

Lecture Notes

Review for the First Exam

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1. Nonparametric Regression

- ▶ Naive Nonparametric Regression (binning and averaging)
- ▶ Local Regression (lowess)

2. Examining Data

- ▶ Univariate Displays
 - histograms
 - stem-and-leaf displays
 - density estimates (use *one* of histogram, stem-and-leaf, density estimate)
 - boxplots
 - quantile-comparison plots (if there's a reason to compare, e.g., to the normal distribution)
- ▶ Plotting Bivariate Data
 - scatterplots
 - jittered scatterplots for discrete data
 - parallel boxplots

- ▶ Multivariate Data
 - Scatterplot matrices (all marginal pairs)
 - 3D dynamic scatterplots

3. Transforming Data

- ▶ Family of Powers and Roots (including logs)
- ▶ Transforming Skewness (transform on ladder of powers in *opposite* direction of skew)
- ▶ Transforming Nonlinearity ('bulging rule' for simple, monotone nonlinearity)
- ▶ Transforming Non-Constant Spread (spread-level plot, not covered in class)
- ▶ Transforming Proportions (logit transformation, not covered in class)

4. Linear Least-Squares Regression

- ▶ Simple Regression
 - Least-Squares Fit (interpretation of A and B)
 - Simple Correlation (r and r^2 , S_E , analysis of variance for the regression)
- ▶ Multiple Regression
 - Two Explanatory Variables
 - Several Explanatory Variables (interpretation of A and B_j 's)
 - Multiple Correlation (R and R^2 , S_E , analysis of variance for the regression)
 - Standardized Regression Coefficients (caveats)

5. Statistical Inference for Regression

- ▶ Simple Regression
 - Simple Regression Model (assumptions of linearity, constant error variance, normality, independence, fixed X or X independent of ε)
 - Properties of the Least-Squares Estimator
 - Confidence Intervals and Hypothesis Tests for α and β
- ▶ Multiple Regression
 - Multiple Regression Model (and assumptions)
 - Confidence Intervals and Hypothesis Tests (individual coefficients, all slopes, a subset of slopes — incremental F -test)
 - Empirical vs. Structural Relations

6. Dummy-Variable Regression and Analysis of Variance

- ▶ Dichotomous Explanatory Variable, Additive Model: A 0/1 Dummy Regressor
- ▶ Polytomous Explanatory Variables: Sets of 0/1 Dummy Regressors
- ▶ Modeling Interactions (product regressors)
 - The Principle of Marginality (main effects and interactions)
 - Hypothesis Tests for Main Effects and Interactions (Type-II tests)
- ▶ One-way Analysis of Variance Using Dummy Regressors
- ▶ Two-way Analysis of Variance Using Dummy Regressors and Interaction Regressors
 - Patterns of Association in Two-Way ANOVA