

Political Science 688
Applied Bayesian and Robust Statistical Methods in Political Research

Winter 2005

<http://www.umich.edu/~jwbowers/ps688.html>

Class in 7603 Haven Hall 10-12 Friday

Instructor:	Office Hours:
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This course is an introduction to applied Bayesian and robust methods with special emphasis on political science applications. We will spend about 2 months on Bayesian data analysis, first covering the basics of Bayesian approaches to inference and then applying these conceptual tools to “plain old” generalized linear models, multilevel models, and item response models. We will then spend about 2 months learning about statistical methods that attempt to help closely to the principles of good research design and to a specific understanding of what is means for X to “cause” Y . These approaches tend to involve fewer, or at least different, assumptions from those commonly used in political science and include techniques such as matching, propensity scores, instrumental variables, randomization inference, and sensitivity analysis.

I’ll calculate your grade for the course this way: 40% class participation (including presentations if that is what we decide to do, paper topics, paper production plans, and paper production plan reports, comments on other peoples’ papers) and 60% the final paper (of which 25% is the draft).

Books I’ve ordered one book for the class at the Shaman Drum bookstore:

Gelman, Carlin, Stern and Rubin. 2004. *Bayesian Data Analysis, 2nd Edition*

Computing Computing is an essential part of modern statistical data analysis — both for producing persuasive information from data and for conveying that information to the scholarly community. So we will pay attention to computing, with special emphasis on understanding what is going on behind the scenes.

Since this is an advanced course we will be mostly writing our own code in the dialect of the S language that is implemented in the open-source (and free) R software. I will also require that you begin to learn to use \LaTeX as you write your papers. R and \LaTeX are the *de facto* standard tools among applied statisticians, and as students in our most advanced applied statistics course, you should learn them.

Schedule

1/6— Introduction and Planning

- Reading:**
1. Jackman, Simon. 2004. “Bayesian Analysis for Political Research.” *APSR*
 2. Box, George. 1976. “Science and Statistics.” *JASA*

1/14— Single Parameter Models

Reading: Gelman Chapter 1 and 2

Problem: Example 2.8

Due: Draft paper topics.

1/21— Multiparameter and Hierarchical Models

Reading: Gelman Chapter 3 and 5

Problem: Example 5.5.

Due: Final paper topics. Draft paper production plan.

1/28— *Simulation Based Inference*

Reading: Gelman Chapter 10 and 11 (and section 13.2)

Problem: Example 11.7

Due: Final paper production plan.

2/4— *Linear Models (aka Regression)*

Reading: Gelman Chapter 9 and 14

Problem: Example 14.3.

2/11— *Hierarchical Linear Models (aka Multilevel Regression aka Random Coefficient Models aka Random Effects Models aka ...)*

Reading: 1. Gelman Chapter 15
2. *Raudenbush and Bryk, 2nd Ed, Chap 13

Problem: Example 15.2

Due: Paper production report #1.

2/18— *Generalized Linear Models — In 2462 Mason Hall*

Reading: Gelman Chapter 16

Problem: Example 16.6.

2/25— *Multivariate Models (aka Item Response Models and Factor Analysis)*

Reading: 1. Gelman Chapter 19
2. Clinton, J., S. Jackman, and D. Rivers. (2004) “The Statistical Analysis of Roll Call Data.” *American Political Science Review* 98, 355-370.
3. Bafumi, J., A. Gelman, D. K. Park, and Kaplan, N. (2004) “Practical issues in implementing and understanding Bayesian ideal point estimation.” *Political Analysis*, Forthcoming.

Presentating Article: Hyeran

Special Guest: Burt Monroe

Problem: Example from section 19.4

Due: Paper production report #2.

3/3— *No Class, Spring Break*

3/11— *Causality and Causal Effects in Observational Studies*

- Reading:**
1. Holland, P. 1986. "Statistics and Causal Inference" (with Discussion) *JASA* 81:945-970.
 2. Cox, D. R. (1992). "Causality: Some Statistical Aspects." *Journal of the Royal Statistical Society, Series A*, 155, part 2, 291-301.
 3. Brady, Henry and Jason Seawright. 2004. "Framing Social Inquiry: From Models of Causation to Statistically Based Causal Inference" August 28, 2004. Unpublished Manuscript.
 4. Winship, C.. and Morgan, S.L. 1999. "The Estimation of Causal Effects from Observational Data." *Annual Review of Sociology* 25:659-707.
 5. Rosenbaum, P. 1999. "Choice as an Alternative to Control in Observational Studies (with discussion)." *Statistical Science* 14:259-304.
- Extra:**
1. Freedman, David, "Statistical Models and Shoe Leather," *Sociological Methodology*, 21, 1991, 291-313.¹
- Due:** Paper production report #3.

3/18— *Propensity Scores and Matching*

- Reading:**
1. Rosenbaum, Paul. 2001. "Observational Studies: Overview." in *International Encyclopedia of the Social and Behavioral Sciences*.
 2. Rubin, Donald. 1997. "Estimating Causal Effects from Large Data Sets Using Propensity Scores." *Annals of Internal Medicine*. 5;127(8 Pt 2):757-63. also http://www.stat.columbia.edu/~gelman/stuff_for_blog/propensity.html
 3. Rosenbaum, P. R. and D. B. Rubin. (1984) "Reducing bias in observational studies using subclassification on the propensity score." *Journal of the American Statistical Association* 79, 516-524.
 4. Rosenbaum, Paul R. and Rubin, Donald B. (1985) "Constructing a control group using multivariate matched sampling methods that incorporate the propensity score" *American Statistician* 39: 33-38.
 5. Hansen, Ben. 2004. "Full matching in an observational study of coaching for the SAT." *Journal of the American Statistical Association* 99, 609-618.
 6. Ho Daniel, Kosuke Imai, Gary King, and Elizabeth A. Stuart.2004. "Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference." <http://www.princeton.edu/~kimai/research/preprocess.html>
- Extra:**
1. Rosenbaum, P. R. and D. B. Rubin. (1983) "The central role of the propensity score in observational studies for causal effects." *Biometrika* 70, 41-55.
 2. Braitman and Rosenbaum, P. 2002. "Rare Outcomes, Common Treatments: Analytic Strategies Using Propensity Scores" *Ann Intern Med* 137 (8): 693-695.
 3. D'Agostino Jr., R. B. and D. B. Rubin. (2000) "Estimating and using propensity scores with partially missing data", *Journal of the American Statistical Association* 95, 749-759.

Presenting Article: Katie

3/25— *Instrumental Variables and Randomization Inference*

¹see also the discussion of this article in the same volume for different viewpoints on Freeman's argument.

- Reading:**
1. Angrist, Joshua, Guido Imbens, and Donald Rubin, “Identification of Causal Effects Using Instrumental Variables,” *Journal of the American Statistical Association*, 91, 1996, 444-455.
 2. Imbens GW, Rosenbaum PR. 2005. “Robust, accurate confidence intervals with a weak instrument: quarter of birth and education” *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, Vol. 168, No. 1., 109
 3. Gerber, Alan S. and Donald P. Green. 2000. “The Effects of Canvassing, Telephone Calls, and Direct Mail on Voter Turnout: A Field Experiment.” *American Political Science Review* 94(3): 653-663.
 4. Imai, Kosuke. “Do Get-Out-The-Vote Calls Reduce Turnout? The Importance of Statistical Methods for Field Experiments.” *American Political Science Review*. Forthcoming. <http://www.princeton.edu/~kimai/research/matching.html>
 5. Bowers, Jake and Ben Hansen. 2005. “Attributable Effects and Full Matching for Binary Outcomes in Field Experiments and Observational Studies” Unpublished Manuscript. <http://www.umich.edu/~jwbowers/papers.html>

- Extra:**
1. Rosenbaum, Paul. 2002. *Observational Studies*. Chapters 2
 2. Reply to Imai from Gerber and Green if available.

Presenting Article: Joel

Due: Paper production report #4.

4/1— Sensitivity Analysis

- Reading:**
1. Cornfield, J, Haenszel, W, Hammond, EC, Lilienfeld, AM, Shimkin, MB, and Wynder, EL 1959. “Smoking and lung cancer: recent evidence and a discussion of some questions.” *Journal of the National Cancer Institute* 22: 173-203.
 2. Rosenbaum, Paul. 2002. *Observational Studies*. Chapters 4
 3. Aakvik, A 2001. “Bounding a matching estimator: the case of a Norwegian training program.” *Oxford Bulletin of Economics and Statistics* 63: 115-143.
 4. Imbens, G.W. (2003). “Sensitivity to exogeneity assumptions in program evaluation.” *Am. Econ. Rev.* 93, 126-32.

Presenting Article:

Due:

4/8— Wrapping up and/or Open for Suggestions

- Reading:**
1. Heckman, James. 2000. “Causal Parameters and Policy Analysis in Economics: A Twentieth Century Retrospective.” *The Quarterly Journal of Economics* Volume: 115 Number: 1 Page: 45-97
 2. Rubin, DB. 2005. “Causal Inference Using Potential Outcomes: Design, Modeling, Decisions” *Journal of the American Statistical Association*, Vol. 100, No. 469. (March 2005), pp. 322-331.
 3. Little, Roderick J., and Donald Rubin. 2000. “Causal effects in clinical and epidemiological studies via potential outcomes: concepts and analytical approaches.” *Annual Review of Public Health* 21: 121-145.
 4. Rosenbaum, Paul and Jeff Silber. 2001. “Matching and thick description in an observational study of mortality after surgery.” *Biostatistics*, 2, 217-232.

Presenting Article:

Due:

4/15— Paper Draft Workshop

Reading: Each others' draft papers.

Due: Comments on the drafts.

4/22— No Class — Papers Due