Causal Inference

Correlation versus Causation
Potential Outcomes
Fundamental Problem of Causal Inference
Estimands
- ATE, ATT, ATU

Bias: Estimation versus Identification
Identifiability: what is it?
Identifying the ATE
- Counterfactual Consistency
- No Interference
- Exchangeability
- Conditional Exchangeability
- Positivity
    - Diagnosing Violations
        - PS Overlap
        - Distribution of SW
        - Covariate Balance
        - Weighted and Unweighted eCDFs

Probability and Statistical Inference

- What is Probability?
- Direct versus Inverse Problems
- Bernoulli's Fallacy
- What is a Probability?
    - Mathematical versus Philosophical
    - Classical, Subjective, and Frequentist
- P Value (One versus Two Sided)
    - Lindley's Paradox
- P Value Functions
- S Values
- Fisher versus Neyman Pearson
    - Divergence versus Decision Formulations
    - Fundamental Problems with NP Testing
    - Specific Problems with NP Testing
    - Choosing alpha and beta
- Confidence Intervals
    - Coverage Property
    - Conservative versus Anticonservative
    - Honest versus Dishonest
- Compatibility Intervals

Regression

- Marginal and Conditional Effects

- Marginal and Conditional Adjustment
- Collapsibility and Noncollapsibility
    - Strictly Collapsible
    - Collapsible
    - Noncollapsible
- Conditionally Adjusted Regression
    - GLMs: Distributions and Link Functions
    - Risk Difference, Risk Ratio, Odds Ratio
        - Deriving via Link Functions
    - Model Based, Robust, and Bootstrap SE
    - Interactions in Conditionally Adjusted Models
- Marginal Standardization & IP Weighting
    - ATE, ATT, and ATU
- IP Weighting for Categorical & Continuous Exposure
- Variable Coding in Regression
    - Target Function versus Nuisance Function
    - Z-Score
    - Dummy Variables
    - Splines

Missing Data

- MCAR, MAR, MNAR
- Relations to Exchangeability
- IP Weighting
- MICE in R
    - Selecting Methods
    - Modifying p Matrix
    - Implementing with:
        - Conditional Regression
        - IP Weighting
        - Marginal Standardization (with Bootstrap)

Longitudinal Data

- Clustering in Data
- Robust Variance and Clustered Bootstrap
- Generalized Estimating Equations
- (IP weighting and g Computation for Time-Dependent Confounding)

(Variance Estimation)

- Model-Based SEs
- Robust (Sandwich) SEs
- Bootstrapping
    - Normal Interval (Wald)
    - Percentile

- BCa Intervals