

Package ‘BayesTools’

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Title Tools for Bayesian Analyses

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Description Provides tools for conducting Bayesian analyses. The package contains functions for creating a wide range of prior distribution objects, mixing posterior samples from 'JAGS' and 'Stan' models, plotting posterior distributions, and etc... The tools for working with prior distribution span from visualization, generating 'JAGS' and 'bridgesampling' syntax to basic functions such as rng, quantile, and distribution functions.

Maintainer František Bartoš <f.bartos96@gmail.com>

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BugReports <https://github.com/FBartos/BayesTools/issues>

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Author František Bartoš [aut, cre] (<<https://orcid.org/0000-0002-0018-5573>>)

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R topics documented:

BayesTools	3
BayesTools_ensemble_tables	3
BayesTools_model_tables	5
check_input	6
density.prior	8

ensemble_inference	10
format_BF	11
geom_prior	11
geom_prior_list	13
inclusion_BF	14
interpret	15
is.prior	15
JAGS_add_priors	16
JAGS_bridgesampling	17
JAGS_bridgesampling_posterior	18
JAGS_check_and_list	19
JAGS_check_convergence	21
JAGS_fit	22
JAGS_get_inits	24
JAGS_marglik_parameters	25
JAGS_marglik_priors	25
JAGS_to_monitor	26
lines.prior	26
lines_prior_list	28
mean.prior	29
mix_posteriors	30
plot.prior	31
plot_models	33
plot_posterior	34
plot_prior_list	36
point	38
print.BayesTools_table	39
print.prior	39
prior	40
prior_functions	42
prior_functions_methods	44
prior_informed	45
prior_informed_medicine_names	46
prior_PP	47
prior_weightfunction	48
range.prior	49
sd	50
sd.prior	51
var	51
var.prior	52
weightfunctions	53
weightfunctions_mapping	55

BayesTools

BayesTools

Description

BayesTools: Provides tools for conducting Bayesian analyses. The package contains functions for creating a wide range of prior distribution objects, mixing posterior samples from JAGS and Stan models, plotting posterior distributions, and etc... The tools for working with prior distribution span from visualization, generating JAGS and bridgesampling syntax to basic functions such as `rng`, `quantile`, and distribution functions.

Author(s)

František Bartoš <f.bartos96@gmail.com>

See Also

Useful links:

- <https://fbartos.github.io/BayesTools/>
- Report bugs at <https://github.com/FBartos/BayesTools/issues>

BayesTools_ensemble_tables

Create BayesTools ensemble summary tables

Description

Creates estimate summaries based on posterior distributions created by `mix_posteriors`, inference summaries based on inference created by `ensemble_inference`, or ensemble summary/diagnostics based on a list of `models_inference` models.

Usage

```
ensemble_estimates_table(  
  samples,  
  parameters,  
  probs = c(0.025, 0.95),  
  title = NULL,  
  footnotes = NULL,  
  warnings = NULL  
)
```

```
ensemble_inference_table(  
  inference,
```

```

    parameters,
    logBF = FALSE,
    BF01 = FALSE,
    title = NULL,
    footnotes = NULL,
    warnings = NULL
  )

ensemble_summary_table(
  models,
  parameters,
  title = NULL,
  footnotes = NULL,
  warnings = NULL,
  remove_spike_0 = TRUE,
  short_name = FALSE
)

ensemble_diagnostics_table(
  models,
  parameters,
  title = NULL,
  footnotes = NULL,
  warnings = NULL,
  remove_spike_0 = TRUE,
  short_name = FALSE
)

```

Arguments

samples	posterior samples created by mix_posteriors
parameters	character vector of parameters (or a named list with of character vectors for summary and diagnostics tables) specifying the parameters (and their grouping) for the summary table
probs	quantiles for parameter estimates
title	title to be added to the table
footnotes	footnotes to be added to the table
warnings	warnings to be added to the table
inference	model inference created by ensemble_inference
logBF	whether the Bayes factor should be on log scale
BF01	whether the Bayes factor should be inverted
models	list of models_inference model objects, each of which containing a list of priors and inference object, The inference must be a named list with information about the model: model number <code>m_number</code> , marginal likelihood <code>marglik</code> , prior and posterior probability <code>prior_prob</code> and <code>post_prob</code> , inclusion Bayes factor <code>inclusion_BF</code> , and fit summary generated by runjags_estimates_table for the diagnostics table

`remove_spike_0` whether prior distributions equal to spike at 0 should be removed from the `prior_list`

`short_name` whether the prior distribution names should be shortened. Defaults to FALSE.

Value

`ensemble_estimates_table` returns a table with the model-averaged estimates, `ensemble_inference_table` returns a table with the prior and posterior probabilities and inclusion Bayes factors, `ensemble_summary_table` returns a table with overview of the models included in the ensemble, and `ensemble_diagnostics_table` returns an overview of the MCMC diagnostics for the models included in the ensemble. All of the tables are objects of class 'BayesTools_table'.

See Also

[ensemble_inference](#) [mix_posteriors](#) [BayesTools_model_tables](#)

BayesTools_model_tables

Create BayesTools model tables

Description

Creates model summary based on a model objects or provides estimates table for a runjags fit.

Usage

```
model_summary_table(
  model,
  model_description = NULL,
  title = NULL,
  footnotes = NULL,
  warnings = NULL,
  remove_spike_0 = TRUE,
  short_name = FALSE
)
```

```
runjags_estimates_table(
  fit,
  prior_list,
  transformations = NULL,
  title = NULL,
  footnotes = NULL,
  warnings = NULL,
  remove_spike_0 = TRUE
)
```

```
runjags_estimates_empty_table(title = NULL, footnotes = NULL, warnings = NULL)
```

Arguments

model	model object containing a list of priors and inference object, The inference must be a named list with information about the model: model number <code>m_number</code> , marginal likelihood <code>marglik</code> , prior and posterior probability <code>prior_prob</code> and <code>post_prob</code> , and model inclusion Bayes factor <code>inclusion_BF</code>
model_description	named list with additional description to be added to the table
title	title to be added to the table
footnotes	footnotes to be added to the table
warnings	warnings to be added to the table
remove_spike_0	whether prior distributions equal to spike at 0 should be removed from the <code>prior_list</code>
short_name	whether the prior distribution names should be shortened. Defaults to FALSE.
fit	runjags model fit
prior_list	list of prior distributions
transformations	named list of transformations to be applied to specific parameters

Value

`model_summary_table` returns a table with overview of the fitted model, `runjags_estimates_table` returns a table with MCMC estimates, and `runjags_estimates_empty_table` returns an empty estimates table. All of the tables are objects of class 'BayesTools_table'.

See Also

[BayesTools_ensemble_tables](#)

check_input

Check input

Description

A set of convenience functions for checking objects/arguments to a function passed by a user.

Usage

```
check_bool(x, name, check_length = 1, allow_NULL = FALSE, call = "")
```

```
check_char(
  x,
  name,
  check_length = 1,
  allow_values = NULL,
```

```
    allow_NULL = FALSE,  
    call = ""  
  )  
  
check_real(  
  x,  
  name,  
  lower = -Inf,  
  upper = Inf,  
  allow_bound = TRUE,  
  check_length = 1,  
  allow_NULL = FALSE,  
  call = ""  
)  
  
check_int(  
  x,  
  name,  
  lower = -Inf,  
  upper = Inf,  
  allow_bound = TRUE,  
  check_length = 1,  
  allow_NULL = FALSE,  
  call = ""  
)  
  
check_list(  
  x,  
  name,  
  check_length = 0,  
  check_names = NULL,  
  all_objects = FALSE,  
  allow_other = FALSE,  
  allow_NULL = FALSE,  
  call = ""  
)
```

Arguments

x	object to be checked
name	name of the object that will be print in the error message.
check_length	length of the object to be checked. Defaults to 1. Set to 0 in order to not check object length.
allow_NULL	whether the object can be NULL. If so, no checks are executed.
call	string to be placed as a prefix to the error call.
allow_values	names of values allowed in a character vector. Defaults to NULL (do not check).
lower	lower bound of allowed values. Defaults to -Inf (do not check).

upper	upper bound of allowed values. Defaults to Inf (do not check).
allow_bound	whether the values at the boundary are allowed. Defaults to TRUE.
check_names	names of entries allowed in a list. Defaults to NULL (do not check).
all_objects	whether all entries in check_names must be present. Defaults to FALSE.
allow_other	whether additional entries then the specified in check_names might be present

Value

returns NULL, called for the input check.

Examples

```
# check whether the object is logical
check_bool(TRUE, name = "input")

# will throw an error on any other type
## Not run:
  check_bool("TRUE", name = "input")

## End(Not run)
```

density.prior	<i>Prior density</i>
---------------	----------------------

Description

Computes density of a prior distribution across a range of values.

Usage

```
## S3 method for class 'prior'
density(
  x,
  x_seq = NULL,
  x_range = NULL,
  x_range_quant = NULL,
  n_points = 1000,
  n_samples = 10000,
  force_samples = FALSE,
  individual = FALSE,
  transformation = NULL,
  transformation_arguments = NULL,
  transformation_settings = FALSE,
  truncate_end = TRUE,
  ...
)
```

Arguments

<code>x</code>	a prior
<code>x_seq</code>	sequence of x coordinates
<code>x_range</code>	vector of length two with lower and upper range for the support (used if <code>x_seq</code> is unspecified)
<code>x_range_quant</code>	quantile used for automatically obtaining <code>x_range</code> if both <code>x_range</code> and <code>x_seq</code> are unspecified. Defaults to 0.005 for all but Cauchy, Student-t, Gamma, and Inverse-gamme distributions that use 0.010.
<code>n_points</code>	number of equally spaced points in the <code>x_range</code> if <code>x_seq</code> is unspecified
<code>n_samples</code>	number of samples from the prior distribution if the density cannot be obtained analytically (or if samples are forced with <code>force_samples = TRUE</code>)
<code>force_samples</code>	should prior be sampled instead of obtaining analytic solution whenever possible
<code>individual</code>	should individual densities be returned (e.g., in case of weightfunction)
<code>transformation</code>	transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations: lin linear transformation in form of $a + b \cdot x$ tanh also known as Fisher's z transformation exp exponential transformation , or a list containing the transformation function <code>fun</code> , inverse transformation function <code>inv</code> , and the Jacobian of the transformation <code>jac</code> . See examples for details.
<code>transformation_arguments</code>	a list with named arguments for the transformation
<code>transformation_settings</code>	boolean indicating whether the settings the <code>x_seq</code> or <code>x_range</code> was specified on the transformed support
<code>truncate_end</code>	whether the density should be set to zero in for the endpoints of truncated distributions
<code>...</code>	additional arguments

Value

`density.prior` returns an object of class 'density'.

See Also

[prior\(\)](#)

ensemble_inference *Compute posterior probabilities and inclusion Bayes factors*

Description

Computes prior probabilities, posterior probabilities, and inclusion Bayes factors based either on (1) a list of models, vector of parameters, and a list of indicators the models represent the null or alternative hypothesis for each parameter, (2) on prior model odds, marginal likelihoods, and indicator whether the models represent the null or alternative hypothesis, or (3) list of models for each model.

Usage

```
compute_inference(prior_weights, margliks, is_null = NULL, conditional = FALSE)

ensemble_inference(model_list, parameters, is_null_list, conditional = FALSE)

models_inference(model_list)
```

Arguments

prior_weights	vector of prior model odds
margliks	vector of marginal likelihoods
is_null	logical vector of indicators specifying whether the model corresponds to the null or alternative hypothesis (or an integer vector indexing models corresponding to the null hypothesis)
conditional	whether prior and posterior model probabilities should be returned only for the conditional model. Defaults to FALSE
model_list	list of models, each of which contains marginal likelihood estimated with bridge sampling <code>marglik</code> and prior model odds <code>prior_weights</code>
parameters	vector of parameters names for which inference should be drawn
is_null_list	list with entries for each parameter carrying either logical vector of indicators specifying whether the model corresponds to the null or alternative hypothesis (or an integer vector indexing models corresponding to the null hypothesis)

Value

`compute_inference` returns a named list of prior probabilities, posterior probabilities, and Bayes factors, `ppoint` gives the distribution function, `ensemble_inference` gives a list of named lists of inferences for each parameter, and `models_inference` returns a list of models, each expanded by the inference list.

See Also

[mix_posteriors](#) [BayesTools_ensemble_tables](#)

format_BF	<i>Format Bayes factor</i>
-----------	----------------------------

Description

Formats Bayes factor

Usage

```
format_BF(BF, logBF = FALSE, BF01 = FALSE)
```

Arguments

BF	Bayes factor(s)
logBF	log(BF)
BF01	1/BF

Value

format_BF returns a formatted Bayes factor.

geom_prior	<i>Add prior object to a ggplot</i>
------------	-------------------------------------

Description

Add prior object to a ggplot

Usage

```
geom_prior(  
  x,  
  xlim = NULL,  
  x_seq = NULL,  
  x_range_quant = NULL,  
  n_points = 1000,  
  n_samples = 10000,  
  force_samples = FALSE,  
  transformation = NULL,  
  transformation_arguments = NULL,  
  transformation_settings = FALSE,  
  show_parameter = if (individual) 1 else NULL,  
  individual = FALSE,  
  rescale_x = FALSE,  
  scale_y2 = 1,  
  ...  
)
```

Arguments

<code>x</code>	a prior
<code>xlim</code>	plotting range of the prior
<code>x_seq</code>	sequence of x coordinates
<code>x_range_quant</code>	quantile used for automatically obtaining <code>x_range</code> if both <code>x_range</code> and <code>x_seq</code> are unspecified. Defaults to <code>0.005</code> for all but Cauchy, Student-t, Gamma, and Inverse-gamma distributions that use <code>0.010</code> .
<code>n_points</code>	number of equally spaced points in the <code>x_range</code> if <code>x_seq</code> is unspecified
<code>n_samples</code>	number of samples from the prior distribution if the density cannot be obtained analytically (or if samples are forced with <code>force_samples = TRUE</code>)
<code>force_samples</code>	should prior be sampled instead of obtaining analytic solution whenever possible
<code>transformation</code>	transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations: lin linear transformation in form of $a + b \cdot x$ tanh also known as Fisher's z transformation exp exponential transformation , or a list containing the transformation function <code>fun</code> , inverse transformation function <code>inv</code> , and the Jacobian of the transformation <code>jac</code> . See examples for details.
<code>transformation_arguments</code>	a list with named arguments for the transformation
<code>transformation_settings</code>	boolean indicating whether the settings the <code>x_seq</code> or <code>x_range</code> was specified on the transformed support
<code>show_parameter</code>	which parameter should be returned in case of multiple parameters per prior. Useful when priors for the omega parameter are plotted and <code>individual = TRUE</code> .
<code>individual</code>	should individual densities be returned (e.g., in case of weightfunction)
<code>rescale_x</code>	allows to rescale x-axis in case a weightfunction is plotted.
<code>scale_y2</code>	scaling factor for a secondary axis
<code>...</code>	additional arguments

Value

`geom_prior_list` returns an object of class `'ggplot'`.

See Also

[plot.prior\(\)](#) [lines.prior\(\)](#)

geom_prior_list *Add list of prior objects to a plot*

Description

Add list of prior objects to a plot

Usage

```
geom_prior_list(
  prior_list,
  xlim = NULL,
  x_seq = NULL,
  x_range_quant = NULL,
  n_points = 500,
  n_samples = 10000,
  force_samples = FALSE,
  transformation = NULL,
  transformation_arguments = NULL,
  transformation_settings = FALSE,
  rescale_x = FALSE,
  scale_y2 = NULL,
  prior_list_mu = NULL,
  ...
)
```

Arguments

prior_list	list of prior distributions
xlim	x plotting range
x_seq	sequence of x coordinates
x_range_quant	quantile used for automatically obtaining x_range if both x_range and x_seq are unspecified. Defaults to 0.005 for all but Cauchy, Student-t, Gamma, and Inverse-gamme distributions that use 0.010.
n_points	number of equally spaced points in the x_range if x_seq is unspecified
n_samples	number of samples from the prior distribution if the density cannot be obtained analytically (or if samples are forced with force_samples = TRUE)
force_samples	should prior be sampled instead of obtaining analytic solution whenever possible
transformation	transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations: lin linear transformation in form of $a + b \cdot x$ tanh also known as Fisher's z transformation exp exponential transformation

, or a list containing the transformation function `fun`, inverse transformation function `inv`, and the Jacobian of the transformation `jac`. See examples for details.

`transformation_arguments` a list with named arguments for the transformation

`transformation_settings` boolean indicating whether the settings the `x_seq` or `x_range` was specified on the transformed support

`rescale_x` allows to rescale x-axis in case a weightfunction is plotted.

`scale_y2` scaling factor for a secondary axis

`prior_list_mu` list of priors for the mu parameter required when plotting PET-PEESE

... additional arguments

Value

`geom_prior_list` returns an object of class 'ggplot'.

See Also

[plot_prior_list\(\)](#) [lines_prior_list\(\)](#)

inclusion_BF

Compute inclusion Bayes factors

Description

Computes inclusion Bayes factors based on prior and posterior model probabilities and indicator whether the models represent the null or alternative hypothesis

Usage

```
inclusion_BF(prior_probs, post_probs, is_null)
```

Arguments

`prior_probs` vector of prior model probabilities

`post_probs` vector of posterior model probabilities

`is_null` logical vector of indicators whether the model corresponds to the null or alternative hypothesis (or an integer vector indexing models corresponding to the null hypothesis)

Value

`inclusion_BF` returns a Bayes factor.

interpret	<i>Interpret ensemble inference and estimates</i>
-----------	---

Description

Provides textual summary for posterior distributions created by [mix_posteriors](#) and ensemble inference created by [ensemble_inference](#).

Usage

```
interpret(inference, samples, specification, method)
```

Arguments

inference	model inference created by ensemble_inference
samples	posterior samples created by mix_posteriors
specification	list of lists specifying the generated text. Each inner list carries: (1) inference specifying the name of in the inference entry and optionally inference_name as a name to use in the text and inference_BF_name as a symbol to be used instead of the default "BF", (2) samples specifying the name of in the samples entry and optionally samples_name as a name to use in the text, samples_units as a unit text to be appended after the estimate, and samples_conditional specifying whether the estimate is conditional or model-averaged.
method	character specifying name of the method to be appended at the beginning of each sentence.

Value

interpret returns character.

See Also

[ensemble_inference](#) [mix_posteriors](#) [BayesTools_model_tables](#) [BayesTools_ensemble_tables](#)

is.prior	<i>Reports whether x is a a prior object</i>
----------	--

Description

Reports whether x is a a prior object. Note that point priors inherit the prior.simple property

Usage

```
is.prior(x)

is.prior.point(x)

is.prior.none(x)

is.prior.simple(x)

is.prior.PET(x)

is.prior.PEERE(x)

is.prior.weightfunction(x)
```

Arguments

x an object of test

Value

returns a boolean indicating whether the test object is a prior (of specific type).

Examples

```
# create some prior distributions
p0 <- prior(distribution = "point", parameters = list(location = 0))
p1 <- prior_PET(distribution = "normal", parameters = list(mean = 0, sd = 1))

is.prior(p0)
is.prior.simple(p0)
is.prior.point(p0)
is.prior.PET(p0)

is.prior(p1)
is.prior.simple(p1)
is.prior.point(p1)
is.prior.PET(p1)
```

JAGS_add_priors

Add 'JAGS' prior

Description

Adds priors to a 'JAGS' syntax.

Usage

```
JAGS_add_priors(syntax, prior_list)
```

Arguments

syntax	JAGS model syntax
prior_list	named list of prior distribution (names correspond to the parameter names)

Value

JAGS_add_priors returns a JAGS syntax.

JAGS_bridgesampling *Compute marginal likelihood of a 'JAGS' model*

Description

A wrapper around [bridge_sampler](#) that automatically computes likelihood part dependent on the prior distribution and prepares parameter samples. `log_posterior` must specify a function that takes two arguments - a named list of samples from the prior distributions and the data, and returns log likelihood of the model part.

Usage

```
JAGS_bridgesampling(
  fit,
  data,
  prior_list,
  log_posterior,
  add_parameters = NULL,
  add_bounds = NULL,
  maxiter = 10000,
  silent = TRUE,
  ...
)
```

Arguments

fit	model fitted with either runjags posterior samples obtained with rjags-package
data	data that were used to fit the model
prior_list	named list of prior distribution (names correspond to the parameter names)
log_posterior	function that takes a named list of samples, the data, and additional list of parameters passed as <code>...</code> as input and returns the log of the unnormalized posterior density of the model part
add_parameters	vector of additional parameter names that should be used in <code>bridgesampling</code> but were not specified in the <code>prior_list</code>

add_bounds	list with two name vectors ("lb" and "up") containing lower and upper bounds of the additional parameters that were not specified in the prior_list
maxiter	maximum number of iterations for the bridge_sampler
silent	whether the progress should be printed, defaults to TRUE
...	additional argument to the bridge_sampler and log_posterior function

Value

JAGS_bridgesampling returns an object of class 'bridge'.

Examples

```
## Not run:
# simulate data
set.seed(1)
data <- list(
  x = rnorm(10),
  N = 10
)
data$x

# define priors
priors_list <- list(mu = prior("normal", list(0, 1)))

# define likelihood for the data
model_syntax <-
  "model{
    for(i in 1:N){
      x[i] ~ dnorm(mu, 1)
    }
  }"

# fit the models
fit <- JAGS_fit(model_syntax, data, priors_list)

# define log posterior for bridge sampling
log_posterior <- function(parameters, data){
  sum(dnorm(data$x, parameters$mu, 1, log = TRUE))
}

# get marginal likelihoods
marglik <- JAGS_bridgesampling(fit, data, priors_list, log_posterior)

## End(Not run)
```

JAGS_bridgesampling_posterior

Prepare 'JAGS' posterior for 'bridgesampling'

Description

prepares posterior distribution for 'bridgesampling' by removing unnecessary parameters and attaching lower and upper bounds of parameters based on a list of prior distributions.

Usage

```
JAGS_bridgesampling_posterior(
  posterior,
  prior_list,
  add_parameters = NULL,
  add_bounds = NULL
)
```

Arguments

posterior	matrix of mcmc samples from the posterior distribution
prior_list	named list of prior distribution (names correspond to the parameter names)
add_parameters	vector of additional parameter names that should be used in bridgesampling but were not specified in the prior_list
add_bounds	list with two name vectors ("lb" and "up") containing lower and upper bounds of the additional parameters that were not specified in the prior_list

Value

JAGS_bridgesampling_posterior returns a matrix of posterior samples with 'lb' and 'ub' attributes carrying the lower and upper boundaries.

JAGS_check_and_list *Check and list 'JAGS' fitting settings*

Description

Checks and lists settings for the [JAGS_fit](#) function.

Usage

```
JAGS_check_and_list_fit_settings(
  chains,
  adapt,
  burnin,
  sample,
  thin,
  autofit,
  parallel,
  cores,
  silent,
```

```

seed,
check_mins = list(chains = 1, adapt = 50, burnin = 50, sample = 100, thin = 1),
call = ""
)

JAGS_check_and_list_autofit_settings(
autofit_control,
skip_sample_extend = FALSE,
call = ""
)

```

Arguments

chains	number of chains to be run, defaults to 4
adapt	number of samples used for adapting the MCMC chains, defaults to 500
burnin	number of burnin iterations of the MCMC chains, defaults to 1000
sample	number of sampling iterations of the MCMC chains, defaults to 4000
thin	thinning interval for the MCMC samples, defaults to 1
autofit	whether the models should be refitted until convergence criteria specified in autofit_control. Defaults to FALSE.
parallel	whether the chains should be run in parallel FALSE
cores	number of cores used for multithreading if parallel = TRUE, defaults to chains
silent	whether the function should proceed silently, defaults to TRUE
seed	seed for random number generation
check_mins	named list of minimal values for which should some input be checked. Defaults to: chains 1 adapt 50 burnin 50 sample 100 thin 1
call	string to be placed as a prefix to the error call.
autofit_control	a list of arguments controlling the autofit function. Possible options are: max_Rhat maximum R-hat error for the autofit function. Defaults to 1.05. min_ESS minimum effective sample size. Defaults to 500. max_error maximum MCMC error. Defaults to 1.01. max_SD_error maximum MCMC error as the proportion of standard deviation of the parameters. Defaults to 0.05. max_time list specifying the time time and units after which the automatic fitting function is stopped. The units arguments need to correspond to units passed to difftime function. sample_extend number of samples between each convergence check. Defaults to 1000.
skip_sample_extend	whether sample_extend is allowed to be NULL and skipped in the check

Value

JAGS_check_and_list_fit_settings invisibly returns a list of checked fit settings. JAGS_check_and_list_autofit_settings invisibly returns a list of checked autofit settings. parameter names.

JAGS_check_convergence

Assess convergence of a runjags model

Description

Checks whether the supplied [runjags-package](#) model satisfied convergence criteria.

Usage

```
JAGS_check_convergence(
  fit,
  prior_list,
  max_Rhat = 1.05,
  min_ESS = 500,
  max_error = 0.01,
  max_SD_error = 0.05
)
```

Arguments

fit	a runjags model
prior_list	named list of prior distribution (names correspond to the parameter names)
max_Rhat	maximum R-hat error for the autofit function. Defaults to 1.05.
min_ESS	minimum effective sample size. Defaults to 500.
max_error	maximum MCMC error. Defaults to 1.01.
max_SD_error	maximum MCMC error as the proportion of standard deviation of the parameters. Defaults to 0.05.

Value

JAGS_check_convergence returns a boolean indicating whether the model converged or not, with an attribute 'errors' carrying the failed convergence checks (if any).

See Also

[JAGS_fit\(\)](#)

Examples

```

## Not run:
# simulate data
set.seed(1)
data <- list(
  x = rnorm(10),
  N = 10
)
data$x

# define priors
priors_list <- list(mu = prior("normal", list(0, 1)))

# define likelihood for the data
model_syntax <-
  "model{
    for(i in 1:N){
      x[i] ~ dnorm(mu, 1)
    }
  }"

# fit the models
fit <- JAGS_fit(model_syntax, data, priors_list)
JAGS_check_convergence(fit, priors_list)

## End(Not run)

```

JAGS_fit

Fits a 'JAGS' model

Description

A wrapper around [run.jags](#) that simplifies fitting 'JAGS' models with usage with pre-specified model part of the 'JAGS' syntax, data and list of prior distributions.

Usage

```

JAGS_fit(
  model_syntax,
  data,
  prior_list,
  chains = 4,
  adapt = 500,
  burnin = 1000,
  sample = 4000,
  thin = 1,
  autofit = FALSE,
  autofit_control = list(max_Rhat = 1.05, min_ESS = 500, max_error = 0.01, max_SD_error
    = 0.05, max_time = list(time = 60, unit = "mins"), sample_extend = 1000),

```

```

parallel = FALSE,
cores = chains,
silent = TRUE,
seed = NULL,
add_parameters = NULL,
required_packages = NULL
)

```

Arguments

<code>model_syntax</code>	jags syntax for the model part
<code>data</code>	data fit the model
<code>prior_list</code>	named list of prior distribution (names correspond to the parameter names)
<code>chains</code>	number of chains to be run, defaults to 4
<code>adapt</code>	number of samples used for adapting the MCMC chains, defaults to 500
<code>burnin</code>	number of burnin iterations of the MCMC chains, defaults to 1000
<code>sample</code>	number of sampling iterations of the MCMC chains, defaults to 4000
<code>thin</code>	thinning interval for the MCMC samples, defaults to 1
<code>autofit</code>	whether the models should be refitted until convergence criteria specified in <code>autofit_control</code> . Defaults to FALSE.
<code>autofit_control</code>	a list of arguments controlling the autofit function. Possible options are: max_Rhat maximum R-hat error for the autofit function. Defaults to 1.05. min_ESS minimum effective sample size. Defaults to 500. max_error maximum MCMC error. Defaults to 1.01. max_SD_error maximum MCMC error as the proportion of standard deviation of the parameters. Defaults to 0.05. max_time list specifying the time <code>time</code> and <code>units</code> after which the automatic fitting function is stopped. The <code>units</code> arguments need to correspond to <code>units</code> passed to <code>difftime</code> function. sample_extend number of samples between each convergence check. Defaults to 1000.
<code>parallel</code>	whether the chains should be run in parallel FALSE
<code>cores</code>	number of cores used for multithreading if <code>parallel = TRUE</code> , defaults to <code>chains</code>
<code>silent</code>	whether the function should proceed silently, defaults to TRUE
<code>seed</code>	seed for random number generation
<code>add_parameters</code>	vector of additional parameter names that should be used monitored but were not specified in the <code>prior_list</code>
<code>required_packages</code>	character vector specifying list of packages containing JAGS models required for sampling (in case that the function is run in parallel or in detached R session). Defaults to NULL.

Value

JAGS_fit returns an object of class 'runjags'.

See Also

[JAGS_check_convergence\(\)](#)

Examples

```
## Not run:
# simulate data
set.seed(1)
data <- list(
  x = rnorm(10),
  N = 10
)
data$x

# define priors
priors_list <- list(mu = prior("normal", list(0, 1)))

# define likelihood for the data
model_syntax <-
"model{
  for(i in 1:N){
    x[i] ~ dnorm(mu, 1)
  }
}"

# fit the models
fit <- JAGS_fit(model_syntax, data, priors_list)

## End(Not run)
```

JAGS_get_inits

Create initial values for 'JAGS' model

Description

Creates initial values for priors in a 'JAGS' model.

Usage

```
JAGS_get_inits(prior_list, chains, seed)
```

Arguments

prior_list	named list of prior distribution (names correspond to the parameter names)
chains	number of chains
seed	seed for random number generation

Value

JAGS_add_priors returns a list of JAGS initial values.

JAGS_marglik_parameters

Extract parameters for 'JAGS' priors

Description

Extracts transformed parameters from the prior part of a 'JAGS' model inside of a 'bridgesampling' function (returns them as a named list)

Usage

```
JAGS_marglik_parameters(samples, prior_list)
```

Arguments

samples	samples provided by bridgesampling function
prior_list	named list of prior distribution (names correspond to the parameter names)

Value

JAGS_marglik_parameters returns a named list of (transformed) posterior samples.

JAGS_marglik_priors

Compute marginal likelihood for 'JAGS' priors

Description

Computes marginal likelihood for the prior part of a 'JAGS' model within 'bridgesampling' function

Usage

```
JAGS_marglik_priors(samples, prior_list)
```

Arguments

samples samples provided by bridgesampling function
 prior_list named list of prior distribution (names correspond to the parameter names)

Value

JAGS_marglik_priors returns a numeric value of likelihood evaluated at the current posterior sample.

JAGS_to_monitor *Create list of monitored parameters for 'JAGS' model*

Description

Creates a vector of parameter names to be monitored in a 'JAGS' model.

Usage

```
JAGS_to_monitor(prior_list)
```

Arguments

prior_list named list of prior distribution (names correspond to the parameter names)

Value

JAGS_to_monitor returns a character vector of parameter names.

lines.prior *Add prior object to a plot*

Description

Add prior object to a plot

Usage

```
## S3 method for class 'prior'
lines(
  x,
  xlim = NULL,
  x_seq = NULL,
  x_range_quant = NULL,
  n_points = 1000,
  n_samples = 10000,
```

```

    force_samples = FALSE,
    transformation = NULL,
    transformation_arguments = NULL,
    transformation_settings = FALSE,
    show_parameter = if (individual) 1 else NULL,
    individual = FALSE,
    rescale_x = FALSE,
    scale_y2 = 1,
    ...
)

```

Arguments

<code>x</code>	a prior
<code>xlim</code>	plotting range of the prior
<code>x_seq</code>	sequence of x coordinates
<code>x_range_quant</code>	quantile used for automatically obtaining <code>x_range</code> if both <code>x_range</code> and <code>x_seq</code> are unspecified. Defaults to 0.005 for all but Cauchy, Student-t, Gamma, and Inverse-gamma distributions that use 0.010.
<code>n_points</code>	number of equally spaced points in the <code>x_range</code> if <code>x_seq</code> is unspecified
<code>n_samples</code>	number of samples from the prior distribution if the density cannot be obtained analytically (or if samples are forced with <code>force_samples = TRUE</code>)
<code>force_samples</code>	should prior be sampled instead of obtaining analytic solution whenever possible
<code>transformation</code>	transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations: lin linear transformation in form of $a + b \cdot x$ tanh also known as Fisher's z transformation exp exponential transformation , or a list containing the transformation function <code>fun</code> , inverse transformation function <code>inv</code> , and the Jacobian of the transformation <code>jac</code> . See examples for details.
<code>transformation_arguments</code>	a list with named arguments for the transformation
<code>transformation_settings</code>	boolean indicating whether the settings the <code>x_seq</code> or <code>x_range</code> was specified on the transformed support
<code>show_parameter</code>	which parameter should be returned in case of multiple parameters per prior. Useful when priors for the omega parameter are plotted and <code>individual = TRUE</code> .
<code>individual</code>	should individual densities be returned (e.g., in case of weightfunction)
<code>rescale_x</code>	allows to rescale x-axis in case a weightfunction is plotted.
<code>scale_y2</code>	scaling factor for a secondary axis
<code>...</code>	additional arguments

Value

lines.prior returns NULL.

See Also

[plot.prior\(\)](#) [geom_prior\(\)](#)

lines_prior_list *Add list of prior objects to a plot*

Description

Add list of prior objects to a plot

Usage

```
lines_prior_list(
  prior_list,
  xlim = NULL,
  x_seq = NULL,
  x_range_quant = NULL,
  n_points = 500,
  n_samples = 10000,
  force_samples = FALSE,
  transformation = NULL,
  transformation_arguments = NULL,
  transformation_settings = FALSE,
  rescale_x = FALSE,
  scale_y2 = NULL,
  prior_list_mu = NULL,
  ...
)
```

Arguments

prior_list	list of prior distributions
xlim	x plotting range
x_seq	sequence of x coordinates
x_range_quant	quantile used for automatically obtaining x_range if both x_range and x_seq are unspecified. Defaults to 0.005 for all but Cauchy, Student-t, Gamma, and Inverse-gamme distributions that use 0.010.
n_points	number of equally spaced points in the x_range if x_seq is unspecified
n_samples	number of samples from the prior distribution if the density cannot be obtained analytically (or if samples are forced with force_samples = TRUE)
force_samples	should prior be sampled instead of obtaining analytic solution whenever possible

transformation transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations:
lin linear transformation in form of $a + b \cdot x$
tanh also known as Fisher's z transformation
exp exponential transformation
, or a list containing the transformation function `fun`, inverse transformation function `inv`, and the Jacobian of the transformation `jac`. See examples for details.

transformation_arguments a list with named arguments for the transformation

transformation_settings boolean indicating whether the settings `x_seq` or `x_range` was specified on the transformed support

rescale_x allows to rescale x-axis in case a weightfunction is plotted.

scale_y2 scaling factor for a secondary axis

prior_list_mu list of priors for the mu parameter required when plotting PET-PEESE

... additional arguments

Value

`lines_prior_list` returns NULL.

See Also

[plot_prior_list\(\)](#) [geom_prior_list\(\)](#)

mean.prior

Prior mean

Description

Computes mean of a prior distribution.

Usage

```
## S3 method for class 'prior'
mean(x, ...)
```

Arguments

`x` a prior
... unused

Value

a mean of an object of class 'prior'.

See Also[prior\(\)](#)**Examples**

```
# create a standard normal prior distribution
p1 <- prior(distribution = "normal", parameters = list(mean = 1, sd = 1))

# compute mean of the prior distribution
mean(p1)
```

`mix_posteriors`*Model-average posterior distributions*

Description

Model-averages posterior distributions based on a list of models, vector of parameters, and a list of indicators the models represent the null or alternative hypothesis for each parameter.

Usage

```
mix_posteriors(
  model_list,
  parameters,
  is_null_list,
  conditional = FALSE,
  seed = NULL,
  n_samples = 10000
)
```

Arguments

<code>model_list</code>	list of models, each of which contains marginal likelihood estimated with bridge sampling <code>marglik</code> and prior model odds <code>prior_weights</code>
<code>parameters</code>	vector of parameters names for which inference should be drawn
<code>is_null_list</code>	list with entries for each parameter carrying either logical vector of indicators specifying whether the model corresponds to the null or alternative hypothesis (or an integer vector indexing models corresponding to the null hypothesis)
<code>conditional</code>	whether prior and posterior model probabilities should be returned only for the conditional model. Defaults to <code>FALSE</code>
<code>seed</code>	integer specifying seed for sampling posteriors for model averaging. Defaults to 1.
<code>n_samples</code>	number of samples to be drawn for the model-averaged posterior distribution

Value

mix_posteriors returns a named list of mixed posterior distributions (either a vector of matrix).

See Also

[ensemble_inference](#) [BayesTools_ensemble_tables](#)

plot.prior	<i>Plots a prior object</i>
------------	-----------------------------

Description

Plots a prior object

Usage

```
## S3 method for class 'prior'
plot(
  x,
  plot_type = "base",
  x_seq = NULL,
  xlim = NULL,
  x_range_quant = NULL,
  n_points = 1000,
  n_samples = 10000,
  force_samples = FALSE,
  transformation = NULL,
  transformation_arguments = NULL,
  transformation_settings = FALSE,
  show_figures = if (individual) -1 else NULL,
  individual = FALSE,
  rescale_x = FALSE,
  par_name = NULL,
  ...
)
```

Arguments

x	a prior
plot_type	whether to use a base plot "base" or ggplot2 "ggplot" for plotting.
x_seq	sequence of x coordinates
xlim	x plotting range
x_range_quant	quantile used for automatically obtaining x_range if both x_range and x_seq are unspecified. Defaults to 0.005 for all but Cauchy, Student-t, Gamma, and Inverse-gamma distributions that use 0.010.

n_points	number of equally spaced points in the x_range if x_seq is unspecified
n_samples	number of samples from the prior distribution if the density cannot be obtained analytically (or if samples are forced with force_samples = TRUE)
force_samples	should prior be sampled instead of obtaining analytic solution whenever possible
transformation	transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations: lin linear transformation in form of $a + b \cdot x$ tanh also known as Fisher's z transformation exp exponential transformation , or a list containing the transformation function fun, inverse transformation function inv, and the Jacobian of the transformation jac. See examples for details.
transformation_arguments	a list with named arguments for the transformation
transformation_settings	boolean indicating whether the settings the x_seq or x_range was specified on the transformed support
show_figures	which figures should be returned in case of multiple plots are generated. Useful when priors for the omega parameter are plotted and individual = TRUE.
individual	should individual densities be returned (e.g., in case of weightfunction)
rescale_x	allows to rescale x-axis in case a weightfunction is plotted.
par_name	a type of parameter for which the prior is specified. Only relevant if the prior corresponds to a mu parameter that needs to be transformed.
...	additional arguments

Value

plot.prior returns either NULL or an object of class 'ggplot' if plot_type is plot_type = "ggplot".

See Also

[prior\(\)](#) [lines.prior\(\)](#) [geom_prior\(\)](#)

Examples

```
# create some prior distributions
p0 <- prior(distribution = "point", parameters = list(location = 0))
p1 <- prior(distribution = "normal", parameters = list(mean = 0, sd = 1))
p2 <- prior(distribution = "normal", parameters = list(mean = 0, sd = 1), truncation = list(0, Inf))

# a default plot
plot(p0)

# manipulate line thickness and color, change the parameter name
plot(p1, lwd = 2, col = "blue", par_name = bquote(mu))
```

```

# use ggplot
plot(p2, plot_type = "ggplot")

# utilize the ggplot prior geom
plot(p2, plot_type = "ggplot", xlim = c(-2, 2)) + geom_prior(p1, col = "red", lty = 2)

# apply transformation
plot(p1, transformation = "exp")

```

plot_models

Plot estimates from models

Description

Plot estimates from models

Usage

```

plot_models(
  model_list,
  samples,
  inference,
  parameter,
  plot_type = "base",
  prior = FALSE,
  conditional = FALSE,
  order = NULL,
  transformation = NULL,
  transformation_arguments = NULL,
  transformation_settings = FALSE,
  par_name = NULL,
  ...
)

```

Arguments

model_list	list of models, each of which contains marginal likelihood estimated with bridge sampling <code>marglik</code> and prior model odds <code>prior_weights</code>
samples	samples from a posterior distribution for a parameter generated by mix_posteriors .
inference	object created by ensemble_inference function
parameter	parameter name to be plotted. Does not support PET-PEESE and <code>weightfunction</code> .
plot_type	whether to use a base plot "base" or <code>ggplot2</code> "ggplot" for plotting.
prior	whether prior distribution should be added to the figure
conditional	whether conditional models should be displayed

order	list specifying ordering of the models. The first element describes whether the ordering should be "increasing" or "decreasing" and the second element describes whether the ordering should be based "model" order, "estimate" size, posterior "probability", or the inclusion "BF".
transformation	transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations: lin linear transformation in form of $a + b \cdot x$ tanh also known as Fisher's z transformation exp exponential transformation , or a list containing the transformation function <code>fun</code> , inverse transformation function <code>inv</code> , and the Jacobian of the transformation <code>jac</code> . See examples for details.
transformation_arguments	a list with named arguments for the transformation
transformation_settings	boolean indicating whether the settings the <code>x_seq</code> or <code>x_range</code> was specified on the transformed support
par_name	a type of parameter for which the prior is specified. Only relevant if the prior corresponds to a μ parameter that needs to be transformed.
...	additional arguments. E.g.: "show_updating" whether Bayes factors and change from prior to posterior odds should be shown on the secondary y-axis "show_estimates" whether posterior estimates and 95% CI should be shown on the secondary y-axis "y_axis2" whether the secondary y-axis should be shown

Value

`plot_models` returns either `NULL` or an object of class 'ggplot' if `plot_type` is `plot_type = "ggplot"`.

See Also

[prior\(\)](#) [lines_prior_list\(\)](#) [geom_prior_list\(\)](#)

plot_posterior

Plot samples from the mixed posterior distributions

Description

Plot samples from the mixed posterior distributions

Usage

```
plot_posterior(
  samples,
  parameter,
  plot_type = "base",
  prior = FALSE,
  n_points = 1000,
  n_samples = 10000,
  force_samples = FALSE,
  transformation = NULL,
  transformation_arguments = NULL,
  transformation_settings = FALSE,
  rescale_x = FALSE,
  par_name = NULL,
  dots_prior = list(),
  ...
)
```

Arguments

<code>samples</code>	samples from a posterior distribution for a parameter generated by mix_posteriors .
<code>parameter</code>	parameter name to be plotted. Use "PETPEESE" for PET-PEESE plot with parameters "PET" and "PEESE", and "weightfunction" for plotting a weightfunction with parameters "omega".
<code>plot_type</code>	whether to use a base plot "base" or ggplot2 "ggplot" for plotting.
<code>prior</code>	whether prior distribution should be added to the figure
<code>n_points</code>	number of equally spaced points in the <code>x_range</code> if <code>x_seq</code> is unspecified
<code>n_samples</code>	number of samples from the prior distribution if the density cannot be obtained analytically (or if samples are forced with <code>force_samples = TRUE</code>)
<code>force_samples</code>	should prior be sampled instead of obtaining analytic solution whenever possible
<code>transformation</code>	transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations: lin linear transformation in form of $a + b \cdot x$ tanh also known as Fisher's z transformation exp exponential transformation , or a list containing the transformation function <code>fun</code> , inverse transformation function <code>inv</code> , and the Jacobian of the transformation <code>jac</code> . See examples for details.
<code>transformation_arguments</code>	a list with named arguments for the transformation
<code>transformation_settings</code>	boolean indicating whether the settings the <code>x_seq</code> or <code>x_range</code> was specified on the transformed support
<code>rescale_x</code>	allows to rescale x-axis in case a weightfunction is plotted.

par_name	a type of parameter for which the prior is specified. Only relevant if the prior corresponds to a mu parameter that needs to be transformed.
dots_prior	additional arguments for the prior distribution plot
...	additional arguments

Value

plot_posterior returns either NULL or an object of class 'ggplot' if plot_type is plot_type = "ggplot".

See Also

[prior\(\)](#) [lines_prior_list\(\)](#) [geom_prior_list\(\)](#)

plot_prior_list	<i>Plot a list of prior distributions</i>
-----------------	---

Description

Plot a list of prior distributions

Usage

```
plot_prior_list(
  prior_list,
  plot_type = "base",
  x_seq = NULL,
  xlim = NULL,
  x_range_quant = NULL,
  n_points = 500,
  n_samples = 10000,
  force_samples = FALSE,
  transformation = NULL,
  transformation_arguments = NULL,
  transformation_settings = FALSE,
  rescale_x = FALSE,
  par_name = NULL,
  prior_list_mu = NULL,
  ...
)
```

Arguments

prior_list	list of prior distributions
plot_type	whether to use a base plot "base" or ggplot2 "ggplot" for plotting.
x_seq	sequence of x coordinates

xlim	x plotting range
x_range_quant	quantile used for automatically obtaining x_range if both x_range and x_seq are unspecified. Defaults to 0.005 for all but Cauchy, Student-t, Gamma, and Inverse-gamme distributions that use 0.010.
n_points	number of equally spaced points in the x_range if x_seq is unspecified
n_samples	number of samples from the prior distribution if the density cannot be obtained analytically (or if samples are forced with force_samples = TRUE)
force_samples	should prior be sampled instead of obtaining analytic solution whenever possible
transformation	transformation to be applied to the prior distribution. Either a character specifying one of the prepared transformations: lin linear transformation in form of $a + b \cdot x$ tanh also known as Fisher's z transformation exp exponential transformation , or a list containing the transformation function fun, inverse transformation function inv, and the Jacobian of the transformation jac. See examples for details.
transformation_arguments	a list with named arguments for the transformation
transformation_settings	boolean indicating whether the settings the x_seq or x_range was specified on the transformed support
rescale_x	allows to rescale x-axis in case a weightfunction is plotted.
par_name	a type of parameter for which the prior is specified. Only relevant if the prior corresponds to a mu parameter that needs to be transformed.
prior_list_mu	list of priors for the mu parameter required when plotting PET-PEESE
...	additional arguments

Value

plot_prior_list returns either NULL or an object of class 'ggplot' if plot_type is plot_type = "ggplot".

See Also

[prior\(\)](#) [lines_prior_list\(\)](#) [geom_prior_list\(\)](#)

point	<i>Point mass distribution</i>
-------	--------------------------------

Description

Density, distribution function, quantile function and random generation for point distribution.

Usage

```
dpoint(x, location, log = FALSE)
```

```
rpoint(n, location)
```

```
ppoint(q, location, lower.tail = TRUE, log.p = FALSE)
```

```
qpoint(p, location, lower.tail = TRUE, log.p = FALSE)
```

Arguments

x, q	vector or matrix of quantiles.
location	vector of locations.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
n	number of observations.
lower.tail	logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X \geq x]$.
p	vector of probabilities.

Value

dpoint gives the density, ppoint gives the distribution function, qpoint gives the quantile function, and rpoint generates random deviates.

Examples

```
# draw samples from a point distribution  
rpoint(10, location = 1)
```

```
print.BayesTools_table
```

Print a BayesTools table

Description

Print a BayesTools table

Usage

```
## S3 method for class 'BayesTools_table'  
print(x, ...)
```

Arguments

x a BayesTools_values_tables
... additional arguments.

Value

print.BayesTools_table returns NULL.

```
print.prior                    Prints a prior object
```

Description

Prints a prior object

Usage

```
## S3 method for class 'prior'  
print(  
  x,  
  short_name = FALSE,  
  parameter_names = FALSE,  
  plot = FALSE,  
  digits_estimates = 2,  
  silent = FALSE,  
  ...  
)
```

Arguments

x	a prior
short_name	whether prior distribution names should be shorted
parameter_names	whether parameter names should be printed
plot	to return <code>bquote</code> formatted prior name for plotting.
digits_estimates	number of decimals to be displayed for printed parameters.
silent	to silently return the print message.
...	additional arguments

Value

`print.prior` invisibly returns the print statement.

See Also

[prior\(\)](#)

Examples

```
# create some prior distributions
p0 <- prior(distribution = "point", parameters = list(location = 0))
p1 <- prior(distribution = "normal", parameters = list(mean = 0, sd = 1))

# print them
p0
p1

# use short names
print(p1, short_name = TRUE)

# print parameter names
print(p1, parameter_names = TRUE)

# generate bquote plotting syntax
plot(0, main = print(p1, plot = TRUE))
```

prior

Creates a prior distribution

Description

`prior` creates a prior distribution. The prior can be visualized by the `plot` function.

Usage

```
prior(
  distribution,
  parameters,
  truncation = list(lower = -Inf, upper = Inf),
  prior_weights = 1
)

prior_none(prior_weights = 1)
```

Arguments

distribution	name of the prior distribution. The possible options are "point" for a point density characterized by a location parameter. "normal" for a normal distribution characterized by a mean and sd parameters. "lognormal" for a lognormal distribution characterized by a meanlog and sdlog parameters. "cauchy" for a Cauchy distribution characterized by a location and scale parameters. Internally converted into a generalized t-distribution with df = 1. "t" for a generalized t-distribution characterized by a location, scale, and df parameters. "gamma" for a gamma distribution characterized by either shape and rate, or shape and scale parameters. The later is internally converted to the shape and rate parametrization "invgamma" for an inverse-gamma distribution characterized by a shape and scale parameters. The JAGS part uses a 1/gamma distribution with a shape and rate parameter. "beta" for a beta distribution characterized by an alpha and beta parameters. "exp" for an exponential distribution characterized by either rate or scale parameter. The later is internally converted to rate. "uniform" for a uniform distribution defined on a range from a to b
parameters	list of appropriate parameters for a given distribution.
truncation	list with two elements, lower and upper, that define the lower and upper truncation of the distribution. Defaults to <code>list(lower = -Inf, upper = Inf)</code> . The truncation is automatically set to the bounds of the support.
prior_weights	prior odds associated with a given distribution. The value is passed into the model fitting function, which creates models corresponding to all combinations of prior distributions for each of the model parameters and sets the model priors odds to the product of its prior distributions.

Value

`prior` and `prior_none` return an object of class 'prior'. A named list containing the distribution name, parameters, and prior weights.

See Also

[plot.prior\(\)](#), [Normal](#), [Lognormal](#), [Cauchy](#), [Beta](#), [Exponential](#), [LocationScaleT](#), [InvGamma](#).

Examples

```
# create a standard normal prior distribution
p1 <- prior(distribution = "normal", parameters = list(mean = 1, sd = 1))

# create a half-normal standard normal prior distribution
p2 <- prior(distribution = "normal", parameters = list(mean = 1, sd = 1),
truncation = list(lower = 0, upper = Inf))

# the prior distribution can be visualized using the plot function
# (see ?plot.prior for all options)
plot(p1)
```

prior_functions

Elementary prior related functions

Description

Density (pdf / lpdf), distribution function (cdf / ccdf), quantile function (quant), random generation (rng), mean, standard deviation (sd), and marginal variants of the functions (mpdf, mlpf, mcdf, mccdf, mquant) for prior distributions.

Usage

```
## S3 method for class 'prior'
rng(x, n, ...)

## S3 method for class 'prior'
cdf(x, q, ...)

## S3 method for class 'prior'
ccdf(x, q, ...)

## S3 method for class 'prior'
lpdf(x, y, ...)

## S3 method for class 'prior'
pdf(x, y, ...)

## S3 method for class 'prior'
quant(x, p, ...)

## S3 method for class 'prior'
mcdf(x, q, ...)
```

```
## S3 method for class 'prior'
mccdf(x, q, ...)

## S3 method for class 'prior'
mlpdf(x, y, ...)

## S3 method for class 'prior'
mpdf(x, y, ...)

## S3 method for class 'prior'
mquant(x, p, ...)
```

Arguments

x	prior distribution
n	number of observations
...	unused arguments
q	vector or matrix of quantiles
y	vector of observations
p	vector of probabilities

Value

pdf (mpdf) and lpdf (mlpdf) give the (marginal) density and the log of (marginal) density, cdf (mccdf) and ccdf (mccdf) give the (marginal) distribution and the complement of (marginal) distribution function, quant (mquant) give the (marginal) quantile function, and rng generates random deviates for an object of class 'prior'.

Examples

```
# create a standard normal prior distribution
p1 <- prior(distribution = "normal", parameters = list(mean = 1, sd = 1))

# generate a random sample from the prior
rng(p1, 10)

# compute cumulative density function
cdf(p1, 0)

# obtain quantile
quant(p1, .5)

# compute probability density
pdf(p1, c(0, 1, 2))
```

prior_functions_methods

Creates generics for common statistical functions

Description

Density (pdf / lpdf), distribution function (cdf / ccdf), quantile function (quant), random generation (rng), mean, standard deviation (sd), and marginal variants of the functions (mpdf, mlpf, mcdf, mccdf, mquant).

Usage

rng(x, ...)

cdf(x, ...)

ccdf(x, ...)

quant(x, ...)

lpdf(x, ...)

pdf(x, ...)

mcdf(x, ...)

mccdf(x, ...)

mquant(x, ...)

mlpdf(x, ...)

mpdf(x, ...)

Arguments

x	main argument
...	unused arguments

Value

pdf (mpdf) and lpdf (mlpdf) give the (marginal) density and the log of (marginal) density, cdf (mcdf) and ccdf (mccdf) give the (marginal) distribution and the complement of (marginal) distribution function, quant (mquant) give the (marginal) quantile function, and rng generates random deviates for an object of class 'prior'.

The pdf function proceeds to PDF graphics device if x is a character.

prior_informed	<i>Creates an informed prior distribution based on research</i>
----------------	---

Description

prior_informed creates an informed prior distribution based on past research. The prior can be visualized by the plot function.

Usage

```
prior_informed(name, parameter = NULL, type = "smd")
```

Arguments

name	name of the prior distribution. There are many options based on prior psychological or medical research. For psychology, the possible options are "van Erp" for an informed prior distribution for the heterogeneity parameter tau of meta-analytic effect size estimates based on standardized mean differences (van Erp et al. 2017), "Oosterwijk" for an informed prior distribution for the effect sizes expected in social psychology based on prior elicitation with dr. Oosterwijk (Gronau et al. 2017). For medicine, the possible options are based on BartoÅj et al. (2021) who developed empirical prior distributions for the effect size and heterogeneity parameters of the continuous standardized outcomes based on the Cochrane database of systematic reviews. Use "Cochrane" for a prior distribution based on the whole database or call print(prior_informed_medicine_names) to inspect the names of all 46 subfields and set the appropriate parameter and type.
parameter	parameter name describing what prior distribution is supposed to be produced in cases where the name corresponds to multiple prior distributions. Relevant only for the empirical medical prior distributions.
type	prior type describing what prior distribution is supposed to be produced in cases where the name and parameter correspond to multiple prior distributions. Relevant only for the empirical medical prior distributions.

Value

prior_informed returns an object of class 'prior'.

References

BartoÅj F, Gronau QF, Timmers B, Otte WM, Ly A, Wagenmakers E (2021). "Bayesian model-averaged meta-analysis in medicine." *Statistics in Medicine*. <https://doi.org/10.1002/sim.9170>.

Gronau QF, Van Erp S, Heck DW, Cesario J, Jonas KJ, Wagenmakers E (2017). "A Bayesian

model-averaged meta-analysis of the power pose effect with informed and default priors: The case of felt power.” *Comprehensive Results in Social Psychology*, 2(1), 123–138. <https://doi.org/10.1080/23743603.2017.1326760>.

van Erp S, Verhagen J, Grasman RP, Wagenmakers E (2017). “Estimates of between-study heterogeneity for 705 meta-analyses reported in Psychological Bulletin from 1990–2013.” *Journal of Open Psychology Data*, 5(1). <https://doi.org/10.5334/jopd.33>.

See Also

[prior\(\)](#), [prior_informed_medicine_names](#)

Examples

```
# prior distribution representing expected effect sizes in social psychology
# based on prior elicitation with dr. Oosterwijk
p1 <- prior_informed("Oosterwijk")

# the prior distribution can be visualized using the plot function
# (see ?plot.prior for all options)
plot(p1)

# empirical prior distribution for the standardized mean differences from the oral health
# medical subfield based on meta-analytic effect size estimates from the
# Cochrane database of systematic reviews
p2 <- prior_informed("Oral Health", parameter = "effect", type = "smd")
print(p2)
```

prior_informed_medicine_names

Names of medical subfields from the Cochrane database of systematic reviews

Description

Contain names identifying the individual subfields from the Cochrane database of systematic reviews. The individual elements correspond to valid name arguments for the [prior_informed\(\)](#) function.

Usage

```
prior_informed_medicine_names
```

Format

An object of class character of length 47.

Value

returns a character vector with names of medical subfields from Cochrane database of systematic reviews.

See Also

[prior_informed\(\)](#)

Examples

```
print(prior_informed_medicine_names)
```

prior_PP	<i>Creates a prior distribution for PET or PEESE models</i>
----------	---

Description

prior creates a prior distribution for fitting a PET or PEESE style models in RoBMA. The prior distribution can be visualized by the plot function.

Usage

```
prior_PET(
  distribution,
  parameters,
  truncation = list(lower = 0, upper = Inf),
  prior_weights = 1
)
```

```
prior_PEESE(
  distribution,
  parameters,
  truncation = list(lower = 0, upper = Inf),
  prior_weights = 1
)
```

Arguments

distribution	name of the prior distribution. The possible options are "point" for a point density characterized by a location parameter. "normal" for a normal distribution characterized by a mean and sd parameters. "lognormal" for a lognormal distribution characterized by a meanlog and sdlog parameters. "cauchy" for a Cauchy distribution characterized by a location and scale parameters. Internally converted into a generalized t-distribution with df = 1.
--------------	--

	"t" for a generalized t-distribution characterized by a location, scale, and df parameters.
	"gamma" for a gamma distribution characterized by either shape and rate, or shape and scale parameters. The later is internally converted to the shape and rate parametrization
	"invgamma" for an inverse-gamma distribution characterized by a shape and scale parameters. The JAGS part uses a 1/gamma distribution with a shape and rate parameter.
	"beta" for a beta distribution characterized by an alpha and beta parameters.
	"exp" for an exponential distribution characterized by either rate or scale parameter. The later is internally converted to rate.
	"uniform" for a uniform distribution defined on a range from a to b
parameters	list of appropriate parameters for a given distribution.
truncation	list with two elements, lower and upper, that define the lower and upper truncation of the distribution. Defaults to <code>list(lower = -Inf, upper = Inf)</code> . The truncation is automatically set to the bounds of the support.
prior_weights	prior odds associated with a given distribution. The value is passed into the model fitting function, which creates models corresponding to all combinations of prior distributions for each of the model parameters and sets the model priors odds to the product of its prior distributions.

Value

prior_PET and prior_PEESE return an object of class 'prior'.

See Also

`plot.prior()`, `prior()`

Examples

```
# create a half-Cauchy prior distribution
# (PET and PEESE specific functions automatically set lower truncation at 0)
p1 <- prior_PET(distribution = "Cauchy", parameters = list(location = 0, scale = 1))

plot(p1)
```

prior_weightfunction *Creates a prior distribution for a weight function*

Description

prior_weightfunction creates a prior distribution for fitting a RoBMA selection model. The prior can be visualized by the plot function.

Usage

```
prior_weightfunction(distribution, parameters, prior_weights = 1)
```

Arguments

distribution name of the prior distribution. The possible options are
 "two.sided" for a two-sided weight function characterized by a vector steps and vector alpha parameters. The alpha parameter determines an alpha parameter of Dirichlet distribution which cumulative sum is used for the weights omega.
 "one.sided" for a one-sided weight function characterized by either a vector steps and vector alpha parameter, leading to a monotonic one-sided function, or by a vector steps, vector alpha1, and vector alpha2 parameters leading non-monotonic one-sided weight function. The alpha / alpha1 and alpha2 parameters determine an alpha parameter of Dirichlet distribution which cumulative sum is used for the weights omega.

parameters list of appropriate parameters for a given distribution.

prior_weights prior odds associated with a given distribution. The model fitting function usually creates models corresponding to all combinations of prior distributions for each of the model parameters, and sets the model priors odds to the product of its prior distributions.

Value

prior_weightfunction returns an object of class 'prior'.

See Also

[plot.prior\(\)](#)

Examples

```
p1 <- prior_weightfunction("one-sided", parameters = list(steps = c(.05, .10), alpha = c(1, 1, 1)))

# the prior distribution can be visualized using the plot function
# (see ?plot.prior for all options)
plot(p1)
```

range.prior

Prior range

Description

Computes range of a prior distribution (if the prior distribution is unbounded range from quantiles to 1 -quantiles) is returned.

Usage

```
## S3 method for class 'prior'  
range(x, quantiles = NULL, ..., na.rm = FALSE)
```

Arguments

x	a prior
quantiles	quantile to be returned in case of unbounded distribution.
...	additional arguments
na.rm	unused

Value

`range.prior` returns a numeric vector of length with a plotting range of a prior distribution.

See Also

[prior\(\)](#)

sd	<i>Creates generic for sd function</i>
----	--

Description

Creates generic for sd function

Usage

```
sd(x, ...)
```

Arguments

x	main argument
...	additional arguments

Value

`sd` returns a standard deviation of the supplied object (if it is either a numeric vector or an object of class 'prior').

See Also

[sd](#)

sd.prior	<i>Prior sd</i>
----------	-----------------

Description

Computes standard deviation of a prior distribution.

Usage

```
## S3 method for class 'prior'  
sd(x, ...)
```

Arguments

x	a prior
...	unused arguments

Value

a standard deviation of an object of class 'prior'.

See Also

[prior\(\)](#)

Examples

```
# create a standard normal prior distribution  
p1 <- prior(distribution = "normal", parameters = list(mean = 1, sd = 1))  
  
# compute sd of the prior distribution  
sd(p1)
```

var	<i>Creates generic for var function</i>
-----	---

Description

Creates generic for var function

Usage

```
var(x, ...)
```

Arguments

x main argument
... additional arguments

Value

var returns a variance of the supplied object (if it is either a numeric vector or an object of class 'prior').

See Also

[cor](#)

var.prior

Prior var

Description

Computes variance of a prior distribution.

Usage

```
## S3 method for class 'prior'  
var(x, ...)
```

Arguments

x a prior
... unused arguments

Value

a variance of an object of class 'prior'.

See Also

[prior\(\)](#)

Examples

```
# create a standard normal prior distribution  
p1 <- prior(distribution = "normal", parameters = list(mean = 1, sd = 1))  
  
# compute variance of the prior distribution  
var(p1)
```

weightfunctions	<i>Weight functions</i>
-----------------	-------------------------

Description

Marginal density, marginal distribution function, marginal quantile function and random generation for weight functions.

Usage

```
mdone.sided(x, alpha = NULL, alpha1 = NULL, alpha2 = NULL, log = FALSE)
```

```
mdtwo.sided(x, alpha, log = FALSE)
```

```
mdone.sided_fixed(x, omega, log = FALSE)
```

```
mdtwo.sided_fixed(x, omega, log = FALSE)
```

```
rone.sided(n, alpha = NULL, alpha1 = NULL, alpha2 = NULL)
```

```
rtwo.sided(n, alpha)
```

```
rone.sided_fixed(n, omega)
```

```
rtwo.sided_fixed(n, omega)
```

```
mpone.sided(
  q,
  alpha = NULL,
  alpha1 = NULL,
  alpha2 = NULL,
  lower.tail = TRUE,
  log.p = FALSE
)
```

```
mptwo.sided(q, alpha, lower.tail = TRUE, log.p = FALSE)
```

```
mpone.sided_fixed(q, omega, lower.tail = TRUE, log.p = FALSE)
```

```
mptwo.sided_fixed(q, omega, lower.tail = TRUE, log.p = FALSE)
```

```
mqone.sided(
  p,
  alpha = NULL,
  alpha1 = NULL,
  alpha2 = NULL,
  lower.tail = TRUE,

```

```

    log.p = FALSE
  )

mqtwo.sided(p, alpha, lower.tail = TRUE, log.p = FALSE)

mqone.sided_fixed(p, omega, lower.tail = TRUE, log.p = FALSE)

mqtwo.sided_fixed(p, omega, lower.tail = TRUE, log.p = FALSE)

```

Arguments

<code>x, q</code>	vector or matrix of quantiles.
<code>alpha</code>	vector or matrix with concentration parameters for the Dirichlet distribution for a monotonic one.sided or a two.sided weight function.
<code>alpha1</code>	vector or matrix with concentration parameters for the Dirichlet distribution for the expected direction of non-monotonic one.sided of weight function.
<code>alpha2</code>	vector or matrix with concentration parameters for the Dirichlet distribution for the unexpected direction of non-monotonic one.sided of weight function.
<code>log, log.p</code>	logical; if TRUE, probabilities p are given as $\log(p)$.
<code>omega</code>	vector or matrix of fixed probabilities for a one.sided or a two.sided weight function.
<code>n</code>	number of observations.
<code>lower.tail</code>	logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X \geq x]$.
<code>p</code>	vector of probabilities.

Value

`mdone.sided`, `mdtwo.sided`, `mdone.sided_fixed`, and `mdtwo.sided_fixed` give the marginal density, `mpone.sided`, `mptwo.sided`, `mpone.sided_fixed`, and `mptwo.sided_fixed` give the marginal distribution function, `mqone.sided`, `mqtwo.sided`, `mqone.sided_fixed`, and `mqtwo.sided_fixed` give the marginal quantile function, and `rone.sided`, `rtwo.sided`, `rone.sided_fixed`, and `rtwo.sided_fixed` generate random deviates.

Examples

```

# draw samples from a two-sided weight function
rtwo.sided(10, alpha = c(1, 1))

# draw samples from a monotone one-sided weight function
rone.sided(10, alpha = c(1, 1, 1))

# draw samples from a non-monotone one-sided weight function
rone.sided(10, alpha1 = c(1, 1), alpha2 = c(1, 1))

```

`weightfunctions_mapping`*Create coefficient mapping between multiple weightfunctions*

Description

Creates coefficients mapping between multiple weightfunctions.

Usage

```
weightfunctions_mapping(prior_list, cuts_only = FALSE)
```

Arguments

<code>prior_list</code>	list of prior distributions
<code>cuts_only</code>	whether only p-value cuts should be returned

Value

`weightfunctions_mapping` returns a list of indices mapping the publication weights ω from the individual weightfunctions into a joint weightfunction.

Index

- * **datasets**
 - prior_informed_medicine_names, 46
- * **package**
 - BayesTools, 3
 - _PACKAGE (BayesTools), 3
- BayesTools, 3
- BayesTools-package (BayesTools), 3
- BayesTools_ensemble_tables, 3, 6, 10, 15, 31
- BayesTools_model_tables, 5, 5, 15
- Beta, 42
- bquote, 40
- bridge_sampler, 17, 18
- Cauchy, 42
- ccdf (prior_functions_methods), 44
- ccdf.prior (prior_functions), 42
- cdf (prior_functions_methods), 44
- cdf.prior (prior_functions), 42
- check_bool (check_input), 6
- check_char (check_input), 6
- check_input, 6
- check_int (check_input), 6
- check_list (check_input), 6
- check_real (check_input), 6
- compute_inference (ensemble_inference), 10
- cor, 52
- density.prior, 8
- difftime, 20, 23
- dpoint (point), 38
- ensemble_diagnostics_table
 - (BayesTools_ensemble_tables), 3
- ensemble_estimates_table
 - (BayesTools_ensemble_tables), 3
- ensemble_inference, 3–5, 10, 15, 31, 33
- ensemble_inference_table
 - (BayesTools_ensemble_tables), 3
- ensemble_summary_table
 - (BayesTools_ensemble_tables), 3
- Exponential, 42
- format_BF, 11
- geom_prior, 11
- geom_prior(), 28, 32
- geom_prior_list, 13
- geom_prior_list(), 29, 34, 36, 37
- inclusion_BF, 14
- interpret, 15
- InvGamma, 42
- is.prior, 15
- JAGS_add_priors, 16
- JAGS_bridgesampling, 17
- JAGS_bridgesampling_posterior, 18
- JAGS_check_and_list, 19
- JAGS_check_and_list_autofit_settings
 - (JAGS_check_and_list), 19
- JAGS_check_and_list_fit_settings
 - (JAGS_check_and_list), 19
- JAGS_check_convergence, 21
- JAGS_check_convergence(), 24
- JAGS_fit, 19, 22
- JAGS_fit(), 21
- JAGS_get_inits, 24
- JAGS_marglik_parameters, 25
- JAGS_marglik_priors, 25
- JAGS_to_monitor, 26
- lines.prior, 26
- lines.prior(), 12, 32
- lines_prior_list, 28
- lines_prior_list(), 14, 34, 36, 37
- LocationScaleT, 42
- Lognormal, 42
- lpdf (prior_functions_methods), 44
- lpdf.prior (prior_functions), 42

- mccdf (prior_functions_methods), 44
- mccdf.prior (prior_functions), 42
- mcdf (prior_functions_methods), 44
- mcdf.prior (prior_functions), 42
- mdone.sided (weightfunctions), 53
- mdone.sided_fixed (weightfunctions), 53
- mdtwo.sided (weightfunctions), 53
- mdtwo.sided_fixed (weightfunctions), 53
- mean.prior, 29
- mix_posteriors, 3–5, 10, 15, 30, 33, 35
- mldf (prior_functions_methods), 44
- mldf.prior (prior_functions), 42
- model_summary_table
 - (BayesTools_model_tables), 5
- models_inference, 3, 4
- models_inference (ensemble_inference), 10
- mpdf (prior_functions_methods), 44
- mpdf.prior (prior_functions), 42
- mpone.sided (weightfunctions), 53
- mpone.sided_fixed (weightfunctions), 53
- mptwo.sided (weightfunctions), 53
- mptwo.sided_fixed (weightfunctions), 53
- mqone.sided (weightfunctions), 53
- mqone.sided_fixed (weightfunctions), 53
- mqtwo.sided (weightfunctions), 53
- mqtwo.sided_fixed (weightfunctions), 53
- mquant (prior_functions_methods), 44
- mquant.prior (prior_functions), 42
- Normal, 42
- pdf (prior_functions_methods), 44
- pdf.prior (prior_functions), 42
- plot.prior, 31
- plot.prior(), 12, 28, 42, 48, 49
- plot_models, 33
- plot_posterior, 34
- plot_prior_list, 36
- plot_prior_list(), 14, 29
- point, 38
- ppoint (point), 38
- print.BayesTools_table, 39
- print.prior, 39
- prior, 40
- prior(), 9, 30, 32, 34, 36, 37, 40, 46, 48, 50–52
- prior_functions, 42
- prior_functions_methods, 44
- prior_informed, 45
- prior_informed(), 46, 47
- prior_informed_medicine_names, 46, 46
- prior_none (prior), 40
- prior_PEESE (prior_PP), 47
- prior_PET (prior_PP), 47
- prior_PP, 47
- prior_weightfunction, 48
- qpoint (point), 38
- quant (prior_functions_methods), 44
- quant.prior (prior_functions), 42
- range.prior, 49
- rjags-package, 17
- rng (prior_functions_methods), 44
- rng.prior (prior_functions), 42
- rone.sided (weightfunctions), 53
- rone.sided_fixed (weightfunctions), 53
- rpoint (point), 38
- rtwo.sided (weightfunctions), 53
- rtwo.sided_fixed (weightfunctions), 53
- run.jags, 22
- runjags, 17
- runjags-package, 21
- runjags_estimates_empty_table
 - (BayesTools_model_tables), 5
- runjags_estimates_table, 4
- runjags_estimates_table
 - (BayesTools_model_tables), 5
- sd, 50, 50
- sd.prior, 51
- var, 51
- var.prior, 52
- weightfunctions, 53
- weightfunctions_mapping, 55