PSC 506
Advanced Topics in Methods

Spring 2015

Thurs, 2-4:40

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PURPOSE: This course covers topics that one might encounter in advanced political methodology research, but which are not yet standard fare in methods courses: e.g., Bayesian methods, bootstrapping, nonparametric regression, semiparametric methods, neural nets, etc. As a research workshop, this course will also allow students to pursue areas of individual interest in more depth. The course content, therefore, depends not only on what I want to cover, but also on what students want to cover. Finally, since students taking 506 are assumed to be interested in political methodology as a major field, they will be required (1) to solve "unsolved" problems during the semester and (2) to write a research paper that makes a contribution to the methods literature.

PREREQUISITES: Students must have taken PSC 404, 405, and 505. Students who would like to waive these courses based on courses previously taken must have those courses approved by me.

COURSE REQUIREMENTS:

- **Participation and Weekly Assignments (40%)**. Each week, students will be responsible for (1) having done all the required readings, (2) presenting one of those readings, and (3) participating in our discussions. The student presentation should be in the form of LaTeX'd notes, a Beamer presentation, or a Powerpoint presentation. The presentation should include (a) a summary of the article's main points/contributions, (b) a detailed walk through the main model and/or technique, (c) a summary of the results, and (d) a short critique of the paper. Applied or theoretical problems will also be assigned from time to time based on the required readings. Students will be expected to have completed the assignment and should be prepared to present their results in class.

- **Final Paper (60%)**. A final paper is due the last day of final exams. The paper should either develop a new statistical technique or apply advanced methods. Except in very rare circumstances, the paper should employ real data and make a substantive contribution.

COURSE SCHEDULE AND READINGS: If you are interested in pursuing political methodology fas a subfield, you should purchase as many of the below texts as possible. Having said that, most will be available in the star lab. I will often assign articles each week. Students will use the R programming language for much of this course.

1. Course Organization

- Students should be familiar with methods literature on linear models, MLE, duration models, grouped binary duration models, selection models, and strategic models.

2. Parallel Processing in R

HW: Run a MC simulation in parallel on the linux cluster.

3. Bayesian Inference and MCMC

- Bayesian inference
- MCMC, Gibbs sampler, Convergence
- Jags

Jackman, Simon. 2000. "Estimation and Inference via Bayesian Simulation." *AJPS*.

Efron, B. 1986. "Why Isn't Everyone Bayesian?" *The American Statistician*.

Brooks, Stephen P. 1998. "Markov Chain Monte Carlo and Its Application." *The Statistician*.

Casella, George and Edward I. George. 1992. "Explaining the Gibbs Sampler." *The American Statistician*.

Albert, James H. and Siddhartha Chib. 1993. "Bayesian Analysis of Binary and Polychotomous Response Data." *JASA*.

Gelman, Andrew and Donald B. Rubin. 1992. "Inference from Iterative Simulation Using Multiple Sequences." *Statistical Science*.

Cowles, Mary Kathryn and Bradley P. Carlin. 1996. "Markov Chain Monte Carlo Convergence Diagnostics." *JASA*.

(Everyone) Kass, Carlin, Gelman, Neal. 1998. "Markov Chain Monte Carlo in Practice: A Roundtable Discussion." *The American Statistician*.

(Reference) Jeff Gill. *Bayesian Methods*. Chapman & Hall/CRC.

HW: Replicate a PSC 505 HW using MCMC by (1) programming your own Gibbs sampler and (2) using jags.

Multiple Imputation

Rubin, Donald B. 1996. "Multiple Imputation After 18+ Years." *JASA*.

Schafer, Joseph L. 1999. "Multiple Imputation: A Primer." *Statistical Methods in Medical Research*.

Schafer, Joseph L. and John W. Graham. 2002. "Missing Data: Our View of the State of the Art." *Psychological Methods*.

King, Gary, James Honacker, Anne Joseph, and Kenneth Scheve. 2001. "Analyzing Incomplete Political Science Data." *APSR*.

Blackwell, Matthew, James Honaker, and Gary King. 2012. "Multiple Overimputation: A Unified Approach…" Working paper.

HW: Replicate a PSC 505 HW using multiple imputation. First, program it yourself. Then use an available package.

Multilevel Models

Greenland, Sander. 2000. "Principles of Multilevel Modeling." *International Journal of Epidemiology*.

Park, David K., Andrew Gelman, and Joseph Bafumi. 2004. "Bayesian Multilevel Estimation with Poststratification." *Political Analysis*.

Shor, Boris, Joseph Bafumi, Luke Keele, and David Park. 2007. "Bayesian Multilevel Modeling Approach to Time-Series Cross-Sectional Data." *Political Analysis*.

Jackman, Simon. 2008. Ch 7.1-7.2. *Bayesian Analysis for the Social Sciences.*

Jackman Simon. 2008. Ch 7.3-7.5. *Bayesian Analysis for the Social Sciences.*

(reference) Tom Loredo 2014 lecture notes.

HW: Replicate a PSC 505 HW using a multilevel model. Just use jags for this.

4. Geography and Spatial Interdependence

Ward, Michael and Kristian Skrede Gleditsch. 2002. "Location, Location, Location: An MCMC Approach to Modeling the Spatial Context of War and Peace." *Political Analysis.*

Beck, Nathaniel, Kristian Skrede Gleditsch, and Kyle Beardsley. 2006. "Space is More than Geography: Using Spatial Econometrics in the Study of Political Economy." *International Studies Quarterly*.

Franzese, Robert J. and Jude C. Hays. 2007. "Spatial Econometric Models of Cross-Sectional Interdependence in Political Science Panel and Time-Series-Cross-Section Data." *Political Analysis*.

5. Network Models

6. Ideal Point Estimation

Keith Poole. *Spatial Models of Parliamentary Voting*. Cambridge Univ.

- NOMINATE

- Bayesianpara
- Factor analysis
- Bridging
- Bonica -- expenditures

7. Bootstrap II

A.C. Davison and D.V. Hinkley. *Bootstrap Methods and their Applications.* Cambridge.
Bradley Efron and Robert J. Tibshirani. *An Introduction to the Bootstrap*. Chapman & Hall/CRC.

8. Machine Learning

Hastie, Tibshirani, Friedman. *The Elements of Statistical Learning*. Springer. E-version available online.

- Neural nets
- Support vector machines
- Regression trees
- Penalized estimators

9. Propensity Scores, Matching, and Causal Inference

10. Estimating Games

11. Student Project Presentations (last class: April 23)

Paper topic due April 9 in class

Paper due May 8 by 5pm