

Geog 560
Advanced Quantitative Analysis
Spring 2015
MW 9:30-10:45
Office Hours: M 4-5, R 1-2

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Description: This is a second course in statistical methods covering techniques widely used in quantitative geography. The primary emphasis is on data-driven predictive modeling, including multiple regression and extensions, nonlinear least squares, and categorical prediction. We also cover principal components, clustering and related methods, and computer-intensive methods. The course concludes with an introduction to times series if time permits. The formal prerequisite is a course in univariate methods, similar to Geography 360 or Statistics 301.

Readings: The primary texts are Kutner et al., *Applied Linear Regression Models* (Irwin, 2004 or 2003) and S. Sharma, *Applied Multivariate Techniques* (Wiley, 1996). We will also use J.E. Burt, G.M. Barber, and D.L. Rigby, *Elementary Statistics for Geographers, 3rd Ed.* (Guilford, 2009). Depending on your background, other texts may be helpful. For multiple regression, I recommend W. Mendenhall and T. Sincich, *A Second Course in Statistics* (Pearson, 2011), or T.P. Ryan, *Modern Regression Methods, 2nd Ed.* (Wiley, 2009), or Hill et al., *Undergraduate Econometrics* (Wiley, 2000). For other multivariate techniques, consider or R. A. Johnson and D. W. Wichern, *Applied Multivariate Statistical Analysis* (Pearson, 2007) or J. Tacq, *Multivariate Analysis: Techniques in Social Science Research* (Sage, 1997). Additional readings are on reserve in the Geography Library, and a variety of animations and resources are posted on learn@uw.

Grading: Course grades will be based on two exams (33% each) and a set of short exercises (33%). The exercises will use PC software and data available in Geography computing facilities. Beyond general familiarity with Windows, no specific computer knowledge is presumed.

Topic Outline

I. Review

- A. Basic Statistical Concepts
- B. Hypothesis Testing and Confidence Intervals
- B. Bivariate Regression and Correlation

II. Multiple Regression

- A. Estimation and Hypothesis Testing
- B. Problems and Diagnostics (multicollinearity, variable selection)

III. Extensions of Multivariate Regression

- A. Polynomials, Trend Surfaces, Transformations
- B. General Linear Adaptive Models
- C. Mixed Spatial/Aspatial Models (GWR, etc.)

IV. Intrinsically Nonlinear Models

- A. Problem Statement
- B. Methods for Nonlinear Least Squares

V. Nominal Dependent Variables

- A. Logit and Related Models
- B. Discriminant Analysis

- C. Other Categorical Prediction Methods
 - 1. Bayes Estimators (naïve and non-naïve)
 - 2. Nearest Neighbor
 - 3. Categorical Regression Trees
- VI. Density Estimation
 - A. Probability Density Functions
 - B. Spatial Data
- VII. Computer-Intensive Methods
 - A. Jackknifing
 - B. Bootstrapping
- VIII. Other Multivariate Methods
 - A. Principal Components Analysis
 - B. Cluster Analysis
- IX. Methods for Temporal Data
 - A. Sampling Theorem in Time and Space
 - B. Time Series Models

Other books:

F. P. Agterberg, *Geomathematics: Mathematical Background and Geo-science Applications*, Elsevier, 1974.

J-P. Chiles and P. Delfiner, *Geostatistics: Modeling Spatial Uncertainty*, Wiley, 2012.

R. D. Cook and S. Weisberg, *Applied Regression Including Computing and Graphics*, Wiley, 2009.

J.C. Davis, *Statistics and Data Analysis in Geology*, Wiley, 2003.

P. Goovaerts, *Geostatistics for Natural Resources Evaluation*, Oxford University Press, 1997.

J.M. Hilbe, *Logistic Regression Models*, Chapman and Hall/CRC Press, 2009.

D.W. Hosmer, S. Lemeshow, R.X. Sturdivant, *Applied Logistic Regression*, Wiley, 2013.

E. H. Isaaks and R. M. Srivastava, *Applied Geostatistics*, Oxford University Press, 1990.

D. B. Percival and A. T. Walden, *Spectral Analysis for Physical Applications*, Cambridge Univ. Press, 1993.

D. S. Wilks, *Statistical Methods in Atmospheric Sciences*, Academic Press, 2011.

Advanced Quantitative Methods. University of Mississippi Political Science 552 Spring 2011. Dr. Megan Shannon 236 Deupree Hall (662) 915-6656 mshannon@olemiss.edu Oce Hours: MW 1:00 - 2:30pm. Introduction. Regression analysis is a powerful tool for understanding the world around us. This class introduces the theory, methods, and practical application of linear regression. By the end of the semester, you will be able to understand and evaluate social science research that uses regression analysis. You will use regression to address a research question of interest. Finally, you will learn and ap... GEOG 660. Advanced Spatial Analysis. Tuesday, Thursday 9:30-10:45 a.m. DH 116. GEOG 560 - Remote Sensing of the Environment. No. No. GEOG 661 - Advanced Quantitative Methods for Geographic Research. Yes. No. Yes. No. GEOG 662 - Advanced Urban Geography. No. No. GEOG 760 - Advanced Geospatial Science. No. No. Typical Hall probes cover an operating range of 3 to 5 orders of magnitude. Operation beyond this field range requires some compromise in performance, often including higher noise or loss of resolution. Choosing the correct probe type ensures optimal performance in the desired measurement range. High stability (HST-1, HST-2, HST-3, HST-4): With a high field range of up to 350 kG (35 T), high stability probes are used when fields exceed the limit of other probe types. Their low field performance is slightly degraded with a minimum sensitivity of 50 mG (5 μ T). HST probes are also inherently mor...