

Package ‘rstantools’

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Type Package

Title Tools for Developing R Packages Interfacing with 'Stan'

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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 a vignette with recommendations for developers.

License GPL (>= 3)

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

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

Encoding UTF-8

LazyData true

Imports stats, utils

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rstantools-package	<i>Tools for Developing R Packages Interfacing with Stan</i>
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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

- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the **rstantools** page on the [CRAN website](#).
- The [Stan Forums](#) and the **rstantools issue tracker** for assistance if you have trouble setting up your package.

bayes_R2	<i>Generic function and default method for Bayesian R-squared</i>
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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

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

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 y -hat 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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the **rstantools** page on the [CRAN website](#).

init_cpp

Register functions implemented in C++

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 \geq 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>
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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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the **rstantools** page on the [CRAN website](#).

Examples

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

loo-prediction *Generic functions for LOO predictions*

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

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

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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the [rstantools](#) page on the [CRAN website](#).

posterior_interval	<i>Generic function and default method for posterior uncertainty intervals</i>
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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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the **rstantools** page on the [CRAN website](#).

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

if (require("rstanarm")) {
  fit <- stan_glmer(
    mpg ~ wt + am + (1|cyl),
    data = mtcars,
    QR = TRUE,
    prior = normal(0, 1),
    iter = 500 # to speed up example
  )
  posterior_interval(fit, prob = 0.5)
}

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

```

posterior_linpred *Generic function for accessing the posterior distribution of the linear predictor*

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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the [rstantools](#) page on the [CRAN website](#).

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

<code>object</code>	The object to use.
<code>...</code>	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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the [rstantools](#) page on the [CRAN website](#).

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

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

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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the **rstantools** page on the [CRAN website](#).

Examples

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

# 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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the [rstantools](#) page on the [CRAN website](#).

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

<code>object</code>	The object to use.
<code>...</code>	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](#)).
- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the **rstantools** page on the [CRAN website](#).

Examples

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

```
rstan_package_skeleton
```

Create a skeleton for a new R package with Stan programs

Description

This function is very similar to [package.skeleton](#) but is designed for source packages that want to include Stan Programs that can be built into binary versions.

Usage

```
rstan_package_skeleton(name = "anRpackage", list = character(),
  environment = .GlobalEnv, path = ".", force = FALSE,
  code_files = character(), stan_files = character(), travis = TRUE)
```

Arguments

<code>name</code> , <code>list</code> , <code>environment</code> , <code>path</code> , <code>force</code> , <code>code_files</code>	Same as in package.skeleton .
<code>stan_files</code>	A character vector with paths to <code>.stan</code> files to include in the package. Otherwise similar to <code>code_files</code> .
<code>travis</code>	Should a <code>.travis.yml</code> file be added to the package directory? Defaults to TRUE.

Details

This function first calls [package.skeleton](#) and then adds the files listed in `stan_files` to an `exec` directory. Finally, it downloads several files from the **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. Otherwise, it may be worth considering whether it would be easier to include your `.stan` programs and supporting R code in the **rstanarm** package.

After running `rstan_package_skeleton` see the `Read-and-delete-me` file created in the package directory. The content in that file contains the content of the `Read-and-delete-me` file created by [package.skeleton](#) plus additional Stan-specific instructions.

See Also

The **rstanarm** repository on GitHub (<https://github.com/stan-dev/rstanarm>) and a useR2016 presentation (<https://channel9.msdn.com/Events/useR-international-R-User-conferences/useR-International-R-User-2017-Conference/How-to-Use-RStan-to-Estimate-Models-in-External-R-Packages>)

- The guidelines for developers of R packages interfacing with Stan, a copy of which can be found in the package vignettes. See `browseVignettes("rstantools")` or `vignette(package = "rstantools")`. The document is also available online at the **rstantools** page on the **CRAN website**.
- The **Stan Forums** and the **rstantools issue tracker** for assistance if you have trouble setting up your package.

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