PSYCH 711/712
Course Outline
Winter Term, 2009

1 Contact Information

Instructor: Patrick Bennett
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office hour: By Appointment

2 Course Information

Overview: This course is an introduction to robust statistics and the bootstrap. Robust statistics refers loosely to statistical methods that work well even in non-ideal situations. For example, robust measures of central tendency provide reasonable estimates of "typical" values in a distribution even when the data are highly skewed, contain outliers, and so forth. Data sets in many psychological experiments often exhibit these non-ideal features, and so robust statistics potentially are useful for analyzing such data. Unfortunately, the distributional properties of robust statistics such as the median, or trimmed means, are difficult to specify, and therefore it is difficult assess Type-I and Type-II error rates when doing statistical inference with these robust measures. Fortunately, this limitation can be overcome in many circumstances by using bootstrap methods. Bootstrapping is a computationally-intensive and (in its most general form) non-parametric technique for making statistical inferences. Bootstrapping differs from traditional, parametric approaches to inference by estimating the sampling distribution of a statistic directly from the data itself, rather than relying on assumptions about the distribution.

Meeting Times: The course will meet on Tuesday, 2:30-5:30 PM. The first part of each meeting will consist of a lecture that will be held in PC-335. The second part will consist of a statistics lab that will be held in PC-403.

Required Textbook: There is no required textbook for this course. Readings will be made available to students through the course website.

Software: Laboratory exercises will use the statistical computing environment, **R**. This course assumes that you are familiar with the basic aspects of R. Versions of R have been written for Windows, OS X, and Linux. R can be obtained at `http://cran.r-project.org/` . Students are encouraged to install R on their own computers and, if possible, on their work computers.

The following documents – which can be obtained at `http://cran.r-project.org/other-docs.html` – are recommended for people who are unfamiliar with R.

- Baron, J. & Li, Y. (2004). Notes on the use of R for psychology experiments and questionnaires.
- Burns, P. (2003). A guide for the unwilling S User.
- Paradis, E. (2005). R for beginners.

Grading: Grades will be based on a single in-class, final exam. Students will have access to R during the exam.

It is the student's responsibility to notify the instructor of the reasons for missing a test in a timely fashion. Students who miss a test due to illness must submit a McMaster University Student Medical Certificate and a Missed Term Work form to the Associate Dean for Graduate Studies within five business days of the missed exam. Both forms are available at

`http://www.science.mcmaster.ca/~associatedean/services/exemptions.html`

which also contains a fuller description of the University's policy regarding missed term work.

Academic Integrity: Students are responsible for demonstrating behaviour that is honest and ethical in their academic work, and are expected to be familiar with the University's regulations regarding academic integrity (see section 6.1, Graduate Calendar 2008-09, pp. 15-16).

Statistical Laboratories: The purpose of the labs is to provide students with opportunities to work on statistical problems related to the lectures. At the beginning of each lab, students will be provided with materials that describe the lab exercises. Students are expected to complete all lab exercises, although they will not be graded. Answers to the exercises will be posted on the web.

3 Topics

- January 13: Introduction

  Reading:

  - Erceg-Hurn, D.M. & Mirosevich, V.M. (2008). Modern robust statistical methods: An easy way to maximize the accuracy and power of your research. Am Psychol, 63(7), 591-601.
  - Grunkemeier, G. L. & Y. Wu (2004). Bootstrap resampling methods: Something for nothing? Ann Thorac Surg 77(4): 1142-4.

- January 20: Confidence Intervals

  Reading:

  - Mooney, C. Z. & Duval, R.D. (1993). Bootstrapping : a nonparametric approach to statistical inference. (Sage University Paper series on Quantitative Applications in the Social Sciences, series no. 07-095). Sage Publications: Newbury Park, CA. [Pages 1-14 & 33-42.]

- January 27: Robust Measures of Location & Scale

  Reading:

  - Keselman, H.J., Othman, A.R., Wilcox, R.R., & Fradette, K. (2004). The new and improved two-sample t test. Psych Sci, 15(1), 47-51.

- February 3: Bootstrapping ANOVAs

  Reading:

  - Berkovits, I., Hancock, G.R., & Nevitt, J. (2000). Bootstrap resampling approaches for repeated measure designs: Relative robustness to sphericity and normality violations. Educ Psychol Meas, 60(6), 877-892.
  - Wilcox, R. R. (2002). Understanding the practical advantages of modern ANOVA methods. J Clin Child Adolesc Psychol 31(3): 399-412.

- February 10: Regression

  Reading:

  - Efron, B. & Tibshirani, R. (1993). An introduction to the bootstrap. Chapman Hall, New York. [Chapter 9, pp. 105-121].

- February 17: READING WEEK
- February 24: Review
- March 3: Final Exam (PC-403, 2:30-6:00 PM)