Package ‘tidytreatment’

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Type Package

Title Tidy Methods for Bayesian Treatment Effect Models

Version 0.2.1

Description Functions for extracting tidy data from Bayesian treatment effect models, in particular BART, but extensions are possible. Functionality includes extracting tidy posterior summaries as in 'tidybayes' <https://github.com/mjskay/tidybayes>, estimating (average) treatment effects, common support calculations, and plotting useful summaries of these.

Encoding UTF-8

LazyData true

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URL https://github.com/bonStats/tidytreatment

BugReports https://github.com/bonStats/tidytreatment/issues

Language en-US

Depends R (>= 3.1.0)

Suggests knitr, rmarkdown, BART, ggplot2, testthat (>= 3.0.0), withr

VignetteBuilder knitr

RoxygenNote 7.1.1

Imports tidybayes, purrr, tidyr, dplyr, readr, rlang

Enhances bartMachine

Config/testthat/edition 3

NeedsCompilation no

Author Joshua J Bon [aut, cre] (<https://orcid.org/0000-0003-2313-2949>)

Maintainer Joshua J Bon <joshuajbon@gmail.com>

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R topics documented:

avg_treatment_effects
bartmodel1
bartmodel1_modelmatrix
covariate_importance
covariate_with_treatment_importance
fitted_draws.bartMachine
fitted_draws.lbart
fitted_draws.mbart
fitted_draws.mbart2
fitted_draws.pbart
fitted_draws.wbart
fitted_draws_BART
has_common_support
has_tidytreatment_methods
highDim_testdataset3
posterior_trees_BART
predicted_draws.bartMachine
predicted_draws.wbart
predicted_draws_BART
residual_draws.bartMachine
residual_draws.pbart
residual_draws.wbart
residual_draws_BART
simulate_su_hill_data
suhillsim1
tidytreating
tidy_ate
tidy_att
treatment_effects
treatment_effects.default
variance_draws

Index

avg_treatment_effects  Get (conditional) average treatment effect draws from posterior

Description

(C)ATE = (Conditional) Average Treatment Effects newdata specifies the conditions, if unspecified it defaults to the original data. Assumes treated column is either a integer column of 1’s (treated) and 0’s (nontreated) or logical indicating treatment if TRUE.
Usage

```r
avg_treatment_effects(
  model,
  treatment,
  newdata,
  subset = "all",
  common_support_method,
  cutoff,
  ...
)
```

Arguments

- **model**: A supported Bayesian model fit that can provide fits and predictions.
- **treatment**: A character string specifying the name of the treatment variable.
- **newdata**: Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
- **subset**: Either "treated", "nontreated", or "all". Default is "all".
- **common_support_method**: Either "sd", or "chisq". Default is unspecified, and no common support calculation is done.
- **cutoff**: Cutoff for common support (if in use).
- **...**: Arguments to be passed to `tidybayes::fitted_draws` typically scale for BART models.

Value

A tidy data frame (tibble) with treatment effect values.

---

### Example model 1

**Description**

Model fit with simulated data from simulated dataset `suhillsim1`.

**Usage**

```r
bartmodel1
```

**Format**

Object of type `BART::wbart`
Details

Propensity score estimated and included `suhillsim1` for fitting the model.

Source


---

`bartmodel1_modelmatrix`

*Model matrix used for bartmodel1*

---

Description

Useful for testing tidytreatment package functions.

Usage

`bartmodel1_modelmatrix`

Format

Object of type `BART::wbart`

Source


---

`covariate_importance`  *Counts of variable overall inclusion*

---

Description

Inclusion metric for bartMachine and BART are scaled differently. bartMachine averaged over number of trees, in addition to number of MCMC draws.

Usage

`covariate_importance(model, ...)`

Arguments

- `model`  Model
- `...`  Arguments to pass to particular methods.

Value

Tidy data with counts of variable inclusion, when interacting with treatment variable.
**covariate_with_treatment_importance**

*Counts of variable inclusion when interacting with treatment*

**Description**

Counts of variable inclusion when interacting with treatment

**Usage**

`covariate_with_treatment_importance(model, treatment, ...)`

**Arguments**

- `model`: Model
- `treatment`: A character string specifying the name of the treatment variable.
- `...`: Arguments to pass to particular methods.

**Value**

Tidy data with counts of variable inclusion, when interacting with treatment variable.

---

**fitted_draws.bartMachine**

*Get fitted draws from posterior of bartMachine model*

**Description**

Get fitted draws from posterior of bartMachine model

**Usage**

```r
## S3 method for class 'bartMachine'
fitted_draws(  
  model,  
  newdata,  
  value = ".value",  
  ...,  
  n = NULL,  
  include_newdata = TRUE,  
  include_sigsqs = FALSE
)
```
fitted_draws.lbart

Arguments

model A bartMachine model.
newdata Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
value The name of the output column for fitted_draws; default ".value".
... Not currently in use.
n Not currently implemented.
include_newdata Should the newdata be included in the tibble?
include_sigsqs Should the posterior sigma-squared draw be included?

Value

A tidy data frame (tibble) with fitted values.

fitted_draws.lbart Get fitted draws from posterior of lbart model

Description

Get fitted draws from posterior of lbart model

Usage

## S3 method for class 'lbart'
fitted_draws(
  model,
  newdata,
  value = ".value",
  ...,
  n = NULL,
  include_newdata = TRUE,
  include_sigsqs = FALSE
)

Arguments

model A model from BART package.
newdata Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
value The name of the output column for fitted_draws; default ".value".
... Not currently in use.
n Not currently implemented.
include_newdata Should the newdata be included in the tibble?
include_sigsqs Should the posterior sigma-squared draw be included?
**fitted_draws.mbart**

**Value**

A tidy data frame (tibble) with fitted values.

---

**fitted_draws.mbart**  
*Get fitted draws from posterior of mbart model*

**Description**

Get fitted draws from posterior of mbart model.

**Usage**

```r
## S3 method for class 'mbart'
fitted_draws(
  model,  
  newdata,  
  value = ".value",  
  ...,  
  n = NULL,  
  include_newdata = TRUE,  
  include_sigsqs = FALSE
)
```

**Arguments**

- **model**  
  A model from BART package.

- **newdata**  
  Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.

- **value**  
  The name of the output column for fitted_draws; default ".value".

- **...**  
  Not currently in use.

- **n**  
  Not currently implemented.

- **include_newdata**  
  Should the newdata be included in the tibble?

- **include_sigsqs**  
  Should the posterior sigma-squared draw be included?

**Value**

A tidy data frame (tibble) with fitted values.
Get fitted draws from posterior of \texttt{mbart2} model

### Description

Get fitted draws from posterior of \texttt{mbart2} model

### Usage

```r
## S3 method for class 'mbart2'
fitted_draws(
  model,
  newdata,
  value = ".value",
  ..., 
  n = NULL,
  include_newdata = TRUE,
  include_sigsqs = FALSE 
)
```

### Arguments

- **model**: A model from BART package.
- **newdata**: Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
- **value**: The name of the output column for \texttt{fitted_draws}; default ".value".
- **...**: Not currently in use.
- **n**: Not currently implemented.
- **include_newdata**: Should the newdata be included in the tibble?
- **include_sigsqs**: Should the posterior sigma-squared draw be included?

### Value

A tidy data frame (tibble) with fitted values.
Description

Get fitted draws from posterior of `pbart` model

Usage

```r
# S3 method for class 'pbart'
fitted_draws(
  model, 
  newdata, 
  value = ".value",
  ..., 
  n = NULL, 
  include_newdata = TRUE, 
  include_sigsqs = FALSE
)
```

Arguments

- **model**: A model from BART package.
- **newdata**: Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
- **value**: The name of the output column for `fitted_draws`; default ".value".
- **...**: Not currently in use.
- **n**: Not currently implemented.
- **include_newdata**: Should the newdata be included in the tibble?
- **include_sigsqs**: Should the posterior sigma-squared draw be included?

Value

A tidy data frame (tibble) with fitted values.
fitted_draws.wbart  Get fitted draws from posterior of \texttt{wbart} model

Description
Get fitted draws from posterior of \texttt{wbart} model

Usage
```r
## S3 method for class 'wbart'
fitted_draws(
  model,
  newdata,
  value = ".value",
  ...,n = NULL,
  include_newdata = TRUE,
  include_sigsqs = FALSE
)
```

Arguments
- \texttt{model}  A model from \texttt{BART} package.
- \texttt{newdata}  Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
- \texttt{value}  The name of the output column for \texttt{fitted_draws}; default ".value".
- \texttt{...}  Not currently in use.
- \texttt{n}  Not currently implemented.
- \texttt{include_newdata}  Should the newdata be included in the tibble?
- \texttt{include_sigsqs}  Should the posterior sigma-squared draw be included?

Value
A tidy data frame (tibble) with fitted values.
Get fitted draws from posterior of BART-package models

Usage

```r
fitted_draws_BART(
  model, newdata = NULL, value = ".value",
  ..., include_newdata = TRUE, include_sigsqs = FALSE, scale = "real"
)
```

Arguments

- `model`: A model from BART package.
- `newdata`: Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
- `value`: The name of the output column for `fitted_draws`; default ".value".
- `...`: Arguments to pass to `predict` (e.g. `BART:::predict.wbart`).
- `include_newdata`: Should the newdata be included in the tibble?
- `include_sigsqs`: Should the posterior sigma-squared draw be included?
- `scale`: Should the fitted values be on the real, probit or logit scale?

Value

A tidy data frame (tibble) with fitted values.

Description

The common support identification methods are based on Hill and Su (2013). Loosely speaker, an individual's treatment effect estimate has common support if the counterfactual estimate is not too uncertain. The estimates are uncertain when the prediction is 'far away' from other observations. Removing estimates without common support can be beneficial for treat effect estimates.
has_tidytreatment_methods

Usage

has_common_support(model, treatment, method, cutoff, modeldata = NULL)

Arguments

- **model**: A supported Bayesian model fit that can provide fits and predictions.
- **treatment**: A character string specifying the name of the treatment variable.
- **method**: Method to use in determining common support. 'chisq', or 'sd'.
- **cutoff**: Cutoff point to use for method.
- **modeldata**: Manually provide model data for some models (e.g. from BART package)

Details


Value

Tibble with a row for each observation and a column indicating whether common support exists.

has_tidytreatment_methods

Check if a model class has required generic methods for tidytreatment functions.

Description

Check if a model class has required generic methods for tidytreatment functions.

Usage

has_tidytreatment_methods(model)

Arguments

- **model**: Model to be checked.

Value

Boolean
**ACIC2019 High Dimensional Test Dataset**

**Description**

Dataset from the "Data Challenge" for the Atlantic Causal Inference Conference 2019.

**Usage**

highDim_testdataset3

**Format**

A data frame with 2000 observations, and 187 variables.

Y Outcome variable
A Treatment variable

Other covariates ...

**Source**


---

**posterior_trees_BART**  Get posterior tree draws into tibble format from BART model

**Description**

Tibble grouped by iteration (‘iter’) and tree id (‘tree_id’). All information calculated by method is included in output.

**Usage**

posterior_trees_BART(model, label_digits = 2)

**Arguments**

model BART model.
label_digits Rounding for labels.
Value

A tibble with columns to

iter  Integer describing unique MCMC iteration.
tree_id  Integer. Unique tree id with each 'iter'.
node  Integer describing node in tree. Unique to each 'tree'-iter'.
parent  Integer describing parent node in tree.
label  Label for the node.
tier  Position in tree hierarchy.
var  Variable for split.
cut  Numeric. Value of decision rule for 'var'.
is_leaf  Logical. 'TRUE' if leaf, 'FALSE' if stem.
leaf_value
child_left  Integer. Left child of node.
child_right  Integer. Right child of node.

predicted_draws.bartMachine

Get predict draws from posterior of bartMachine model

Description

Get predict draws from posterior of bartMachine model

Usage

## S3 method for class 'bartMachine'
predicted_draws(
  object,
  newdata,
  value = ".prediction",
  ..., 
  ndraws = NULL,
  include_newdata = TRUE,
  include_fitted = FALSE,
  include_sigsqs = FALSE
)


**predicted_draws.wbart**  
*Get predict draws from posterior ofwbart model*

**Description**
Get predict draws from posterior of wbart model

**Usage**
```r
## S3 method for class 'wbart'
predicted_draws(
  object,
  newdata,
  value = ".prediction",
  ..., 
  ndraws = NULL,
  include_newdata = TRUE,
  include_fitted = FALSE,
  include_sigsqs = FALSE
)
```

**Arguments**
- **object**: A wbart model.
- **newdata**: Data frame to generate predictions from. If omitted, most model types will generate predictions from the data used to fit the model.
- **value**: The name of the output column for predicted_draws; default ".prediction".
- **...**: Not currently in use.
- **ndraws**: Not currently implemented.
- **include_newdata**: Should the newdata be included in the tibble?
- **include_fitted**: Should the posterior fitted values be included in the tibble?
- **include_sigsqs**: Should the posterior sigma-squared draw be included?

**Value**
A tidy data frame (tibble) with predicted values.
predicted_draws_BART

Get predict draws from posterior of BART-package models

Usage

predicted_draws_BART(
  object,
  newdata = NULL,
  value = ".prediction",
  ...,
  rng = stats::rnorm,
  include_newdata = TRUE,
  include_fitted = FALSE,
  include_sigsqs = FALSE
)

Arguments

object A BART-package model.
newdata Data frame to generate predictions from. If omitted, most model types will generate predictions from the data used to fit the model.
value The name of the output column for predicted_draws; default ".prediction".
... Arguments to pass to predict (e.g. BART:::predict.wbart).
rng Random number generator function. Default is rnorm for models with Gaussian errors.
include_newdata Should the newdata be included in the tibble?
include_fitted Should the posterior fitted values be included in the tibble?
include_sigsqs Should the posterior sigma-squared draw be included?

Value

A tidy data frame (tibble) with predicted values.
Get residual draw for `bartMachine` model

**Description**

Get residual draw for `bartMachine` model

**Usage**

```r
## S3 method for class 'bartMachine'
residual_draws(
  object,
  newdata,
  value = ".residual",
  ...,
  ndraws = NULL,
  include_newdata = TRUE,
  include_sigsqs = FALSE
)
```

**Arguments**

- `object` : `bartMachine` model.
- `newdata` : Data frame to generate predictions from. If omitted, original data used to fit the model.
- `value` : Name of the output column for residual_draws; default is `.residual`.
- `...` : Additional arguments passed to the underlying prediction method for the type of model given.
- `ndraws` : Not currently implemented.
- `include_newdata` : Should the newdata be included in the tibble?
- `include_sigsqs` : Should the posterior sigma-squared draw be included?

**Value**

Tibble with residuals.
residual_draws.pbart  Get residual draw for pbart model

Description

The original response variable must be passed as an argument to this function. e.g. `response = y`

Usage

```r
## S3 method for class 'pbart'
residual_draws(
  object,
  newdata,
  value = ".residual",
  ..., # Additional arguments passed to the underlying prediction method for the type of model given.
  ndraws = NULL,
  include_newdata = TRUE,
  include_sigsqs = FALSE
)
```

Arguments

- **object**  
  wbart model.
- **newdata**  
  Data frame to generate predictions from. If omitted, original data used to fit the model.
- **value**  
  Name of the output column for residual_draws; default is `.residual`.
- **...**  
  Additional arguments passed to the underlying prediction method for the type of model given.
- **ndraws**  
  Not currently implemented.
- **include_newdata**  
  Should the newdata be included in the tibble?
- **include_sigsqs**  
  Should the posterior sigma-squared draw be included?

Value

Tibble with residuals.
### residual_draws.wbart

Get residual draw for `wbart` model

---

**Description**

The original response variable must be passed as an argument to this function. e.g. `response = y`

**Usage**

```r
## S3 method for class 'wbart'
residual_draws(
  object,
  newdata,
  value = ".residual",
  ..., 
  ndraws = NULL,
  include_newdata = TRUE,
  include_sigsqs = FALSE
)
```

**Arguments**

- **object**: `wbart` model.
- **newdata**: Data frame to generate predictions from. If omitted, original data used to fit the model.
- **value**: Name of the output column for residual_draws; default is `.residual`.
- **...**: Additional arguments passed to the underlying prediction method for the type of model given.
- **ndraws**: Not currently implemented.
- **include_newdata**: Should the newdata be included in the tibble?
- **include_sigsqs**: Should the posterior sigma-squared draw be included?

**Value**

Tibble with residuals.
residual_draws_BART  Get residual draw for BART model

Description

Classes from BART-package models

Usage

residual_draws_BART(
  object,
  response,
  newdata = NULL,
  value = ".residual",
  include_newdata = TRUE,
  include_sigsqs = FALSE
)

Arguments

  object  model from BART package.
  response Original response vector.
  newdata  Data frame to generate predictions from. If omitted, original data used to fit the model.
  value  Name of the output column for residual_draws; default is .residual.
  include_newdata  Should the newdata be included in the tibble?
  include_sigsqs  Should the posterior sigma-squared draw be included?

Value

   Tibble with residuals.

simulate_su_hill_data  Simulate data with scenarios from Hill and Su (2013)

Description

Sample $n$ observations with the following scheme:

1. Covariates: $X_j \sim N(0, 1)$.
2. Assignment: $Z \sim Bin(n, p)$ with $p = \logit^{-1}(a + X\gamma^L + Q\gamma^N)$ where $a = \omega - mean(X\gamma^L + Q\gamma^N)$.
3. Mean response: $E(Y(0)|X) = X\beta_0^L + Q\beta_0^N$ and $E(Y(1)|X) = X\beta_1^L + Q\beta_1^N$.
4. Observation: $Y \sim N(\mu, \sigma^2_y)$.

Superscript $L$ denotes the linear components, whilst $N$ denotes the non-linear components.
Usage

simulate_su_hill_data(
  n,
  treatment_linear = TRUE,
  response_parallel = TRUE,
  response_aligned = TRUE,
  y_sd = 1,
  tau = 4,
  omega = 0,
  add_categorical = FALSE,
  coef_categorical_treatment = NULL,
  coef_categorical_nontreatment = NULL
)

Arguments

n                Size of simulated sample.
treatment_linear          Treatment assignment mechanism is linear?
response_parallel          Response surface is parallel?
response_aligned          Response surface is aligned?
y_sd                Observation noise.
tau                Treatment effect for parallel response surfaces. Not applicable if surface is non-
                   parallel.
omega          Offset to control treatment assignment ratios.
add_categorical          Should a categorical variable be added? (Not in Hill and Su)
coef_categorical_treatment          What are the coefficients of the categorical variable under treatment? (Not in
                                       Hill and Su)
coef_categorical_nontreatment          What are the coefficients of the categorical variable under nontreatment? (Not
                                         in Hill and Su)

Details

Coefficients used are returned in the list this function creates. See Table 1 in Su and Hill (2013) for the table of coefficients. The $X_j$ are in a data.frame named data in the returned list. The formula for the model matrix $[X, Q]$ is named su_hill_formula in the returned list. The coefficients used for the model matrix are contained in coefs. The Su and Hill (2013) simulations did not include categorical variables, but you can add them here using arguments: add_categorical, coef_categorical_treatment, coef_categorical_nontreatment.

Value

An object of class `suhillsim` that is a list with elements:

- **data**: Simulated data in data.frame
- **mean_y**: The mean y values for each individual (row)
- **args**: List of arguments passed to function
- **formulas**: Response formulas used to generate data
- **coefs**: Coefficients for the formulas

---

**suhillsim1**  
*Example simulated dataset 1*

Description

Simulated with `simulate_su_hill_data(...)`, see details. Includes propensity score estimated using BART (`prop_score`), see source.

Usage

`suhillsim1`

Format

See `?simulate_su_hill_data` for output format.

Details

```r
set.seed(101)
suhillsim1 <- simulate_su_hill_data(n = 100, treatment_linear = FALSE, omega = 0, add_categorical = TRUE,
                               coef_categorical_treatment = c(0,0,1),
                               coef_categorical_nontreatment = c(-1,0,-1))
```

Source


---

**tidytreatment**  
*tidytreatment: Tidy methods for Bayesian treatment effect models*

Description

`tidytreatment` provides functions for extracting tidy data from Bayesian treatment effect models, estimating treatment effects, and plotting useful summaries of these.
tidy_ate

Get average treatment effect draws from posterior

Description

ATE = Average Treatment Effects Assumes treated column is either a integer column of 1’s (treated) and 0’s (nontreated) or logical indicating treatment if TRUE.

Usage

tidy_ate(model, treatment, common_support_method, cutoff, ...)

Arguments

model A supported Bayesian model fit that can provide fits and predictions.
treatment A character string specifying the name of the treatment variable.
common_support_method Either "sd", or "chisq". Default is unspecified, and no common support calculation is done.
cutoff Cutoff for common support (if in use).
... Arguments to be passed to tidybayes::fitted_draws typically scale for BART models.

Value

A tidy data frame (tibble) with treatment effect values.

tidy_att

Get average treatment effect on treated draws from posterior

Description

ATT = average Treatment Effects on Treated Assumes treated column is either a integer column of 1’s (treated) and 0’s (nontreated) or logical indicating treatment if TRUE.

Usage

tidy_att(model, treatment, common_support_method, cutoff, ...)


**Arguments**

- `model`: A supported Bayesian model fit that can provide fits and predictions.
- `treatment`: A character string specifying the name of the treatment variable.
- `common_support_method`: Either "sd", or "chisq". Default is unspecified, and no common support calculation is done.
- `cutoff`: Cutoff for common support (if in use).
- `...`: Arguments to be passed to `tidybayes::fitted_draws` typically scale for BART models.

**Value**

A tidy data frame (tibble) with treatment effect values.

---

**Description**

CTE = Conditional Treatment Effects (usually used to generate (C)ATE or ATT) `newdata` specifies the conditions, if unspecified it defaults to the original data. Assumes treated column is either an integer column of 1’s (treated) and 0’s (nontreated) or logical indicating treatment if TRUE.

**Usage**

```r
 treatment_effects(
   model,
   treatment,
   newdata,
   subset = "all",
   common_support_method,
   cutoff,
   ...
)
```

**Arguments**

- `model`: A supported Bayesian model fit that can provide fits and predictions.
- `treatment`: A character string specifying the name of the treatment variable.
- `newdata`: Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
- `subset`: Either "treated", "nontreated", or "all". Default is "all".
- `common_support_method`: Either "sd", or "chisq". Default is unspecified, and no common support calculation is done.
cutoff

Cutoff for common support (if in use).

... Arguments to be passed to tidybayes::fitted_draws typically scale for BART models.

Value

A tidy data frame (tibble) with treatment effect values.

treatment_effects.default

*Get treatment effect draws from posterior*

Description

CTE = Conditional Treatment Effects (or CATE, the average effects) newdata specifies the conditions, if unspecified it defaults to the original data. Assumes treated column is either a integer column of 1’s (treated) and 0’s (nontreated) or logical indicating treatment if TRUE.

Usage

```r
## Default S3 method:
treatment_effects(
  model, 
  treatment, 
  newdata, 
  subset = "all", 
  common_support_method, 
  cutoff, 
  ... 
)
```

Arguments

- **model**: A supported Bayesian model fit that can provide fits and predictions.
- **treatment**: A character string specifying the name of the treatment variable.
- **newdata**: Data frame to generate fitted values from. If omitted, defaults to the data used to fit the model.
- **subset**: Either "treated", "nontreated", or "all". Default is "all".
- **common_support_method**: Either "sd", or "chisq". Default is unspecified, and no common support calculation is done.
- **cutoff**: Cutoff for common support (if in use).
- **...**: Arguments to be passed to tidybayes::fitted_draws typically scale for BART models.
Value

A tidy data frame (tibble) with treatment effect values.

---

**variance_draws**

*Get variance draws from posterior of BART models*

Description

Models from BART-package include warm-up and skipped MCMC draws.

Usage

`variance_draws(model, value = ".sigma_sq", ...)`

Arguments

- **model**: A model from a supported package.
- **value**: The name of the output column for variance parameter; default ".sigma_sq".
- **...**: Additional arguments.

Value

A tidy data frame (tibble) with draws of variance parameter
Index

* datasets
  - bartmodel1, 3
  - bartmodel1_modelmatrix, 4
  - highDim_testdataset3, 13
  - suhillsim1, 22
- avg_treatment_effects, 2
- bartmodel1, 3
- bartmodel1_modelmatrix, 4
- covariate_importance, 4
- covariate_with_treatment_importance, 5
- fitted_draws.bartMachine, 5
- fitted_draws.lbart, 6
- fitted_draws.mbart, 7
- fitted_draws.mbart2, 8
- fitted_draws.pbart, 9
- fitted_draws.wbart, 10
- fitted_draws_BART, 11
- has_common_support, 11
- has_tidytreatment_methods, 12
- highDim_testdataset3, 13
- posterior_trees_BART, 13
- predicted_draws.bartMachine, 14
- predicted_draws.wbart, 15
- predicted_draws_BART, 16
- residual_draws.bartMachine, 17
- residual_draws.pbart, 18
- residual_draws.wbart, 19
- residual_draws_BART, 20
- simulate_su_hill_data, 20
- suhillsim1, 22
- tidy_ate, 23
- tidy_att, 23

- tidytreatment, 22
- treatment_effects, 24
- treatment_effects.default, 25
- variance_draws, 26