Bayesian Methods and the Statistics and Data Science Curriculum

Jingchen (Monika) Hu

Colin Rundel

Kevin Ross

CAUSE/Journal of Statistics and Data Science Education webinar series

Upcoming webinars:

- "Playing the whole game" and "Data scraping for fun and profit" (Tuesday, March 23rd, 4:00-4:45pm EST)
- "What makes a good statistical question?" (Tuesday, April 27th, 4:00-4:45pm)
- Signup at https://www.causeweb.org/cause/webinars
- All webinars slides and recordings available at that link

Consortium for the Advancement of Undergraduate Statistics Education

https://www.causeweb.org/cause
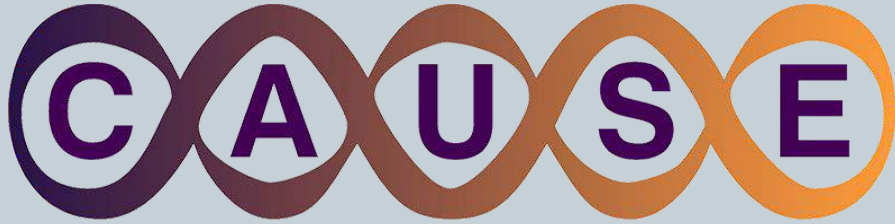
Posters and beyond deadline March 11, 2021

Bayesian cluster in JSDSE (December 2020)

- Why Bayesian Ideas Should Be Introduced in the Statistics Curricula and How to Do So (Andrew Hoegh)
- A Bayesian Statistics Course for Undergraduates: Bayesian Thinking, Computing, and Research (Jingchen Hu)
- Bayesian Computing in the Undergraduate Statistics Curriculum (Jim Albert and Jingchen Hu)
- Review of "Statistical Rethinking: A Bayesian Course with Examples in R and Stan" (Jim Albert)
- Teaching an Undergraduate Course in Bayesian Statistics: A Panel Discussion (Johnson, Rundel, Hu, Ross, and Rossman)

https://www.tandfonline.com/toc/ujse20/28/3?nav=tocList

Jingchen (Monika) Hu

Assistant Professor
Department of Mathematics and Statistics
Vassar College

Upper-level statistics elective at Vassar College

- Pre-reqs:
  - Multivariable Calculus and Probability
  - No prior statistics or programming required
- Topics:
  - Inference: prior, posterior, and posterior predictive
  - Computing: MCMC estimation with JAGS
  - Applications:
    - Methods: hierarchical modeling, regression, latent class modeling
    - Contexts: student dining preference, drama ratings, Consumer Expenditure Surveys, student test scores

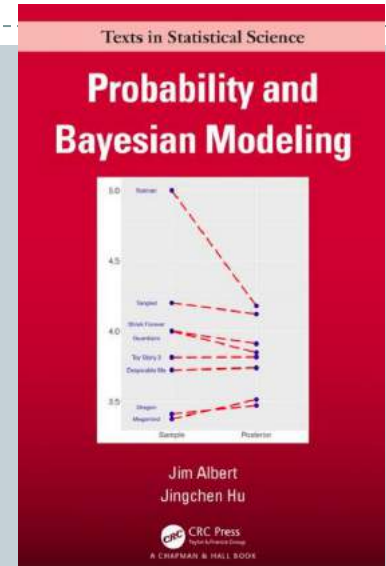# Upper-level statistics elective at Vassar College

- Features and recommendations
  - Case studies (discussion forum)
  - Journal articles (discussion form)
    - Reading guide
    - Computing labs
  - Projects
- GitHub repo
  (https://github.com/monika76five/Undergrad-Bayesian-Course)
- Probability and Bayesian Modeling (2019), Albert and Hu, CRC Press. (https://monika76five.github.io/ProbBayes/)

Colin Rundel

Lecturer, School of Mathematics
University of Edinburgh

Assistant Professor of the Practice
Department of Statistical Science
Duke University

A Bayesian Elective at Duke

- Sta 444/644: Spatio-temporal Modeling
- 15 weeks, elective
- 15-25 students per year
  - 4th year UG students & 2nd year MS students
- Prerequisites: Sta 360 / 601 / 602
  - 3rd year UG / 1st year MS Bayesian Theory course
- Expected prior R experience from Intro DS, Regression, or Stat Computing courses

Spatio-temporal modeling

- Covers theory, application, and computation for common spatial and time series models
  - Topics & course materials
  - Includes both Bayesian and Frequentist approaches
- Computing: R, JAGS, Stan (demos), and domain specific packages (e.g. spBayes)
- Sta 344 variant in the fall

Kevin Ross

Associate Professor of Statistics
Cal Poly San Luis Obispo

Bayesian Statistics at Cal Poly

- STAT 415: Bayesian Reasoning and Methods
- 10 weeks, elective
- 25-30 students per year
  - Majority Statistics majors
- Prerequisites: Stat 2 + Probability
  - single-variable calculus
  - computer programming
- No prior experience with R required

Bayesian Statistics at Cal Poly

- Bayesian Intro Stat?
- [Course topics](#) (a little outdated)
- [My course notes](#) (work in progress)
- Bayesian versions of Stat 1-2 methods
- Hierarchical models
- Comparison of Bayesian and frequentist
- Computing: R, MCMC, JAGS

Nick's questions

1. Was there something that you learned or that you found surprising from the cluster of papers?

Nick's questions

2. What about the mathematical prerequisites? Can we afford to wait until students have completed pre-calc, Calc I, Calc II, Calc III, then Probability before they are introduced to Bayesian Inference?

Nick's questions

3. The panel noted concerns about JAGS, STAN, and PyJAGS. What is your assessment of the modern technologies for Bayesian Inference?

Nick's questions

4. When they graduate, what ought our students be able to do computationally, and are we preparing them adequately in this regard?