First Course Handout

Summer term 2024
CGS698C: Bayesian models & data analysis

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Objectives

This is an introductory course designed to equip students with a conceptual understanding of Bayesian inference and its applications in data analysis and modeling. By the end of this course, students will be able to - (i) analyze data in the Bayesian framework, (ii) develop and implement Bayesian models, and (ii) evaluate compuational (cognitive) models given the data.

Prerequisites

A major part of this course will be focused on practicing Bayesian modeling **using R programming**. It is expected that you have basic programming knowledge, e.g., you should be able to write 'for' loops, conditional statements, and functions in R.

Course content

The lecture plan for each week is as follows:

Week 1	Probability and random variables	May 20-24
Week 2	Bayes' theorem, likelihood function, priors, and posteriors	May 27-31
Week 3	Parameter estimation I	June 3-7
Week 4	Parameter estimation II	June 10-14
Week 5	Bayesian regression models	June 17-21
Week 6	Model comparison I	June 24-28
Week 7	Model comparison II	July 1-5
Week 8	Bayesian hierarchical modeling	July 8-12

Lectures and assignments

The participation in this course will be through lectures and weekly assignments. There will be three lectures every week on Monday, Wednesday, and Thursday (except on holidays, midsem break, etc.) at 2:15 PM, and one assignment every week that students need to submit online. There will be no separate tutorial classes or lab hours. Lectures and assignments will be available on HelloIITK course page: https://hello.iitk.ac.in/studio/cgs698csem32324/student/home.

Lecture timings: 14:15 – 16:00 (Monday, Wednesday, Thursday)
Lecture venue: L02

Evaluation components

Evaluation will be done based on:
25% - Assignments spread over the semester
25% - Midsem
50% - Endsem

Office hours

Wednesday 16:15 to 17:30

Office address: 507, 4th floor, ESB II, Department of Cognitive Science

Books and references:

1. Richard McElreath. Statistical Rethinking: A Bayesian Course with Examples in R and Stan, 2nd Ed., CRC Press, 2020.
2. Bruno Nicenboim, Daniel Schad, and Shravan Vasishth. An Introduction to Bayesian Data Analysis for Cognitive Science, 2022.
3. John K Kruschke. Doing Bayesian Data Analysis, 2nd Ed., Elsevier, 2015.
4. Andrew Gelman and John B. Carlin. Bayesian Data Analysis, 1995