kilianr: an R package for structural vector autoregressive analysis

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Summary

A vector autoregressive model identifies correlations between data series. How are those correlations causally? One way uses economic theory to specify restrictions that allow the correlations to be identified causally. One of the most prominent ways uses short-run identifying restrictions that recurisvely identify the model. In precise terms, TKTK. The kilianr package implements these procedures in a code base. The package builds directly upon Kilian (2009) and Kilian & Lütkepohl (2017).

The forces on stars, galaxies, and dark matter under external gravitational fields lead to the dynamical evolution of structures in the universe. The orbits of these bodies are therefore key to understanding the formation, history, and future state of galaxies. The field of "galactic dynamics," which aims to model the gravitating components of galaxies to study their structure and evolution, is now well-established, commonly taught, and frequently used in astronomy. Aside from toy problems and demonstrations, the majority of problems require efficient numerical tools, many of which require the same base code (e.g., for performing numerical orbit integration).

Pfaff (2008)

Lange et al. (2021)

NOTES: What to include

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  - A list of the authors of the software and their affiliations, using the correct format (see the example below).
  - A summary describing the high-level functionality and purpose of the software for a diverse, non-specialist audience.
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  - Mention (if applicable) a representative set of past or ongoing research projects using the software and recent scholarly publications enabled by it.
  - Acknowledgement of any financial support.

Statement of need

Gala is an Astropy-affiliated Python package for galactic dynamics. Python enables wrapping low-level languages (e.g., C) for speed without losing flexibility or ease-of-use in the user-interface. The API for Gala was designed to provide a class-based and user-friendly interface to fast (C or Cython-optimized) implementations of common operations such as gravitational potential and force evaluation, orbit integration, dynamical transformations, and chaos indicators for nonlinear dynamics. Gala also relies heavily on and interfaces well with the implementations of physical units and astronomical coordinate systems in the Astropy package (**?**) (`astropy.units` and `astropy.coordinates`).

Gala was designed to be used by both astronomical researchers and by students in courses on gravitational dynamics or astronomy. It has already been used in a number of scientific publications (**?**) and has also been used in graduate courses on Galactic dynamics to, e.g., provide interactive visualizations of textbook material (**?**). The combination of speed, design, and support for Astropy functionality in Gala will enable exciting scientific explorations of forthcoming data releases from the *Gaia* mission (**?**) by students and experts alike.

Mathematics

Single dollars ($) are required for inline mathematics e.g. $f(x) = e^{\pi/x}$

Double dollars make self-standing equations:

$$\Theta(x) = \left\{ \begin{array}{l} 0 \text{ if } x < 0 \\ 1 \text{ else} \end{array} \right.$$

You can also use plain LaTeX for equations

$$\hat{f}(\omega) = \int_{-\infty}^{\infty} f(x)e^{i\omega x}dx \tag{1}$$

and refer to Equation 1 from text.

Citations

Citations to entries in paper.bib should be in rMarkdown format.

If you want to cite a software repository URL (e.g. something on GitHub without a preferred citation) then you can do it with the example BibTeX entry below for (**?**).

For a quick reference, the following citation commands can be used: - @author:2001 -> "Author et al. (2001)" - [@author:2001] -> "(Author et al., 2001)" - [@author1:2001; @author2:2001] -> "(Author1 et al., 2001; Author2 et al., 2002)"

Figures

Figures can be included like this: Caption for example figure. and referenced from text using section .

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