

A validation suite for texmex

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1 Introduction

The `texmex` [5] package for R provides a suite of test routines. These tests include comparisons of parameter estimates with published versions – particularly values published in works by Coles [1] and Heffernan and Tawn [2] – as well as many comparisons with values produced by independently written code, and many logical checks and checks for routine failure in the context of inappropriate usage.

Many graphs are produced by the test suite and these can be visually compared with published versions, or evaluated against known plausible output.

The `testthat` [7] package is used to provide the testing environment.

In total, over 1000 tests are performed providing a reasonable degree of confidence that `texmex` produces the output expected of it.

1.1 Software

R version 3.6.2 (2019-12-12) [4] was used in the construction of this vignette.

1.2 Acknowledgements

Some of the independently written code that is used for validation is borrowed from the `ismev` [1] and `evd` [6] packages. Other code has been provided by Yiannis Papastathopoulos [3] and by Paul Metcalfe of AstraZeneca.

The development of the `texmex` package, including its test suite, was partially funded by AstraZeneca.

2 Using the validation suite

To install the test suite, it is necessary to install the package with the option `--install-tests`. For example, if installing version 2.3 at the command line from the package source (the `.tar.gz` file), the command would be

```
R CMD INSTALL --install-tests texmex_2.3.tar.gz
```

The test suite depends upon the `devtools` [8] package, so it is necessary to load that package before attempting to run any tests.

```
library(texmex)
library(devtools)
```

The test scripts are located under the package directory in `tests/testthat`. To run a specific test script, for example the test for plotting of return levels from `evm` fitting, you can use

```
#devtools::test("../texmex", filter="plotrl.evm")
test_dir("../tests/testthat", filter="plotrl.evm")
```

```
## v | OK F W S | Context
##
/ | 0          | plotrl.evm
v | 0      1 | plotrl.evm
```

```
## -----
## test-plotrl.evm.R:4: skip: plotrl.evm behaves as it should
## Reason: On CRAN
## -----
##
```

```
## == Results ==
## OK:          0
## Failed:      0
## Warnings:    0
## Skipped:     1
```

inserting your own path to the package. The plots produced can be checked against the published figures which are indicated in the plot titles. Most tests carry out numerical tests rather than graphical ones, as in the following set of tests for calculations of the GPD distribution function in a range of contexts:

```
#devtools::test("../texmex", filter="pgpd")
test_dir("../tests/testthat", filter="pgpd")
```

```
## v | OK F W S | Context
##
/ | 0          | pgpd
x | 0 1        | pgpd
```

```
## -----
## test-pgpd.R:4: error: pgpd behaves as it should
## object '.evd.pgpd' not found
```

```
## -----
##
## == Results =====
## OK:      0
## Failed:   1
## Warnings: 0
## Skipped:  0
```

To run all test scripts (which will take a while), the command is as follows. The output is not shown here.

```
devtools::test("../texmex")
```

References

- [1] S. Coles. *An Introduction to Statistical Modelling of Extreme Values*. Springer, 2001.
- [2] J. E. Heffernan and J. Tawn. A conditional approach for multivariate extreme values. *Journal of the Royal Statistical Society Series B*, 56:497 – 546, 2004.
- [3] I. Papastathopoulos. *Statistical Models for Pharmaceutical Extremes*. PhD thesis, Lancaster University, 2013.
- [4] R Development Core Team. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria, 2011. ISBN 3-900051-07-0.
- [5] H. Southworth and J. E. Heffernan. *termex: Threshold exceedences and multivariate extremes*, 2016. R package version 2.3.
- [6] A. G. Stephenson. evd: Extreme value distributions. *R News*, 2(2):0, June 2002.
- [7] Hadley Wickham. testthat: Get started with testing. *The R Journal*, 3:5–10, 2011.
- [8] Hadley Wickham and Winston Chang. *devtools: Tools to Make Developing R Packages Easier*, 2016. R package version 1.12.0.