

Package ‘rstantools’

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Description Provides various tools for developers of R packages interfacing with 'Stan' <<http://mc-stan.org>>, including functions to set up the required package structure, S3 generics and default methods to unify function naming across 'Stan'-based R packages, and vignettes with recommendations for developers.

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URL <http://discourse.mc-stan.org/>, <http://mc-stan.org/rstantools/>

BugReports <https://github.com/stan-dev/rstantools/issues>

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R topics documented:

rstantools-package	2
bayes_R2	3
init_cpp	4
log_lik	4
loo-prediction	5
posterior_interval	6
posterior_linpred	7
posterior_predict	8
predictive_error	9
predictive_interval	10
prior_summary	11
rstan_package_skeleton	12
Index	14

rstantools-package *Tools for Developing R Packages Interfacing with Stan*

Description

The **rstantools** package provides various tools for developers of R packages interfacing with Stan (<http://mc-stan.org>), including functions to set up the required package structure, S3 generic methods to unify function naming across Stan-based R packages, and a vignette with guidelines for developers. To get started building a package see [rstan_package_skeleton](#).

See Also

- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with **rstantools** and at <http://mc-stan.org/rstantools/articles/>.
- After reading the guidelines for developers, if you have trouble setting up your package let us know on the the [Stan Forums](#) or at **rstantools** [issue tracker](#).
- The useR2016 presentation [How to Use \(R\)Stan to Estimate Models in External R Packages](#).

`bayes_R2`*Generic function and default method for Bayesian R-squared*

Description

Generic function and default method for Bayesian version of R-squared for regression models. See `bayes_R2.stanreg` in the [rstanarm](#) package for an example of defining a method.

Usage

```
bayes_R2(object, ...)
```

```
## Default S3 method:
```

```
bayes_R2(object, y, ...)
```

Arguments

<code>object</code>	The object to use.
<code>...</code>	Arguments passed to methods. See the methods in the rstanarm package for examples.
<code>y</code>	For the default method, a vector of y values the same length as the number of columns in the matrix used as <code>object</code> .

Value

`bayes_R2` methods should return a vector of length equal to the posterior sample size.

The default method just takes `object` to be a matrix of \hat{y} values (one column per observation, one row per posterior draw) and `y` to be a vector with length equal to `ncol(object)`.

See Also

- The [rstanarm](#) package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with [rstantools](#) and at <http://mc-stan.org/rstantools/articles/>.

init_cpp	<i>Register functions implemented in C++</i>
----------	----------------------------------------------

Description

If you set up your package using `rstan_package_skeleton` before version 1.2.1 of **rstantools** it may be necessary for you to call this function yourself in order to pass `R CMD check` in `R >= 3.4`. If you used `rstan_package_skeleton` in **rstantools** version 1.2.1 or later then this has already been done automatically.

Usage

```
init_cpp(name, path)
```

Arguments

name	The name of your package as a string.
path	The path to the root directory for your package as a string. If not specified it is assumed that this is already the current working directory.

Value

This function is only called for its side effect of writing the necessary `init.cpp` file to the package's `src/` directory.

log_lik	<i>Generic function for pointwise log-likelihood</i>
---------	------------------------------------------------------

Description

We define a new function `log_lik` rather than a `logLik` method because (in addition to the conceptual difference) the documentation for `logLik` states that the return value will be a single number, whereas `log_lik` returns a matrix. See `log_lik.stanreg` in the **rstanarm** package for an example.

Usage

```
log_lik(object, ...)
```

Arguments

object	The object to use.
...	Arguments passed to methods. See the methods in the rstanarm package for examples.

Value

`log_lik` methods should return a S by N matrix, where S is the size of the posterior sample (the number of draws from the posterior distribution) and N is the number of data points.

See Also

- The **rstanarm** package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with **rstantools** and at <http://mc-stan.org/rstantools/articles/>.

Examples

```
# See help("log_lik", package = "rstanarm")
```

loo-prediction	<i>Generic functions for LOO predictions</i>
----------------	----------------------------------------------

Description

See the methods in the **rstanarm** package for examples.

Usage

```
loo_linpred(object, ...)

loo_predict(object, ...)

loo_predictive_interval(object, ...)

loo_pit(object, ...)

## Default S3 method:
loo_pit(object, y, lw, ...)
```

Arguments

<code>object</code>	The object to use.
<code>...</code>	Arguments passed to methods. See the methods in the rstanarm package for examples.
<code>y</code>	For the default method of <code>loo_pit</code> , a vector of y values the same length as the number of columns in the matrix used as <code>object</code> .
<code>lw</code>	For the default method of <code>loo_pit</code> , a matrix of log-weights of the same length as the number of columns in the matrix used as <code>object</code> .

Value

loo_predict, loo_linpred, and loo_pit (probability integral transform) methods should return a vector with length equal to the number of observations in the data. loo_predictive_interval methods should return a two-column matrix formatted in the same way as for [predictive_interval](#).

See Also

- The [rstanarm](#) package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with [rstantools](#) and at <http://mc-stan.org/rstantools/articles/>.

posterior_interval	<i>Generic function and default method for posterior uncertainty intervals</i>
--------------------	--------------------------------------------------------------------------------

Description

These intervals are often referred to as credible intervals, but we use the term uncertainty intervals to highlight the fact that wider intervals correspond to greater uncertainty. See [posterior_interval.stanreg](#) in the [rstanarm](#) package for an example.

Usage

```
posterior_interval(object, ...)

## Default S3 method:
posterior_interval(object, prob = 0.9, ...)
```

Arguments

object	The object to use.
...	Arguments passed to methods. See the methods in the rstanarm package for examples.
prob	A number $p \in (0, 1)$ indicating the desired probability mass to include in the intervals.

Value

posterior_interval methods should return a matrix with two columns and as many rows as model parameters (or a subset of parameters specified by the user). For a given value of prob, p , the columns correspond to the lower and upper $100p\%$ interval limits and have the names $100\alpha/2\%$ and $100(1 - \alpha/2)\%$, where $\alpha = 1 - p$. For example, if `prob=0.9` is specified (a 90% interval), then the column names would be "5%" and "95%", respectively.

The default method just takes object to be a matrix (one column per parameter) and computes quantiles, with prob defaulting to 0.9.

See Also

- The [rstanarm](#) package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with [rstantools](#) and at <http://mc-stan.org/rstantools/articles/>.

Examples

```
# Default method takes a numeric matrix (of posterior draws)
draws <- matrix(rnorm(100 * 5), 100, 5) # fake draws
colnames(draws) <- paste0("theta_", 1:5)
posterior_interval(draws)

# Example using rstanarm package:
# posterior_interval method for 'stanreg' objects
## Not run:
if (require("rstanarm")) {
  fit <- stan_glm(
    mpg ~ wt + am + (1|cyl),
    data = mtcars,
    QR = TRUE,
    prior = normal(0, 1),
    iter = 500 # to speed up example
  )
  rstanarm::posterior_interval(fit, prob = 0.5)
}

## End(Not run)

# Also see help("posterior_interval", package = "rstanarm")
```

posterior_linpred	<i>Generic function for accessing the posterior distribution of the linear predictor</i>
-------------------	------------------------------------------------------------------------------------------

Description

Extract the posterior draws of the linear predictor, possibly transformed by the inverse-link function. See [posterior_linpred.stanreg](#) in the [rstanarm](#) package for an example.

Usage

```
posterior_linpred(object, transform = FALSE, ...)
```

Arguments

object	The object to use.
transform	Should the linear predictor be transformed using the inverse-link function? The default is FALSE, in which case the untransformed linear predictor is returned.
...	Arguments passed to methods. See the methods in the rstanarm package for examples.

Value

posterior_linpred methods should return a D by N matrix, where D is the number of draws from the posterior distribution and N is the number of data points.

See Also

- The **rstanarm** package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with **rstantools** and at <http://mc-stan.org/rstantools/articles/>.

Examples

```
# See help("posterior_linpred", package = "rstanarm")
```

posterior_predict *Generic function for drawing from the posterior predictive distribution*

Description

Draw from the posterior predictive distribution of the outcome. See [posterior_predict.stanreg](#) in the **rstanarm** package for an example.

Usage

```
posterior_predict(object, ...)
```

Arguments

object	The object to use.
...	Arguments passed to methods. See the methods in the rstanarm package for examples.

Value

posterior_predict methods should return a D by N matrix, where D is the number of draws from the posterior predictive distribution and N is the number of data points being predicted per draw.

See Also

- The **rstanarm** package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with **rstantools** and at <http://mc-stan.org/rstantools/articles/>.

Examples

```
# Example using rstanarm package:
# posterior_predict method for 'stanreg' objects

if (require("rstanarm")) {
  fit <- stan_glm(mpg ~ wt + am, data = mtcars)
  yrep <- posterior_predict(fit)
  all.equal(ncol(yrep), nobs(fit))

  nd <- data.frame(wt = mean(mtcars$wt), am = c(0, 1))
  ytilde <- posterior_predict(fit, newdata = nd)
  all.equal(ncol(ytilde), nrow(nd))
}

# Also see help("posterior_predict", package = "rstanarm")
```

predictive_error

Generic function and default method for predictive errors

Description

Generic function and default method for computing predictive errors $y - y^{rep}$ (in-sample, for observed y) or $y - \tilde{y}$ (out-of-sample, for new or held-out y). See `predictive_error.stanreg` in the **rstanarm** package for an example.

Usage

```
predictive_error(object, ...)

## Default S3 method:
predictive_error(object, y, ...)
```

Arguments

<code>object</code>	The object to use.
<code>...</code>	Arguments passed to methods. See the methods in the rstanarm package for examples.
<code>y</code>	For the default method, a vector of y values the same length as the number of columns in the matrix used as <code>object</code> .

Value

predictive_error methods should return a D by N matrix, where D is the number of draws from the posterior predictive distribution and N is the number of data points being predicted per draw.

The default method just takes object to be a matrix and y to be a vector.

See Also

- The [rstanarm](#) package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with [rstantools](#) and at <http://mc-stan.org/rstantools/articles/>.

Examples

```
# default method
y <- rnorm(10)
ypred <- matrix(rnorm(500), 50, 10)
pred_errors <- predictive_error(ypred, y)
dim(pred_errors)
head(pred_errors)

# Also see help("predictive_error", package = "rstanarm")
```

predictive_interval *Generic function for predictive intervals*

Description

See [predictive_interval.stanreg](#) in the [rstanarm](#) package for an example.

Usage

```
predictive_interval(object, ...)

## Default S3 method:
predictive_interval(object, prob = 0.9, ...)
```

Arguments

object	The object to use.
...	Arguments passed to methods. See the methods in the rstanarm package for examples.
prob	A number $p \in (0, 1)$ indicating the desired probability mass to include in the intervals.

Value

predictive_interval methods should return a matrix with two columns and as many rows as data points being predicted. For a given value of prob, p , the columns correspond to the lower and upper $100p\%$ interval limits and have the names $100\alpha/2\%$ and $100(1 - \alpha/2)\%$, where $\alpha = 1 - p$. For example, if prob=0.9 is specified (a 90% interval), then the column names would be "5%" and "95%", respectively.

The default method just takes object to be a matrix and computes quantiles, with prob defaulting to 0.9.

See Also

- The [rstanarm](#) package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with [rstantools](#) and at <http://mc-stan.org/rstantools/articles/>.

Examples

```
# Default method takes a numeric matrix (of draws from posterior
# predictive distribution)
ytilde <- matrix(rnorm(100 * 5, sd = 2), 100, 5) # fake draws
predictive_interval(ytilde, prob = 0.8)

# Also see help("predictive_interval", package = "rstanarm")
```

prior_summary

Generic function for extracting information about prior distributions

Description

See `prior_summary.stanreg` in the [rstanarm](#) package for an example.

Usage

```
prior_summary(object, ...)

## Default S3 method:
prior_summary(object, ...)
```

Arguments

`object` The object to use.

`...` Arguments passed to methods. See the methods in the [rstanarm](#) package for examples.

Value

prior_summary methods should return an object containing information about the prior distribution(s) used for the given model. The structure of this object will depend on the method.

The default method just returns object\$prior.info, which is NULL if there is no 'prior.info' element.

See Also

- The [rstanarm](#) package for example methods ([CRAN](#), [GitHub](#)).
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with [rstantools](#) and at <http://mc-stan.org/rstantools/articles/>.

Examples

```
# See help("prior_summary", package = "rstanarm")
```

```
rstan_package_skeleton
```

Create the skeleton of a new R package with Stan programs

Description

The rstan_package_skeleton function helps get you started developing R packages that interface with Stan via the **rstan** package. As of **rstantools** v1.5.0, rstan_package_skeleton calls `usethis::create_package` (instead of `utils::package.skeleton`) and then makes necessary adjustments so that the package can include Stan Programs that can be built into binary versions (i.e., pre-compiled like **rstanarm**).

See the **See Also** section below for links to recommendations for developers and a step by step walk-through of what to do after running `rstan_package_skeleton`.

Usage

```
rstan_package_skeleton(path, fields = getOption("devtools.desc"),
  rstudio = TRUE, open = TRUE, stan_files = character(), travis = TRUE)
```

Arguments

`path` A relative or absolute path to the new package to be created (terminating in the package name).

`fields`, `rstudio`, `open` See `usethis::create_package`.

stan_files	A character vector with paths to .stan files to include in the package (these files will be included in the src/stan_files directory). If not specified then the .stan files for the package can be manually placed into the appropriate directory later.
travis	Should a .travis.yml file be added to the package directory? Defaults to TRUE. The file has some settings already set to help with compilation issues, but we do not guarantee that it will work on travis-ci without manual adjustments.

Note

This function downloads several files from **rstanarm** package's [GitHub repository](#) to facilitate building the resulting package. Note that **rstanarm** is licensed under the GPL ≥ 3 , so package builders who do not want to be governed by that license should not use the downloaded files that contain R code (that said, **Rcpp** is GPL, so not using the **rstanarm** files is not the only thing impeding use of other licenses). Otherwise, it may be worth considering whether it would be easier to include your .stan programs and supporting R code in the **rstanarm** package.

See Also

- [The rstanarm repository on GitHub.](#)
- Guidelines and recommendations for developers of R packages interfacing with Stan and a demonstration getting a simple package working can be found in the vignettes included with **rstantools** and at <http://mc-stan.org/rstantools/articles/>.
- After reading the guidelines for developers, if you have trouble setting up your package let us know on the [Stan Forums](#) or at **rstantools** issue tracker.
- The useR2016 presentation [How to Use \(R\)Stan to Estimate Models in External R Packages.](#)

Index

bayes_R2, [3](#)

init_cpp, [4](#)

log_lik, [4](#)
log_lik.stanreg, [4](#)
logLik, [4](#)
loo-prediction, [5](#)
loo_linpred(loo-prediction), [5](#)
loo_pit(loo-prediction), [5](#)
loo_predict(loo-prediction), [5](#)
loo_predictive_interval
(loo-prediction), [5](#)

posterior_interval, [6](#)
posterior_interval.stanreg, [6](#)
posterior_linpred, [7](#)
posterior_linpred.stanreg, [7](#)
posterior_predict, [8](#)
posterior_predict.stanreg, [8](#)
predictive_error, [9](#)
predictive_error.stanreg, [9](#)
predictive_interval, [6](#), [10](#)
predictive_interval.stanreg, [10](#)
prior_summary, [11](#)
prior_summary.stanreg, [11](#)

rstan_package_skeleton, [2](#), [4](#), [12](#)
rstanarm, [3](#), [5–13](#)
rstantools (rstantools-package), [2](#)
rstantools-package, [2](#)