to the forum "Week 01 Survey" under "Discussion Board"
- Make a new thread for yourself and post a response to the following questions:
  - What class or project have you used R the most in, up to now? If you have not used R before, tell me that too!
  - Any questions or surprises as you work through the rintro.pdf?
  - Describe your last encounter with linear and/or mixed linear models.
- Please complete by 9am THURSDAY Sept 1.

HW01

- Available at http://www.stat.cmu.edu/~brian/463-663
- Mainly review/crash course on data frames and graphing in R.
- I DID NOT BRING COPIES.
- PLEASE GO TO THE CLASS WEBSITE AND DOWNLOAD
  - hw01.pdf
  - ….and the accompanying files…

Summary

- Introduction
- Syllabus Stuff
- R!
- Example
- "Quiz"
  - respond to the survey on Blackboard discussion board by Thur Sep 1 at 9am.
- HW01
  - Due next Tue Sep 6.