BTRY/STSCI 4030/5030 syllabus

Fall 2018 Syllabus

STSCI/BTRY 4030 "Linear Models with Matrices"

Instructor

Giles Hooker
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Meeting Time and Place: MW 2:55-4:10pm, 101 Phillips Hall
Office Hours: Thursday 2-3pm, Comstock 1181/1186

Lab 1: M 7:30-9:25pm, MNL B30A
Lab 2: W 7:30-9:25pm, MNL B30A
Lab 3: W 12:20-2:15pm, MNL B30A
Lab 4: Th 7:30-9:25pm, MNL B30A

Labs begin the week of Aug. 27. No labs the weeks of Sep. 3 (Labor day), Oct. 8 (Fall break) and Nov. 19 (Thanksgiving break); labs will not run all other weeks.

Teaching Assistants and Office Hours:
Samriddha Lahiri (sl2938), Friday 1 – 2, Comstock 1187
Zhengze Zhou (zz433), Thursday 10 – 11, Comstock 1187
Elly Kipkogei (ek492) , Tuesday 2 - 3, Comstock 1187

Course Description

The focus of this course is the theory and application of the general linear model expressed in its matrix form. Topics will include: least squares estimation, multiple linear regression, coding for categorical predictors, residual diagnostics, ANOVA decomposition, polynomial regression, model selection techniques, distributional theory assuming normal errors, maximum likelihood estimation, and linear mixed models for designed experiments. If time permits, extensions to the generalized linear mixed model to deal with responses that are counts will be discussed.

This course is required for Biometry and Statistics and Statistical Science majors in their junior or senior years, and for students in the MPS Statistics program.

Prerequisites

A two-semester sequence on statistical methods (e.g. BTRY 3010-3020), a course on probability and distribution theory (e.g. STSCI/BTRY 3080), multivariable calculus, and linear/matrix algebra. STSCI/BTRY 4090 "Theory of Statistics" or equivalent is recommended but not required.

Grading

Grades will be based on 5 homework assignments (best 4 out of 5 grades, 15% each), a mid-term exam (15%) and a final exam (25%).

Homework assignments will require the use of the R statistical computing package, RStudio and R Markdown.

Learning Outcomes

After completing this course students will be able to
1. formulate linear and linear mixed models for data analysis using matrix algebra,
2. use a statistical computing package to analyze data using linear mixed models, and
3. derive the repeated sampling properties of estimators and test-statistics obtained from linear mixed models.

Tentative Homework and Exam Schedule

Homework 1: Due 5pm, Friday, Sep. 14
Homework 2: Due 5pm, Friday, Sep. 28
Homework 3: Due 5pm, Friday, Oct 12
Midterm Exam: Tuesday, Oct. 16, 7:30pm – 9:30pm, PLS233
Homework 4: Due 5pm, Friday, Nov. 9
Homework 5: Due 5pm, Friday, Nov. 30
Final: Tuesday, December 11, 7:00pm – 9:00pm Room TBA

Homework assignments must be completed using RMarkdown in RStudio. Discussion of homework assignments with other students is permitted. However, assignments must be written up independently. There will naturally be similarities between assignments submitted by different students but, for example, identical written comments (and possibly also R code and output) will be flagged. In particular, students are not permitted to share their homework assignment RMarkdown files with others.

References

- Dalgaard (2002). "Introductory Statistics with R". Springer.
- Brown, (2014). "Linear Models in Matrix Form", Springer
- Harville (2008) "Matrix Algebra from a Statistician's Perspective". Springer.
- Christensen (2011) "Plane Answers to Complex Questions: The Theory of Linear Models", Springer.
- Renchler and Schaalje, (2008). "Linear Models in Statistics". Wiley.
- Draper and Smith (1998). "Applied Regression Analysis", Wiley
- Moser (1996) "Linear Models: A Mean Model Approach", Academic Press.
- Seber and Lee (2003). "Linear Regression Analysis", Wiley.
- Searle, Casella and McCulloch (1992). "Variance Components", Wiley.
- McCullogh, Searle, Neuhaus (2008). "Generalized, Linear and Mixed Models", Wiley.
- Verbeke and Molenberghs (2000). "Linear Mixed Models for Longitudinal Data". Springer.

All available online through the Cornell University Library system

Other Links

BSCB home. http://www.bscb.cornell.edu/
My website. http://faculty.bscb.cornell.edu/~hooker/
The R Project for Statistical Computing. http://www.r-project.org/
RStudio download site: http://www.rstudio.com/
Swirl: online R/RStudio courses: http://swirlstats.com/students.html

Academic Integrity

As per university policy, all syllabi should contain some reference to the **Cornell Academic Integrity Code.** Violations are dealt with seriously, so please read it:http://www.cuinfo.cornell.edu/Academic/AIC.html

Accommodations for Students with Disabilities:
It is Cornell policy to provide reasonable accommodations to students who have a documented disability (e.g., physical, learning, psychiatric, vision, hearing, or systemic) that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact Student Disability Services and their instructors for a confidential discussion of their individual need for academic accommodations. Student Disability Services is located in 420 CCC (Computing and Communications Center). Staff can be reached by calling 607.254.4545.