PubH 8401/STAT 8311: Linear Models

Instructors

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Grading

Homework: 40%

Midterm Exam (Oct. 25, 2017): 30%

Final Project: 30%

Covered topics

Weeks 1 and 2: Review of Linear Algebra

Linear Subspaces, Linear Transformations, Projections, Inner
Products, Orthogonality, Coordinates with respect to an Orthonormal Basis, Orthogonal Projections, Orthogonal transformations, Matrices, Eigenvectors and Eigenvalues, Matrix Decompositions

**Week 3-4: Linear Models**

Estimation, Best Estimators, Gauss-Markov theorem, Estimability, Linear Restrictions, Generalized Least Squares, OLS vs Generalized Least Squares

**Week 4-5: Distribution Theory**

Consistency of Least Squares, Characteristic Functions, Multivariate Normal, Chi-Squared and Quadratic forms, and F distributions

**Week 6-7: Inference**

Log-likelihood, Hypothesis testing, Geometry of F tests, Likelihood ratio tests, General Coordinate Free hypotheses, Parametric hypotheses, Relation of least squares estimators under NH and AH, Analysis of Variance Tables, F tests and t tests, Power and Sample Size, Simultaneous confidence intervals (Scheffe method, Bonferroni method, Tukey’s method, and related methods)

**Midterm**

**Week 8-10: Generalized Linear Models**

Review of MLE; Properties of exponential families; Estimation: IWLS, MLE; Hypothesis test: LRT, Wald, score test; Goodness-of-fit: deviance, Pearson X2; Overdispersion: definition, mixture model example; Other models for binary data; Case-control vs. population-based; Quasi- likelihood: estimation (IWLS), linkage
with estimating equations, statistical inference; robust standard error

**Week 10-12: Linear Mixed Models**

Hierarchical modeling of random effects; Modelling the covariance structure; Marginal models arising from random effects; Inferential issues: shrinkage, estimation, prediction.

**Week 13-15: Additional Topics**

Generalized linear mixed models (GLMM) Generalized estimating equations (GEE) Missing data in linear models

**Final project**