



JOHNS HOPKINS

WHITING SCHOOL
of ENGINEERING

Midterm Review

Format

- 4-6 Primary questions (with subparts)
 - Understanding of when, how, and why to use methods we've talked about in class
 - Many questions are open-ended with multiple possible responses
 - Basic definitions
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- If you need any equations we will give them to you (you should be able to recognize them but don't need to memorize them)

Word Statistics

- Key ideas behind two popular methods for examining word statistics:
 - Log-odds with a Dirichlet prior (“Fightin’ Words”)
 - Pointwise mutual information scores
- Examples of applications and understanding of when these methods are useful

Topic Models

- Motivation behind topic modeling
- High-level understanding of LDA formulation and inference
- Key strengths and limitations of LDA
 - When later variants of LDA might be more useful
- Agenda setting and framing
- Structured Topic Model (STM)
 - Example of LDA-variant designed for text analysis
 - Understanding of key differences from LDA and why they are useful

Word Embeddings: Construction

- Intuitive ideas behind representing words as vectors
- Distributional Hypothesis
- TF-IDF weighting
- Word2Vec
 - Difference between CBOW and Skip-gram
 - Skip-gram model and training
 - Practical challenges (e.g. negative sampling)

Word Embeddings: Applications

- Example applications:
 - Measuring bias (gender bias / occupational stereotypes)
 - Measuring change in word meanings over time
 - Measuring stereotypes over time
- Embedding manipulation:
 - Cosine similarity, Euclidean distance
 - Gender subspace
 - Averaging keywords
- Evaluations:
 - Analogy tasks, similarity benchmarks, extrinsic metrics
 - Comparisons with hand-curated analyses or benchmarks
 - Comparisons with survey or crowd-sourced data

Affect and Lexicons

- Emotions:
 - Different models of emotions in psychology
- Lexicons:
 - When lexicons are useful and when they are not
 - Different variants of lexicons
 - Categorical vs. continuous, directed (connotation frames) vs. not
 - Examples: LIWC, NRC lexicons, connotation frames
 - Lexicon construction
 - Manual vs. automated
- Data annotating:
 - Likert scale, Best-worst scaling

Data Annotation

- Tips and tricks for components of annotation process
 - Data selection, annotator selection, task design, quality control
 - Examples: Decomposition, context and priming, quiz questions
- Annotator agreement metrics
 - Cohen's Kappa, Fleiss' Kappa, Krippendorff's alpha
- Ethics of crowdsourcing

Classification Models

- Logistic Regression
- Neural networks
- Prevalence Estimation
 - Classify and count, adjusted classify and count, probabilistic classify and count

Hypothesis Testing

- Basic idea behind hypothesis testing
- Ability to interpret use of hypothesis tests by others
- Ability to select a hypothesis test based on data characteristics
- Selection bias, Simpson's paradox

Causal Inference

- Potential outcomes notation
- Definitions of core concepts:
 - ITE, ATE, Confounder, Mediator, Collider, observational study, randomized control trial
- Assumptions of causal inference:
 - Ignorability/exchangeability, conditional exchangeability / unconfoundedness, positivity, no interference, consistency
- Adjustments:
 - Regression, matching, propensity scores, stratification, IPW

Causal Inference with text

- Motivations
 - Example applications, challenges of working with text
- Adjustment Methods
 - Topic Inverse Regression Matching
 - Causal text embeddings

Network Metrics

- Motivations and examples where methods are useful
- Basic metrics:
 - Network density, closeness centrality, quarter-power scaling
- ERGM
- Graph Neural Networks