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caracas: Computer algebra in R

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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.

Acknowledgements

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