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Software

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Summary

`caracas` is an `R` (R Core Team, 2018) package that enables a computer algebra system (CAS) within `R` via the open source Python CAS `SymPy` (Meurer et al., 2017), which is made possible via `reticulate` (Ushey et al., 2020). `caracas` is published at The Comprehensive R Archive Network (CRAN) (R Core Team, 2018) at https://cran.r-project.org/package=caracas, its source is available at https://github.com/r-cas/caracas and the documentation is available at https://r-cas.github.io/caracas/.

Much work went into integrating `caracas` into `R` such that `caracas` behaves much like other `R` libraries and objects.

`caracas` contains a number of vignettes demonstrating both basic functionality like solving equations as well as more advanced tasks like finding the concentration and covariance matrix in a dynamic linear model.

Compared to other CAS `R` packages like `Ryacas` (Andersen & Højsgaard, 2019) based on `yacas` (A. Pinkus et al., 2016; A. Z. Pinkus & Winitzki, 2002), `caracas` is more feature complete, for example with respect to solving equations.

Statement of Need

From a statistician's perspective, `R` is excellent for data handling, graphics, for model fitting and statistical inference and as a programming environment. However, `R` largely lacks the ability to perform symbolic computations. That is, `R` only supports to a small extent the step from posing a problem (for example a model) in mathematical terms over symbolic manipulations of the model and further onto a stage where a model can be combined with data. The `caracas` provides capabilities for these steps directly in `R`. Topics that can be handled in `caracas` include:

- Sums,
- limits,
- integration,
- differentiation,
- symbolic matrices and vectors,
- simplification of mathematical expressions and
- outputting in TeX format.

Several (commercial) systems are available for such tasks (and many more), e.g. Mathematica (Wolfram Research, Inc., 2021) and Maple (Maplesoft, a division of Waterloo Maple Inc., Waterloo, Ontario, 2021). However, we will argue that there is a virtue in being able to handle such tasks directly from within `R` using the familiar `R` syntax. Moreover, it is an integrated part of the design of `caracas` that it is straightforward to coerce a mathematical object into an `R` expression which can, e.g., be evaluated numerically.

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