Midterm Notes

PUBH 8442: Bayes Decision Theory and Data Analysis

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02/28/2024

Midterm

- Monday March 18th, in class.
- Allowed to bring one page of notes, front and back.
- Otherwise, closed notes and closed book.
- Will be on anything covered in class, up to and including material on Bayesian Linear Models.

Studying

- Exam questions will be similar to HW
- In addition, a sample midterm and solutions are posted on the website
- Review (or re-do) HWs and sample midterm carefully
- Review lecture notes, deriving results yourself
- Review optional reading for more depth (but only need to know what is covered in class)

Topics

- Bayesian basics
  - Bayes rule for basic (discrete) probability
  - Bayesian probability and philosophy
  - Bayes rule for continuous variables
  - Uninformative priors (Jeffrey's, flat)
  - Conjugate prior-posterior models
  - Prior,marginal, joint, posterior, posterior predictive distributions

Topics

- Decision theory
  - General framework (action space, loss function, etc.)
  - Risk definitions (frequentist, posterior, & Bayes risk)
  - Criteria (admissibility, minimax, unbiased, Bayes rule)
  - Bias and the bias-variance tradeoff for point estimation.

Topics

- Interval estimation
  - Credible set definition and interpretation
  - Credible set constructions (HPD, equal tail, symmetric about estimate)
  - Decision theoretic examples

Topics

- Hypothesis testing / model comparison
  - Bayesian vs frequentist hypothesis testing
  - Bayes factors
  - Alternative Bayes factors (partial, fractional, intrinsic)
  - BIC
  - Role of decision theory

Topics

- Model Assessment
  - Bayesian residuals
  - Conditional predictive distribution, psuedo marginal likelihood
  - Bayesian p-values

Topics

- Hierarchical models
  - Definition of hierarchical model
  - Computing and interpreting various marginal & posterior distributions for hierarchical models
  - Normal-normal hierarchical model

Topics

- Linear models
  - Bayesian linear model framework
  - Uninformative linear model
  - Normal-inverse-gamma model
  - Bayesian/standard residuals