
PLSC 42120. Bayesian Inference in Political Science

Instructor: Prof. Jong Hee Park
Office: Pick 426
Phone: 773-702-8056
Email: jhp@uchicago.edu
URL: <http://home.uchicago.edu/~jhp/>

Office Hours: by appointment

T.A.:

Course Outline

The goal of this course is to review Bayesian approaches to advanced statistical models in political science. The main focus of the course is to understand foundations of Bayesian inference and learn Bayesian implementations of advanced statistical models in political science such as changepoint models, Markov transition models, item response theory (ideal point estimation) models, panel models, and models for relational (or network) data. Students are expected to have strong knowledge of linear models and generalized linear models.

Grade Policy

30% Assignments
10% Class participation
60% Research Project

Books

- Carlin, B. P. and Louis, T. A. 1996. *Bayes and Empirical Bayes Methods for Data Analysis*, Chapman and Hall.
- Gelman, A., Carlin, J., Stern, H., and Rubin, D. B. 1995. *Bayesian Data Analysis*, Chapman and Hall.
- Gill, Jeff. 2008. *Bayesian Methods: A Social and Behavioral Approach*, 2nd Edition. Chapman and Hall. A companion BaM package is available.
- Greenberg, Edward. 2007. *Introduction to Bayesian Econometrics*, Cambridge.

Software

We will use R for statistical computation. Students are highly encouraged to use T_EX or L^AT_EX for weekly assignment and the final project.

Course Plan

1. Introduction
2. Review of Bayesian Statistics (April 9)
 - Greenberg. Ch.1~4
 - Gelman et al., Ch. 1~3.
 - Gill, Ch. 3~4.
3. MCMC Computation (April 16)
 - Greenberg. Ch.5~8
 - Siddhartha Chib and Edward Greenberg. 1995. "Understanding the Metropolis-Hastings Algorithm." *American Statistician*, 49(4): 327-335.
 - Gelman et al., Ch. 10~11.
 - Gill, Ch. 8~9.
4. Bayesian Model Selection and Data Augmentation (April 23)
 - (a) Bayesian Model Selection
 - Robert E. Kass and Adrian E. Raftery. 1995. "Bayes Factor." *Journal of the American Statistical Association*, 90: 773-795
 - Siddhartha Chib. 1995. "Marginal likelihood from the Gibbs output." *Journal of the American Statistical Association*, 90: 1313-1321
 - Gelman et. al. Ch. 6.
 - Gill, Ch. 7.
 - Samir Chettri, David Batchelor, William Campbell and Karthik Balakrishnan. 2005. "Newton, Einstein, Jeffreys and Bayesian model selection" *AIP Conference Proceedings* 803(1): 421-430.
 - (a) Data Augmentation
 - Martin A. Tanner and Wing Hung Wong. 1987. "The Calculation of Posterior Distributions by Data Augmentation," *Journal of the American Statistical Association*, 82: 528-550.
 - Jim Albert and Siddhartha Chib. 1993. "Bayesian Analysis of Binary and Polychotomous Response Data" *Journal of the American Statistical Association*, 88: 669-679.
 - Jun S. Liu and Ying Nian Wu, 1999, "Parameter Expansion for Data Augmentation," *Journal of the American Statistical Association*, 94: 1264-1274
 - David A. Van Dyk and Xiao-Li Meng. 2001. "The Art of Data Augmentation." *Journal of Graphical and Computational Statistics*, 10: 1-111.
5. Item Response Theory Models and Ideal Point Estimation (April 30)
 - (a) Basics
 - Keith Poole and Howard Rosenthal. 1985. "A Spatial Model For Legislative Roll Call Analysis." *American Journal of Political Science*, pp. 357-384

- Valen Johnson and James Albert. 1999. *Ordinal Data Modeling*. Chapter 6. New York: Springer.
- Clinton, Joshua, Simon Jackman, and Doug Rivers, 2004, “The Statistical Analysis of Roll Call Voting: A Unified Approach,” *American Political Science Review* 98: 355-370.
- Joseph Bafumi, Andrew Gelman, David Park, and Noah Kaplan. 2005, “Practical Issues in Implementing and Understanding Bayesian Ideal Point Estimation.” *Political Analysis* 13: 171-187.

(a) Extensions and Applications

- Erik Voeten. 2000. “Clashes in the Assembly.” *International Organization* 54(2): 185-215.
- Simon Jackman. 2001. “Multidimensional Analysis of Roll Call Data via Bayesian Simulation: Identification, Estimation, Inference, and Model Checking.” *Political Analysis*. 9: 229-240.
- Andrew Martin and Kevin Quinn. 2002. “Dynamic Ideal Point Estimation via Markov Chain Monte Carlo for the US Supreme Court, 1954-1999,” *Political Analysis* 10: 134-153.
- Johsua D. Clinton and Adam Meiowitz. 2004. “Testing Accounts of Legislative Strategic Voting: The Compromise of 1790,” *American Journal of Political Science* 48(4):675-89.
- Daniel E. Ho and Kevin M. Quinn. 2008. “Measuring Explicit Political Positions of Media” *Quarterly Journal of Political Science*, 3: 353-377.
- Jong Hee Park, 2008. “Detecting Changes in Preference: Change-point Analysis of Ideal Point Estimation Model via Bayesian Inference,” Manuscript.

6. Hierarchical/Panel Models (May 7)

- Siddhartha Chib and Bradley P. Carlin. 1999. “On MCMC Sampling in Hierarchical Longitudinal Models” *Statistics and Computing*, 9: 17-26.
- Siddhartha Chib. 2008. “Panel Data Modeling and Inference: A Bayesian Primer,” *The Econometrics of Panel Data*
- Greenberg, Ch. 9.
- Gelman et al., Ch. 6.

7. Bayesian Time Series Models (May 14)

(a) Basics

- Greenberg, Ch. 10.
- C. K. Carter and R. Kohn, 1994. “On Gibbs sampling for state space models” *Biometrika* 81(3): 541-553.
- Carlin, B., Gelfand, A. and Smith, A.F.M., 1992. “Hierarchical Bayesian analysis of change-point problems.” *Applied Statistics*, 41: 389-405
- Siddhartha Chib. 1998. “Estimation and comparison of multiple change-point models” *Journal of Econometrics*, 86(2): 221-241.

(a) Applications in Political Science

- Arthur Spirling. 2007. “Bayesian Approaches for Limited Dependent Variable Change Point Problems.” *Political Analysis*.
- Jong Hee Park. “Modeling Structural Changes Using Bayesian Inference: Historical Changes in U.S. Presidents’ Use of Force Abroad” Manuscript.
- Patrick T. Brandt and John R. Freeman. 2009. “Modeling Macro-Political Dynamics” *Political Analysis*.

8. Network and Interdependence (May 21)

(a) Basics

- Peter D. Hoff, Adrian E. Raftery, and Mark S. Handcock. 2002. “Latent space approaches to social network analysis.” *Journal of the American Statistical Association*, 97(460):10901097
- Peter D. Hoff. 2003. “Random Effects Models for Network Data.” in *Dynamic Social Network Modeling and Analysis: Workshop Summary and Papers*, pp. 303-312, Ronald Breiger, Kathleen Carley, and Philippa Pattison, eds., The National Academies Press.
- Mark S. Handcock, Adrian E. Raftery, and Jeremy M. Tantrum. 2007. “Model-based clustering for social networks.” *Journal of the Royal Statistical Society, Series A* (with discussions), 170(2):301354.
- Garry Robins, Pip Pattison, Yuval Kalish, Dean Lusher, 2007. “An introduction to exponential random graph (p^*) models for social networks” *Social Networks* 29: 173-191.

(a) Applications in Political Science

- Michael D. Ward and Kristian Skrede Gleditsch. 2002. “Location, Location, Location: An MCMC Approach to Modeling the Spatial Context of War and Peace.” *Political Analysis* 10(3):244-260.
- Peter D. Hoff and Michael D. Ward. 2004. “Modeling Dependencies in International Relations Networks.” *Political Analysis*, 12(2): 160 -175.
- Nathan M. Jensen, Andrew D. Martin, Anton H. Westveld, “Modeling Foreign Direct Investment as a Longitudinal Social Network” Working paper.

9. Student Presentation 1 (May 28)

10. Student Presentation 2 (June 4)

11. The final paper is due on June 11.

ADA Accommodations: Any student who, because of a disability, may require special arrangements in order to meet course requirements should contact me as soon as possible to make necessary arrangements.

Additional Remarks: Cheating will not be tolerated and may result in severe academic sanctions. Disruptive talking in class will not be tolerated. On the other hand, asking and responding to questions in class is strongly encouraged.