

Introduction

Applied Bayesian Statistics for Social Scientists
Winter Term 2018

Introduction

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GSDS

Have you heard...

Editorial

David Trafimow and Michael Marks

New Mexico State University

The *Basic and Applied Social Psychology* (BASP) 2014 Editorial emphasized that the null hypothesis significance testing procedure (NHSTP) is invalid, and thus authors would be not required to perform it (Trafimow, 2014). However, to allow authors a grace period, the Editorial stopped short of actually banning the NHSTP. The purpose of the present Editorial is to announce that the grace period is over. From now on, BASP is banning the NHSTP.

With the banning of the NHSTP from BASP, what are the implications for authors? The following are

a strong case for rejecting it, confidence intervals do not provide a strong case for concluding that the population parameter of interest is likely to be within the stated interval. Therefore, confidence intervals also are banned from BASP.

Bayesian procedures are more interesting. The usual problem with Bayesian procedures is that they depend on some sort of Laplacian assumption to generate numbers where none exist. The Laplacian assumption is that when in a state of ignorance, the researcher should assign an equal probability to each possibility. The

Source: Basic and Applied Social Psychology. Volume 37, Issue 1, 2015.

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- $((H_0 \rightarrow t) \wedge \neg t) \vdash \neg H_0$
- This reasoning is valid in case of $\neg t \dots$
- but not valid in case that t is unlikely.

Some (further) concerns in inference based on frequentist framework

- tired to look for a model specification with * for your effects? (significance test)
- any bad feelings in doing significance test using OECD data? (small n, non sampled data)
- angry with your statistical model which endlessly seeks the global maximum? (flat likelihood function, multiple maxima)
- unsatisfied that every new data bring different results? (cumulation of findings)
- wish to extend the role of theories in the empirical analysis? (use of existing information)

Advantages of Bayesian inference in overview

- non sampled datasets
- systematic integration of prior information (knowledge from existing theories, empirical investigations etc.)
- inference based on fewer N
- feasibility of estimation of complex models using MCMC
- handling of missing data
- intuitive interpretation of results
- no significance test
- ...

... Are these points not attractive for social scientists?

Goals of this course

Making the Bayesian literature accessible and some Bayesian estimation feasible.

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- Bayesian estimation of some selected models using R and JAGS

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This course cannot provide...

- an extensive introduction into Bayesian statistics.

Susumu Shikano

- Professor at Graduate School of Decision Sciences & Department of Politics and Public Administration, Univ. of Konstanz
- Research interest:
 - Spatial models of party competition
 - Adaptive learning models of voter behavior
 - Further topics concerning micro-level political decision makings

Available in ILIAS

- Slides, codes, data, etc.
- Password: `Prior`

Topics to be dealt with

Introduction, basic idea of Bayesian inference

Bayesian estimation of regression models
(conjugacy analysis and
Markov-Chain-Monte-Carlo)

Parameter estimation via Markov-Chain Monte Carlo

Variety of regression models and further statistical models

Further topics (Bayes factor, model averaging data augmentation, etc)

Literature

- General intro: Jeff Gill (1999) The insignificance of null hypothesis significance testing. *Political Research Quarterly*, 52(3), pp. 647-674.
- Linear regression: Susumu Shikano (2014) Bayesian estimation of regression models. Henning Best and Christof Wolf (eds.) *The SAGE Handbook of Regression Analysis and Causal Inference*. Sage.
- Multilevel Model: Andrew Gelman and Jennifer Hill (2007) *Data Analysis Using Regression and Multilevel/Hierarchical Models*. Cambridge: Cambridge University Press. (Part 2A)

Software

- R
- JAGS

See the document in ILIAS.

ECTS

- Some Assignments during Semester
 - Small exercise in R and/or JAGS
- Take-home exam (one week in the mid of February or later)