Journal of Statistical Software

MMMMMM YYYY, Volume VV, Issue II. *doi: 10.18637/jss.v000.i00*

Intervention analysis using the cross section of a wide panel

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Abstract

interCross uses the variation of successive observations in the cross section of a wide panel to identify the law of motion for conduction an intervention analysis. **interCross** creates a discrete approximation to a low-order Markov process defined on a continuous state space in discrete time. Once the state space is discretized, **interCross** provides tools to estimate the transition matrices and analyze the Markov process.

Keywords: Intervention analysis, wide panel, Markov chain, Markov process, discretization.

1. Introduction

The introduction is in principle "as usual". However, it should usually embed both the implemented *methods* and the *software* into the respective relevant literature. For the latter both competing and complementary software should be discussed (within the same software environment and beyond), bringing out relative (dis)advantages. All software mentioned should be properly `\cite{}`d. (See also Appendix B for more details on BibTeX.)

For writing about software JSS requires authors to use the markup `\proglang{}` (programming languages and large programmable systems), `\pkg{}` (software packages), `\code{}` (functions, commands, arguments, etc.). If there is such markup in (sub)section titles (as above), a plain text version has to be provided in the LaTeX command as well. Below we also illustrate how abbrevations should be introduced and citation commands can be employed. See the LaTeX code for more details.

This article illustrates how to uss the variation of successive observations in the cross section of a wide panel to identify the law of motion for conduction an intervention analysis. The **interCross** package creates a discrete approximation to the distribution function of a population of individuals following a Markov process defined on a continuous state space in discrete

time. Once the state space is discretized, **interCross** provides tools to estimate the transition matrices and analyze the Markov process. It is used to model a population of individuals, each following a continuous-state Markov process in discrete time.

Describe intervention analysis and survey R packages.

There are several R packages (R Core Team 2017) available for working with Markov processes. The packages **markovchain** (Spedicato, Kang, Yalamanchi, Yadav, and Cordon 2020) and **DTMCPack** (Nicholson 2013) provide tools for basic computations with Markov chains. The **mcmc** is designed for working with Monte Carlo Markov Chains. Packages **HMM** (Geyer and Johnson 2020) and **depmixS4** (Visser and Speekenbrink 2010) are designed for fitting Hidden Markov Models.

There are several packages aimed at specific applications of Markov chains. Some of these include packges designed for application in health care. There is **TPmsm** (Araújo, Meira-Machado, and Roca-Pardiñas 2014) for estimating transition probabilities for 3-state progressive disease models and **heemod** (Filipović-Pierucci, Zarca, and Durand-Zaleski 2017) for applying Markov models to health care economic applications. Aimed at specific applications, some of these packages assume a considerable knowledge of the relevant subject matter and theory behind those applications.

The packages **msm** (Jackson 2011) and **SemiMarkov** (Król and Saint-Pierre 2015) are used for fitting multistate models to panel data, along with **mstate** (de Wreede, Fiocco, and Putter 2011) for survival analysis applications. These packages are designed to model discrete-state Markov processes in continuous time, with transitions taking place at a stochastic arrival times.

2. Model

Describe model here.

> Note that around the `{equation}` above there should be no spaces (avoided in the LaTeX code by `%` lines) so that "normal" spacing is used and not a new paragraph started.

3. Illustrations

A demonstration of analysis is shown in `interCross_demo.R` and it serves as an example of what a typical session of model specification, estimation and testing can include. This procedure includes the following steps:

1. Organizing data
2. Choosing estimation options
3. Lag selection
4. Model estimation
5. Hypothesis testing

3.1. Organizing data

3.2. Choosing options

3.3. Lag-order selection

3.4. Model estimation

3.5. Hypothesis testing

```
R> data("quine", package = "MASS")
```

For code input and output, the style files provide dedicated environments. Either the "agnostic" `{CodeInput}` and `{CodeOutput}` can be used or, equivalently, the environments `{Sinput}` and `{Soutput}` as produced by `Sweave()` or **knitr** when using the `render_sweave()` hook. Please make sure that all code is properly spaced, e.g., using `y = a + b * x` and *not* `y=a+b*x`. Moreover, code input should use "the usual" command prompt in the respective software system. For R code, the prompt `"R> "` should be used with `"+ "` as the continuation prompt. Generally, comments within the code chunks should be avoided – and made in the regular LaTeX text instead. Finally, empty lines before and after code input/output should be avoided (see above).

4. Summary and discussion

As usual ...

Computational details

If necessary or useful, information about certain computational details such as version numbers, operating systems, or compilers could be included in an unnumbered section. Also, auxiliary packages (say, for visualizations, maps, tables, ...) that are not cited in the main text can be credited here.

The results in this paper were obtained using R 4.0.2. with the **interCross** package Version 0.0.0.9000. R itself and all packages used are available from the Comprehensive R Archive Network (CRAN) at https://CRAN.R-project.org/.

Acknowledgments

Figure 1: Caption goes here

All acknowledgments (note the AE spelling) should be collected in this unnumbered section before the references. It may contain the usual information about funding and feedback from colleagues/reviewers/etc. Furthermore, information such as relative contributions of the authors may be added here (if any).

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A. More technical details

Appendices can be included after the bibliography (with a page break). Each section within the appendix should have a proper section title (rather than just *Appendix*).

For more technical style details, please check out JSS's style FAQ at https://www.jstatsoft.org/pages/view/style#frequently-asked-questions which includes the following topics:

- Title vs. sentence case.
- Graphics formatting.
- Naming conventions.
- Turning JSS manuscripts into R package vignettes.
- Trouble shooting.
- Many other potentially helpful details...

B. Using BibTeX

References need to be provided in a BibTeX file (`.bib`). All references should be made with `\cite`, `\citet`, `\citep`, `\citealp` etc. (and never hard-coded). This commands yield different formats of author-year citations and allow to include additional details (e.g., pages, chapters, ...) in brackets. In case you are not familiar with these commands see the JSS style FAQ for details.

Cleaning up BibTeX files is a somewhat tedious task – especially when acquiring the entries automatically from mixed online sources. However, it is important that informations are complete and presented in a consistent style to avoid confusions. JSS requires the following format.

- JSS-specific markup (`\proglang`, `\pkg`, `\code`) should be used in the references.
- Titles should be in title case.
- Journal titles should not be abbreviated and in title case.
- DOIs should be included where available.
- Software should be properly cited as well. For R packages `citation("pkgname")` typically provides a good starting point.

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Journal of Statistical Software http://www.jstatsoft.org/
published by the Foundation for Open Access Statistics http://www.foastat.org/
MMMMMM YYYY, Volume VV, Issue II *Submitted:* yyyy-mm-dd
doi:10.18637/jss.v000.i00 *Accepted:* yyyy-mm-dd