

Prepare to Teach

Breakout Session: Teaching Bayesian Statistics

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A Bayesian module vs a Bayesian course

- Bayesian modules
 - Introductory courses
 - Intermediate / advanced courses
 - Link to a USCOTS workshop material: bit.ly/USCOTS2021_Bayes_HuRoss_material
- Bayesian courses
 - Introduction to statistics with a Bayesian flavor
 - [Kevin Ross's notes for Cal Poly STAT 415](#) (work in progress!)
 - Intermediate / advanced courses with calculus, probability and statistics pre-reqs
 - [Monika Hu's github repo of Vassar MATH 347](#)
 - [Links to material of other courses \(undergrad / masters\)](#)

Sample course schedules: 10-week vs 14-week

| Area | Topic | 10-week | 14-week |
|----------------------------------|---|---------|---------|
| Foundation of Bayesian Inference | Beta-binomial | 1 | 1 |
| | Normal-normal | - | 2 |
| | Conjugacy | 2 | 3 |
| | Prediction | 3 | 4 |
| Bayesian computing | MCMC | 4 | 5 |
| | Gibbs sampler | 5 | 6 |
| | Metropolis-Hastings | 6 | 7 |
| | MCMC diagnostics | 7 | 8 |
| Bayesian modeling | Linear regression | 8 | 9 |
| | Hierarchical mods | 9 | 10 |
| | Logistic regression | 10 | 11 |
| | GLM | - | 12 |
| Additional topics | Model checking, comparison, selection | - | 13 |
| | Missing data imputation, more on priors | - | 14 |

Dogucu and Hu (in preparation)

Bayesian computing

- Simulation-based teaching and learning (*Albert and Hu, 2020*)
- MCMC estimation (*Hu and Dogucu, submitted*)

| Method | Suitable for... |
|---|---|
| Self-coded MCMC algorithms | <ul style="list-style-type: none">- Intermediate / advanced course |
| JAGS, Stan, BUGS | <ul style="list-style-type: none">- Intermediate / advanced module- Introductory course- Intermediate / advanced course |
| Stan-based wrapper functions, e.g., rstanarm, brms | <ul style="list-style-type: none">- Intermediate / advanced module- Intermediate / advanced course |

Recommendations and tips

- Real world applications
- Student-centered learning (*Hu, 2020*)
 - Projects
 - Case studies
 - Journal articles reading and discussion
- Make a deliberate choice of Bayesian computing
- Comparisons to Frequentist methods?
 - Totally up to you!

Resources

- List of textbooks (some are free online), papers, courses (with slides)
 - [Undergraduate Bayesian Education Resources](#)
 - [Undergraduate Bayesian Resources](#)
- [Undergraduate Bayesian Education Network](#) (Slack)
- [Education Research and Practice Section](#) (International Society for Bayesian Analysis)
- Recent workshops and webinars and papers (2020 ~)
 - [Introducing Bayesian Statistical Analysis into Your Teaching](#) (USCOTS 2021)
 - [Teaching Bayesian Statistics at the Undergraduate Level](#) (USCOTS 2021)
 - [Bayesian Methods and the Statistics and Data Science Curriculum](#) (CAUSE & JSDSE webinar series, 2021)
 - [Bayes cluster](#) @ Journal of Statistics Education, 2020

Discussion questions

- What plans do you have to incorporate Bayesian methods in your teaching?
 - a. A module? At what level?
 - b. A course? At what level?
 - c. Who might be your students? What kind of preparation they might have?

- Have you considered what Bayesian computing approaches to use in your teaching?
 - d. Self-coded MCMC algorithms?
 - e. JAGS, Stan, BUGS?
 - f. Stan-based wrapper functions, e.g., rstanarm, brms

Discussion questions cont'd

- What kind of challenges do you foresee when teaching Bayesian methods?
- What resources for teaching and learning Bayesian ideas are you familiar with? Please share!
- What resources do you wish were available?

References

Albert, J. and Hu, J. (2020), Bayesian computing in the undergraduate statistics curriculum, *Journal of Statistics Education*, 28(3), 236-247.

Dogucu, M. and Hu, J., The current state of undergraduate Bayesian education and recommendations for the future, in preparation.

Hu, J. (2020), A Bayesian statistics course for undergraduates: Bayesian thinking, computing, and research, *Journal of Statistics Education*, 28(3), 229-235.

Hu, J. and Dogucu, M., Content and computing outline of two undergraduate Bayesian courses: tools, examples, and recommendations, submitted.