Syllabus – STOR 757

Spring 2020 (January 8 – April 24)
TuTh 11:00am – 12:15pm
Hanes 130

Instructor: Jan Hannig
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Office Hours: MW 12:30-1:30pm and by appointment

Course home page on https://hannig.cloudapps.unc.edu/STOR757Bayes

Required Text: Gelman, et al (2013), *Bayesian Data Analysis*, 3rd Edition CRC Press (additional resources related to the book are available at http://www.stat.columbia.edu/~gelman/book/)

Optional Text:

- Robert CP, *The Bayesian Choice*, 2nd edition, Springer
- Bernardo JM and Smith AFM, *Bayesian Theory*, Wiley
- Gilks WR, Richarson S and Spiegelhalter DJ, *Markov Chain Monte Carlo in Practice,* Chapman & Hall/CRC
- Albert J, *Bayesian Computation with R*, Springer

Course Objective:
Introduction of both basic and modern aspects of Bayesian methodology.

Covered Topics (in chronological order)

- Philosophical ideas behind Bayesian statistics
- Basic ideas and examples
  - conjugate priors, Jeffreys prior
  - Multivariate distributions
  - Hierarchical Models and basic Gibbs sampler
- Model Selection
  - Model averaging and Bayes factors
  - Jeffreys-Lindley's paradox
  - Zellner prior
- Mathematical theory of improper priors
- Theory of Markov Chain Monte Carlo

    - Review of theory of Markov chain
    - Metropolis-Hastings and Gibbs Sampler
    - Hamiltonian-MC
    - Monitoring convergence
- Fiducial inference and inferential models (time permitting)

Assessment: Your grade will be based on homework (30%), two short class presentations (30%) and a project report (40%).

Important dates:

Final Exam: There will be no final exam.
The final project is due by 12noon on April 27.

Homework: Several homework sets will be assigned on Sakai during the semester.

Class Presentations: February 11 and April 21

Project:

You will be asked to select a modern paper (no older than 5 years) concerning Bayesian statistics and replicate the results in the paper (simulations, theory, etc). You will also be asked to extend the paper in some way, e.g. theoretical extension or additional simulation study. The final report will be typed using LaTeX using the ims-template.tex format. The report should include an appropriate title, introduction, verification, conclusions sections. The final report will be no longer than 10 pages (excluding references). All references must be in refereed journals or books and must be cited appropriately in the body of the text. The final document is due by 12noon, April 27.

Presentations:

You will be asked to give two seminars: The first (February 11) is a short presentation introducing the selected paper and proposing what will be replicated. The second (April 21) will present the results of your work both on the replication and extensions of the material in the paper. Each student is **required** to come to office hours at least once prior to the first seminar to discuss the selection of the paper.

Note: The instructor reserves the right to make any changes he considers academically advisable. It is your responsibility to attend classes and keep track of the proceedings.