Package ‘tidytreatment’

October 14, 2022

Type Package

Title Tidy Methods for Bayesian Treatment Effect Models

Version 0.2.2

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

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### `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 an integer column of 1’s (treated) and 0’s (nontreated) or logical indicating treatment if TRUE.
Usage

```r
avg_treatment_effects(
    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 = "all",  # 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.
)
```

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.

---

**bartmodel1**

**Example model 1**

**Description**

Model fit with simulated data from simulated dataset suhillsim1.

**Usage**

```
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

```r
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

```r
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

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

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

```r
## 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?
Value

A tidy data frame (tibble) with fitted values.

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.
fitted_draws.mbart2  Get fitted draws from posterior of mbart2 model

Description

Get fitted draws from posterior of 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 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.pbart**  
*Get fitted draws from posterior of pbart model*

---

**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
\begin{verbatim}
## S3 method for class 'wbart'
fitted_draws(
  model,                # A model from \texttt{BART} package.
  newdata,              # Data frame to generate fitted values from. If omitted, defaults to the data used
                        # to fit the model.
  value = ".value",     # The name of the output column for \texttt{fitted_draws}; default ".value".
  ...,                  # Not currently in use.
  n = NULL,             # Not currently implemented.
  include_newdata = TRUE,
  include_sigsqs = FALSE
)
\end{verbatim}

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

Description

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.
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.

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
**highDim_testdataset3**  
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.
predicted_draws.bartMachine

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

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

- **object**: A bartMachine 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.wbart**  
Get predict draws from posterior of *wbart* model

Description

Get predict draws from posterior of *wbart* model

Usage

```r
## S3 method for class 'wbart'
predicted_draws(
  object,
  newdata,
  value = ".prediction",
  ...
)
```

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".
- **...**: Use to specify random number generator, default is `rng=stats::rnorm`.
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.
residual_draws.bartMachine

Get residual draw for bartMachine model

Description

Get residual draw for bartMachine model

Usage

## 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`.
- **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.

treatment_effects

Get (individual) treatment effect draws from posterior

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 a integer column of 1's (treated) and 0's (nontreated) or logical indicating treatment if TRUE.

Usage

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.

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
## Default S3 method:
treatment_effects(
  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 = "all",  # 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
model

treatment
	newdata

subset

cutoff

...
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
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