Psychology 6304: Categorical Data Analysis
MW 10:30-11:50
Psychology Building, Room 310

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Content of the Course
Psychological data often comes in the form of frequencies, or counts of instances that fall into different categories. Analytic techniques for categorical data can accommodate experimental or observational designs as rich as those used for quantitative data. This course will cover three modern approaches to the analysis of categorical data: 1) multi-way contingency table analysis, 2) logistic regression, 3) signal detection analysis, and if time permits, 4) multinomial modeling. Hierarchical parameter-based model-fitting procedures will be emphasized in the coverage of all techniques.

Software
SPSS will be the primary statistical software for this course and it is available in the Vinson laboratory (Room 102) and most laboratories in the psychology department, as well as through my.apps.utep.edu. For some assignments, it may be useful to set up spreadsheets (e.g., in Excel) to better understand the computations or to save time relative to using a calculator. Multinomial model testing will be done with free software (MultiTree) available on line.

Text and Additional Readings
3) Additional readings (articles) will be distributed as needed.

Assignments and Basis of Evaluation
Homework will be assigned regularly for practice with the new techniques. Students will be expected to complete the assignments and participate in class discussions of completed assignments. This is essential for adequate performance on exams. The primary basis of grading will be three exams spaced approximately evenly through the semester (February 24th, April 6th, and May 13th) and weighted approximately equally (25% each). Homework will also be graded (15%). Each student will also give a brief presentation to the class on an application of the techniques in their area of research (10%).
Tentative Schedule of Topics

1/20-1/25

Introduction to Topic and Applications
  Overview of topics and techniques
  Necessity of categorical techniques
  Relationship to techniques used with continuous DVs

The One-Way Table
  Sources of data: Bernoulli and Poisson events
  Assumptions
  Hypothesis testing: Tests of fixed distribution (homogeneous or theoretical)
  Measures of badness of fit: Pearson’s $X^2$; Log-Odds Ratio $G^2$
  Exact test: Binomial test
  Planned comparisons
  Measures of dispersion
  Implementation in SPSS

1/27-2/8

The Two-Way Table
  Introduction
  Notation
  Types of Hypotheses
  Measures of Association and Their Interpretation
    Odds Ratios (estimation and confidence intervals)
    Cohen’s kappa (for testing inter-rater reliability)
    Phi coefficient
  Tests of Association
    Pearson’s $X^2$
    Log-Odds Ratio ($G^2$)
    Fisher’s Exact Test
  Planned comparisons and decomposition into single df components
  Test of marginal homogeneity (McNemar’s test)
  Ordinal category tests (e.g., Kendall’s Tau)
  Tables with between-subjects variability
  Implementations in SPSS
  Power and sample size calculation

2/10-2/22

The Three-Way Table (and Extensions to Higher-Dimension Tables)
  Introduction
  Types of association and how to measure them
  Constructing the hierarchical lattice of models under different data constraints
Testing model fit
Testing parameters and model restrictions to address specific hypotheses
Implementation of these tests in SPSS
Power and sample size calculation
Special techniques for analyzing within-subjects designs

2/24 EXAM 1

2/29-3/2, 3/14

Logistic Regression
Dealing with continuous predictors
Introduction to logistic regression
Similarities and differences in comparison to linear regression
Interpretation of unstandardized and standardized logistic regression coefficients
Constructing a hierarchical lattice of models to test models and parameters
Implementation in SPSS

3/16-4/4

Signal Detection Theory
Introduction to goals and ideas of signal detection theory
Review of the probability density function for the normal distribution
Signal and noise distributions
Basic approach with normal distribution and equal variance assumed
  Measure of discrimination: d’
  Measure of criterion: lambda
  Measure of bias: logB
  Taking prior probabilities into account
  Ideal observer models
  ROC curves
Unequal variance model
Distribution-free estimates of discrimination and bias
Detection versus discrimination
Applications to psychological phenomena

4/6 EXAM 2

4/11-4/25

Multinomial Processing Tree Models
Introduction to multinomial processing-tree models
Saturated, unidentifiable, and restricted models
Algebraic solution of the saturated model
Identifying assumptions
Systematic testing of models, hierarchical lattices of models
Testing restricted models
Testing hypotheses about specific parameters
Comparisons across pre-existing groups or experimental conditions

4/27-5/2  Student Presentations

5/4  REVIEW

5/13  FINAL EXAM