

Bayesian Statistics for Political Science

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Class Hours: 09:30-12:30, 13:30-17:30

Web: TBD

Class Room: Villa Sanfelice

Rationale

This workshop aims at introducing the basic theoretical and applied principles of Bayesian statistics specifically geared toward researchers in political science. Despite the usefulness of the Bayesian approach, it is less taught among researchers of political science compared with the frequentist paradigm. The Bayesian framework is particularly useful for the type of data that political scientists encounter. It is a formal method for combining prior information with observed quantitative information; it offers a more general way to deal with issues of model identification, and it allows researchers to fit very realistic, sometimes complicated, models.

Workshop Outline

First, we will discuss the differences between Bayesian and frequentist approaches and the advantages of using the Bayesian approach for political scientists. Second, the workshop will cover the theoretical foundation of Bayesian statistics and briefly introduce Markov chain Monte Carlo simulation methods and the Gibbs sampler and the Metropolis-Hastings algorithms will be discussed. Third, we will mainly focus on using Bayesian models in political science data analysis. Researchers will learn how to do standard statistical models from a Bayesian perspective. The topics include linear, logit/probit, poisson/negative binomial, hierarchical models etc. If time permits, additional topics, such as models for multivariate outcomes and Bayesian change point analysis, will also be introduced.

Workshop Objectives

By taking this workshop, researchers are expected to

1. understand the fundamental differences and similarities between frequentist and Bayesian approaches to inference.
2. be able to formulate linear and generalised linear models in the Bayesian framework.
3. be able to estimate and interpret linear and generalised linear models in the Bayesian framework.

Computing Requirement

This workshop requires researchers to mostly use JAGS or BUGS. If time permits, a gentle introduction to Stan will also be provided. We access JAGS and OpenBUGS through R, and therefore basic knowledge of R language is required. Most models in the lecture will be built on JAGS or OpenBUGS. The languages of these two programmes are almost identical. I recommend JAGS, as it runs on Macs, Windows as well as Linux. Instructions about how to install JAGS will be distributed online prior to the workshop.

Recommended Books

The following two books are recommended for your own reference:

Gelman, Andrew and Jennifer Hill (2007). *Data analysis using regression and multilevel/hierarchical models*. New York, NY: Cambridge University Press.

Gill, Jeff (2014). *Bayesian Methods A Social and Behavioral Sciences Approach*. 3rd edition. Boca Raton, FL: Chapman and Hall/CRC.

For researchers who are not familiar with R, the following:

Fox, John and Sanford Weisberg (2011). *An R Companion to Applied Regression*. 2nd edition. Thousand Oaks: Sage.

A short workshop of introduction to R given by John Fox at the ICPSR summer programme can be found [here](#).

Another very useful workshop for learning R given by Dave Armstrong. All his materials can be found [here](#).

Tutorials

Tutorials with guided hands-on exercises will also be offered during the workshop after each topic.

Credit Policy

To receive 10 credits for this workshop, researchers should attend all sessions and complete one computer-based problem set after the workshop. The solutions to the problem set, along with all code you used, should be sent to Chendi Wang (chendi.wang@eui.eu) by **1 May 2019**. Researchers who do not need credits are also welcome to attend the workshop.

Class Schedule

The schedule below is preliminary. In particular, the list of topics may still be adjusted depending on time availability.

Monday, 25 March 2019: Day 1

Morning

- Probability
- Bayes' Rule
- Priors

Afternoon

- MCMC Algorithms
- Introduction to the JAGS/BUGS Language
- Convergence Diagnostics
- The Linear Model

Tuesday, 26 March 2019: Day 2

Morning

- The Linear Model con.
- Models for Binary & Discrete Choice Outcomes

Afternoon

- Models for Count Outcomes
- Latent Factor Models
- Hierarchical/Multilevel Models

Wednesday, 27 March 2019: Day 3

Morning

- Hierarchical/Multilevel Models con.
- Model Assessment
- Bayes Factors
- Model Comparison

If time permits, following topics will be discussed as well.

- Models for Multivariate Outcomes
- Bayesian Change Point
- Stan