Package ‘aggTrees’

September 20, 2023

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Description
Nonparametric data-driven approach to discovering heterogeneous subgroups in a selection-on-observables framework.
aggTrees allows researchers to assess whether there exists relevant heterogeneity in treatment effects by generating a sequence of optimal groupings, one for each level of granularity. For each grouping, we obtain point estimation and inference about the Group Average Treatment Effects.
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avg_characteristics_rpart

Description

Computes the average characteristics of units in each leaf of an rpart object.

Usage

avg_characteristics_rpart(tree, X)

Arguments

tree An rpart object.
X Covariate matrix (no intercept).

Details

avg_characteristics_rpart regresses each covariate on a set of dummies denoting leaf membership. This way, we get the average characteristics of units in each leaf, together with a standard error.

Leaves are ordered in increasing order of their predictions (from most negative to most positive).

Standard errors are estimated via the Eicker-Huber-White estimator.

Value

A list storing each regression as an lm_robust object.
balance_measures

Author(s)
Riccardo Di Francesco

References

See Also
causal_ols_rpart, estimate_rpart

Examples
## Generate data.
set.seed(1986)
n <- 1000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))
D <- rbinom(n, size = 1, prob = 0.5)
mu0 <- 0.5 * X[, 1]
mu1 <- 0.5 * X[, 1] + X[, 2]
y <- mu0 + D * (mu1 - mu0) + rnorm(n)

## Construct a tree.
library(rpart)
tree <- rpart(y ~ ., data = data.frame("y" = y, X), maxdepth = 2)

## Compute average characteristics in each leaf.
results <- avg_characteristics_rpart(tree, X)
results

---

**balance_measures**

**Balance Measures**

**Description**
Compute several balance measures to check whether the covariate distributions are balanced across treatment arms.

**Usage**
balance_measures(X, D)
Arguments

X  Covariate matrix (no intercept).
D  Treatment assignment vector.

Details

For each covariate in X, balance_measures computes sample averages and standard deviations for both treatment arms. Additionally, two balance measures are computed:

**Norm. Diff.** Normalized differences, computed as the differences in the means of each covariate across treatment arms, normalized by the sum of the within-arm variances. They provide a measure of the discrepancy between locations of the covariate distributions across treatment arms.

**Log S.D.** Log ratio of standard deviations are computed as the logarithm of the ratio of the within-arm standard deviations. They provide a measure of the discrepancy in the dispersion of the covariate distributions across treatment arms.

Compilation of the LATEX code requires the following packages: booktabs, float, adjustbox.

Value

Prints LATEX code in the console.

Author(s)

Elena Dal Torrione, Riccardo Di Francesco

Examples

```r
## Generate data.
set.seed(1986)
n <- 1000
k <- 3
X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))
D <- rbinom(n, size = 1, prob = 0.5)
mu0 <- 0.5 * X[, 1]
mu1 <- 0.5 * X[, 1] + X[, 2]
y <- mu0 + D * (mu1 - mu0) + rnorm(n)

## Print table.
balance_measures(X, D)
```
**Description**

Nonparametric data-driven approach to discovering heterogeneous subgroups in a selection-on-observables framework. The approach constructs a sequence of groupings, one for each level of granularity. Groupings are nested and feature an optimality property. For each grouping, we obtain point estimation and standard errors for the group average treatment effects (GATEs). Additionally, we assess whether systematic heterogeneity is found by testing the hypotheses that the differences in the GATEs across all pairs of groups are zero. Finally, we investigate the driving mechanisms of effect heterogeneity by computing the average characteristics of units in each group.

**Usage**

```r
build_aggtree(
  y,
  D,
  X,
  honest_frac = 0.5,
  method = "aipw",
  scores = NULL,
  cates = NULL,
  is_honest = NULL,
  ...)
```

```r
inference_aggtree(object, n_groups, boot_ci = FALSE, boot_R = 2000)
```

**Arguments**

- `y`: Outcome vector.
- `D`: Treatment vector.
- `X`: Covariate matrix (no intercept).
- `honest_frac`: Fraction of observations to be allocated to honest sample.
- `method`: Either "raw" or "aipw", controls how node predictions are computed.
- `scores`: Optional, vector of scores to be used in computing node predictions. Useful to save computational time if scores have already been estimated. Ignored if `method == "raw"`.
- `cates`: Optional, estimated CATEs. If not provided by the user, CATEs are estimated internally via a `causal_forest`.
- `is_honest`: Logical vector denoting which observations belong to the honest sample. Required only if the `cates` argument is used.
- `...`: Further arguments from `rpart.control`.

---

**build_aggtree**  
*Aggregation Trees*
object
An aggTrees object.
n_groups
Number of desired groups.
boot_ci
Logical, whether to compute bootstrap confidence intervals.
boot_R
Number of bootstrap replications. Ignored if boot_ci == FALSE.

Details
Aggregation trees are a three-step procedure. First, the conditional average treatment effects (CATEs) are estimated using any estimator. Second, a tree is grown to approximate the CATEs. Third, the tree is pruned to derive a nested sequence of optimal groupings, one for each granularity level. For each level of granularity, we can obtain point estimation and inference about the GATEs.

To implement this methodology, the user can rely on two core functions that handle the various steps.

Constructing the Sequence of Groupings:
build_aggtree constructs the sequence of groupings (i.e., the tree) and estimate the GATEs in each node. The GATEs can be estimated in several ways. This is controlled by the method argument. If method == "raw", we compute the difference in mean outcomes between treated and control observations in each node. This is an unbiased estimator in randomized experiment. If method == "aipw", we construct doubly-robust scores and average them in each node. This is unbiased also in observational studies. Honest regression forests and 5-fold cross fitting are used to estimate the propensity score and the conditional mean function of the outcome (unless the user specifies the argument scores).

The user can provide a vector of the estimated CATEs via the cates argument. If so, the user needs to specify a logical vector to denote which observations belong to the honest sample. If honesty is not desired, is_honest must be a vector of FALSEs. If no vector of CATEs is provided, these are estimated internally via a causal_forest.

GATEs Estimation and Inference:
inference_aggtree takes as input an aggTrees object constructed by build_aggtree. Then, for the desired granularity level, chosen via the n_groups argument, it provides point estimation and standard errors for the GATEs. Additionally, it performs some hypothesis testing to assess whether we find systematic heterogeneity and computes the average characteristics of the units in each group to investigate the driving mechanisms.

Point estimates and standard errors for the GATEs:
GATEs and their standard errors are obtained by fitting an appropriate linear model. If method == "raw", we estimate via OLS the following:

\[ Y_i = \sum_{l=1}^{T} L_{i,l} \gamma_l + \sum_{l=1}^{T} L_{i,l} D_i \beta_l + \epsilon_i \]

with \( L_{i,1} \) a dummy variable equal to one if the i-th unit falls in the l-th group, and \(|T|\) the number of groups. If the treatment is randomly assigned, one can show that the betas identify the
GATE of each group. However, this is not true in observational studies due to selection into treatment. In this case, the user is expected to use method == "aipw" when calling `build_aggtree`. In this case, `inference_aggtree` uses the scores in the following regression:

\[ \text{score}_i = \sum_{l=1}^{|T|} L_{i,l} \beta_l + \epsilon_i \]

This way, betas again identify the GATEs.

Regardless of method, standard errors are estimated via the Eicker-Huber-White estimator.

If boot_ci == TRUE, the routine also computes asymmetric bias-corrected and accelerated 95% confidence intervals using 2000 bootstrap samples. Particularly useful when the honest sample is small-ish.

**Hypothesis testing:**
`inference_aggtree` uses the standard errors obtained by fitting the linear models above to test the hypotheses that the GATEs are different across all pairs of leaves. Here, we adjust p-values to account for multiple hypotheses testing using Holm’s procedure.

**Average Characteristics:**
`inference_aggtree` regresses each covariate on a set of dummies denoting group membership. This way, we get the average characteristics of units in each leaf, together with a standard error. Leaves are ordered in increasing order of their predictions (from most negative to most positive). Standard errors are estimated via the Eicker-Huber-White estimator.

**Caution on Inference:**
Regardless of the chosen method, both functions estimate the GATEs, the linear models, and the average characteristics of units in each group using only observations in the honest sample. If the honest sample is empty (this happens because the user either sets honest_frac = 0 or passes a vector of FALSEs as is_honest when calling `build_aggtree`), the same data used to construct the tree are used to estimate the above quantities. This is fine for prediction but invalidates inference.

**Value**
`build_aggtree` returns an `aggTrees` object.

`inference_aggtree` returns an `aggTrees.inference` object, which in turn contains the `aggTrees` object used in the call.

**Author(s)**
Riccardo Di Francesco

**References**

**See Also**
`plot.aggTrees print.aggTrees.inference`
Examples

```r
## Generate data.
set.seed(1986)

n <- 1000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))
D <- rbinom(n, size = 1, prob = 0.5)
mu0 <- 0.5 * X[, 1]
mu1 <- 0.5 * X[, 1] + X[, 2]
y <- mu0 + D * (mu1 - mu0) + rnorm(n)

## Construct sequence of groupings. CATEs estimated internally.
groupings <- build_aggtree(y, D, X, method = "aipw")

## Alternatively, we can estimate the CATEs and pass them.
splits <- sample_split(length(y), training_frac = 0.5)
training_idx <- splits$training_idx
honest_idx <- splits$honest_idx
y_tr <- y[training_idx]
D_tr <- D[training_idx]
X_tr <- X[training_idx, ]
y_hon <- y[honest_idx]
D_hon <- D[honest_idx]
X_hon <- X[honest_idx, ]

library(grf)
forest <- causal_forest(X_tr, y_tr, D_tr) # Use training sample.
cates <- predict(forest, X)$predictions

groupings <- build_aggtree(y, D, X, method = "aipw", cates = cates,
is_honest = 1:length(y) %in% honest_idx)

## We have compatibility with generic S3-methods.
summary(groupings)
print(groupings)
plot(groupings) # Try also setting 'sequence = TRUE'.

## To predict, do the following.
tree <- subtree(groupings$tree, cv = TRUE) # Select by cross-validation.
head(predict(tree, data.frame(X)))

## Inference with 4 groups.
results <- inference_aggtree(groupings, n_groups = 4)

summary(results$model) # Coefficient of leafk is GATE in k-th leaf.
results$gates_diff_pairs$gates_diff # GATEs differences.
```
results$gates_diff_pairs$holm_pvalues # leaves 1-2 not statistically different.

## LATEX.
print(results, table = "diff")
print(results, table = "avg_char")

---

**causal_ols_rpart**

Estimation and Inference about the GATEs with rpart Objects

**Description**

Obtains point estimates and standard errors for the group average treatment effects (GATEs), where groups correspond to the leaves of an `rpart` object. Additionally, performs some hypothesis testing.

**Usage**

```r
causal_ols_rpart(
  tree,
  y,
  D,
  X,
  method = "aipw",
  scores = NULL,
  boot_ci = FALSE,
  boot_R = 2000
)
```

**Arguments**

- `tree`: An `rpart` object.
- `y`: Outcome vector.
- `D`: Treatment assignment vector
- `X`: Covariate matrix (no intercept).
- `method`: Either "raw" or "aipw", defines the outcome used in the regression.
- `scores`: Optional, vector of scores to be used in the regression. Useful to save computational time if scores have already been estimated. Ignored if `method == "raw"`.
- `boot_ci`: Logical, whether to compute bootstrap confidence intervals.
- `boot_R`: Number of bootstrap replications. Ignored if `boot_ci == FALSE`. 
Details

Point estimates and standard errors for the GATEs:
The GATEs and their standard errors are obtained by fitting an appropriate linear model. If method == "raw", we estimate via OLS the following:

\[ Y_i = \sum_{l=1}^{\lvert T \rvert} L_{i,l} \gamma_l + \sum_{l=1}^{\lvert T \rvert} L_{i,l} D_i \beta_l + \epsilon_i \]

with \( L_{i,l} \) a dummy variable equal to one if the i-th unit falls in the l-th leaf of tree, and \( \lvert T \rvert \) the number of groups. If the treatment is randomly assigned, one can show that the betas identify the GATE in each leaf. However, this is not true in observational studies due to selection into treatment. In this case, the user is expected to use method == "aipw" to run the following regression:

\[ score_i = \sum_{l=1}^{\lvert T \rvert} L_{i,l} \beta_l + \epsilon_i \]

where \( score_i \) are doubly-robust scores constructed via honest regression forests and 5-fold cross fitting (unless the user specifies the argument scores). This way, betas again identify the GATEs.

Regardless of method, standard errors are estimated via the Eicker-Huber-White estimator.

If boot_ci == TRUE, the routine also computes asymmetric bias-corrected and accelerated 95% confidence intervals using 2000 bootstrap samples.

If tree consists of a root only, causal_ols_rpart regresses \( y \) on a constant and \( D \) if method == "raw", or regresses the doubly-robust scores on a constant if method == "aipw". This way, we get an estimate of the overall average treatment effect.

Hypothesis testing:
causal_ols_rpart uses the standard errors obtained by fitting the linear models above to test the hypotheses that the GATEs are different across all pairs of leaves. Here, we adjust p-values to account for multiple hypotheses testing using Holm’s procedure.

Caution on Inference:
"honesty" is a necessary requirement to get valid inference. Thus, observations in \( y, D, \) and \( X \) must not have been used to construct the tree and the scores.

Value
A list storing:

- model: The model fitted to get point estimates and standard errors for the GATEs, as an lm_robust object.
gates_diff_pairs
Results of testing whether GATEs differ across all pairs of leaves. This is a list storing GATEs differences and p-values adjusted using Holm’s procedure (check `p.adjust`). NULL if the tree consists of a root only.

boot_ci
Bootstrap confidence intervals (this is an empty list if `boot_ci == FALSE`.

scores
Vector of doubly robust scores. NULL if `method == 'raw'

Author(s)
Riccardo Di Francesco

References

See Also
`estimate_rpart` `avg_characteristics_rpart`

Examples
```
## Generate data.
set.seed(1986)

n <- 1000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))
D <- rbinom(n, size = 1, prob = 0.5)
mu0 <- 0.5 * X[, 1]
mu1 <- 0.5 * X[, 1] + X[, 2]
y <- mu0 + D * (mu1 - mu0) + rnorm(n)

## Split the sample.
splits <- sample_split(length(y), training_frac = 0.5)
training_idx <- splits$training_idx
honest_idx <- splits$honest_idx

y_tr <- y[training_idx]
D_tr <- D[training_idx]
X_tr <- X[training_idx, ]

y_hon <- y[honest_idx]
D_hon <- D[honest_idx]
X_hon <- X[honest_idx, ]

## Construct a tree using training sample.
library(rpart)
tree <- rpart(y ~ ., data = data.frame("y" = y_tr, X_tr), maxdepth = 2)
```

## Estimate GATEs in each node (internal and terminal) using honest sample.
results <- causal_ols_rpart(tree, y_hon, D_hon, X_hon, method = "raw")
summary(results$model) # Coefficient of leafk:D is GATE in k-th leaf.
results$gates_diff_pair$gates_diff # GATEs differences.
results$gates_diff_pair$holm_pvalues # leaves 1-2 and 3-4 not statistically different.

---

**dr_scores**

*Doubly-Robust Scores*

**Description**

Constructs doubly-robust scores via K-fold cross-fitting.

**Usage**

```r
dr_scores(y, D, X, k = 5)
```

**Arguments**

- `y`: Outcome vector.
- `D`: Treatment assignment vector.
- `X`: Covariate matrix (no intercept).
- `k`: Number of folds.

**Details**

Honest regression forests are used to estimate the propensity score and the conditional mean function of the outcome.

**Value**

A vector of scores.

**Author(s)**

Riccardo Di Francesco
**Description**

Replaces node predictions of an `rpart` object using external data to estimate the group average treatment effects (GATEs).

**Usage**

```r
estimate_rpart(tree, y, D, X, method = "aipw", scores = NULL)
```

**Arguments**

- `tree`: An `rpart` object.
- `y`: Outcome vector.
- `D`: Treatment assignment vector.
- `X`: Covariate matrix (no intercept).
- `method`: Either "raw" or "aipw", controls how node predictions are replaced.
- `scores`: Optional, vector of scores to be used in replacing node predictions. Useful to save computational time if scores have already been estimated. Ignored if method == "raw".

**Details**

If `method == "raw"`, `estimate_rpart` replaces node predictions with the differences between the sample average of the observed outcomes of treated units and the sample average of the observed outcomes of control units in each node, which is an unbiased estimator of the GATEs if the assignment to treatment is randomized.

If `method == "aipw"`, `estimate_rpart` replaces node predictions with sample averages of doubly-robust scores in each node. This is a valid estimator of the GATEs in observational studies. Honest regression forests and 5-fold cross fitting are used to estimate the propensity score and the conditional mean function of the outcome (unless the user specifies the argument `scores`).

`estimate_rpart` allows the user to implement "honest" estimation. If observations in y, D and X have not been used to construct the tree, then the new predictions are honest in the sense of Athey and Imbens (2016). To get standard errors for the tree's estimates, please use `causal_ols_rpart`.

**Value**

A tree with node predictions replaced, as an `rpart` object, and the scores (if `method == "raw"`, this is NULL).
Author(s)

Riccardo Di Francesco

References


See Also

causal_ols_rpart avg_characteristics_rpart

Examples

```r
## Generate data.
set.seed(1986)

n <- 1000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))
D <- rbinom(n, size = 1, prob = 0.5)
mu0 <- 0.5 * X[, 1]
mu1 <- 0.5 * X[, 1] + X[, 2]
y <- mu0 + D * (mu1 - mu0) + rnorm(n)

## Split the sample.
splits <- sample_split(length(y), training_frac = 0.5)
training_idx <- splits$training_idx
honest_idx <- splits$honest_idx

y_tr <- y[training_idx]
D_tr <- D[training_idx]
X_tr <- X[training_idx, ]
y_hon <- y[honest_idx]
D_hon <- D[honest_idx]
X_hon <- X[honest_idx, ]

## Construct a tree using training sample.
library(rpart)
tree <- rpart(y ~ ., data = data.frame("y" = y_tr, X_tr), maxdepth = 2)

## Estimate GATEs in each node (internal and terminal) using honest sample.
new_tree <- estimate_rpart(tree, y_hon, D_hon, X_hon, method = "raw")
new_tree$tree
```
**Description**

Expands the covariate matrix, adding interactions and polynomials. This is particularly useful for penalized regressions.

**Usage**

```r
expand_df(X, int_order = 2, poly_order = 4, threshold = 0)
```

**Arguments**

- **X**: Covariate matrix (no intercept).
- **int_order**: Order of interactions to be added. Set equal to one if no interactions are desired.
- **poly_order**: Order of the polynomials to be added. Set equal to one if no polynomials are desired.
- **threshold**: Drop binary variables representing less than `threshold`% of the population. Useful to speed up computation.

**Details**

`expand_df` assumes that categorical variables are coded as factors. Also, no missing values are allowed.

`expand_df` uses `model.matrix` to expand factors to a set of dummy variables. Then, it identifies continuous covariates as those not having 0 and 1 as unique values.

`expand_df` first introduces all the `int_order`-way interactions between the variables (using the expanded set of dummies), and then adds `poly_order`-order polynomials for continuous covariates.

**Value**

The expanded covariate matrix, as a data frame.

**Author(s)**

Riccardo Di Francesco
get_leaves

Number of Leaves

Description

Extracts the number of leaves of an \texttt{rpart} object.

Usage

\texttt{get_leaves(tree)}

Arguments

\texttt{tree}  \hspace{1cm}  An \texttt{rpart} object.

Value

The number of leaves.

Author(s)

Riccardo Di Francesco

See Also

\texttt{subtree node_membership leaf_membership}

Examples

\begin{verbatim}
## Generate data.
set.seed(1986)

n <- 3000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0(“x”, seq_len(k))

y <- exp(X[, 1]) + 2 * X[, 2] * X[, 2] > 0 + rnorm(n)

## Construct tree.
library(rpart)
tree <- rpart(y ~ ., data = data.frame(y, X))

## Extract number of leaves.
n_leaves <- get_leaves(tree)
n_leaves
\end{verbatim}
Leaf Membership

Description

Constructs a variable that encodes in which leaf of an rpart object the units in a given data frame fall.

Usage

leaf_membership(tree, X)

Arguments

tree  
An rpart object.

X  
Covariate matrix (no intercept).

Value

A factor whose levels denote in which leaf each unit falls. Leaves are ordered in increasing order of their predictions (from most negative to most positive).

Author(s)

Riccardo Di Francesco

See Also

subtree node_membership get_leaves

Examples

## Generate data.
set.seed(1986)

n <- 3000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))

y <- exp(X[, 1]) + 2 * X[, 2] * X[, 2] > 0 + rnorm(n)

## Construct tree.
library(rpart)
tree <- rpart(y ~ ., data = data.frame(y, X))

## Extract number of leaves.
leaves_factor <- leaf_membership(tree, X)
## Description

Constructs a binary variable that encodes whether each observation falls into a particular node of an `rpart` object.

## Usage

```
node_membership(tree, X, node)
```

## Arguments

- `tree`: An `rpart` object.
- `X`: Covariate matrix (no intercept).
- `node`: Number of node.

## Value

Logical vector denoting whether each observation in `X` falls into `node`.

## Author(s)

Riccardo Di Francesco

## See Also

`subtree`, `leaf_membership`, `get_leaves`

## Examples

```
## Generate data.
set.seed(1986)

n <- 3000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))

y <- exp(X[, 1]) + 2 * X[, 2] * X[, 2] > 0 + rnorm(n)

## Construct tree.
library(rpart)
tree <- rpart(y ~ ., data = data.frame(y, X))
```

```
head(leaves_factor)
```
## Extract number of leaves.

```r
is_in_third_node <- node_membership(tree, X, 3)
head(is_in_third_node)
```

---

### `plot.aggTrees`  

Plot Method for `aggTrees` Objects

## Description

Plots an `aggTrees` object.

## Usage

```r
## S3 method for class 'aggTrees'
plot(x, leaves = get_leaves(x$tree), sequence = FALSE, ...)
```

## Arguments

- `x`  
  An `aggTrees` object.
- `leaves`  
  Number of leaves of the desired tree. This can be used to plot subtrees.
- `sequence`  
  If TRUE, the whole sequence of optimal groupings is displayed in a short animation.
- `...`  
  Further arguments from `prp`.

## Details

Nodes are colored using a diverging palette. Nodes with predictions smaller than the ATE (i.e., the root prediction) are colored in blue shades, and nodes with predictions larger than the ATE are colored in red shades. Moreover, predictions that are more distant in absolute value from the ATE get darker shades. This way, we have an immediate understanding of the groups with extreme GATEs.

## Value

Plots an `aggTrees` object.

## Author(s)

Riccardo Di Francesco

## References

See Also

`build_aggtree, inference_aggtree`

Examples

```r
## Generate data.
set.seed(1986)

n <- 1000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))
D <- rbinom(n, size = 1, prob = 0.5)
mu0 <- 0.5 * X[, 1]
mu1 <- 0.5 * X[, 1] + X[, 2]
y <- mu0 + D * (mu1 - mu0) + rnorm(n)

## Construct sequence of groupings. CATEs estimated internally,
groupings <- build_aggtree(y, D, X, method = "aipw")

## Plot.
plot(groupings)
plot(groupings, leaves = 3)
plot(groupings, sequence = TRUE)
```

---

### print.aggTrees

Print Method for `aggTrees` Objects

**Description**

Prints an `aggTrees` object.

**Usage**

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

**Arguments**

- `x` `aggTrees` object.
- `...` Further arguments passed to or from other methods.

**Value**

Prints an `aggTrees` object.
print.aggTrees.inference

Author(s)
Riccardo Di Francesco

References

See Also
build_aggtree, inference_aggtree

print.aggTrees.inference

Print Method for aggTrees.inference Objects

Description
Prints an aggTrees.inference object.

Usage
## S3 method for class 'aggTrees.inference'
print(x, table = "avg_char", ...)

Arguments
x aggTrees.inference object.
table Either "avg_char" or "diff", controls which table must be produced.
... Further arguments passed to or from other methods.

Details
A description of each table is provided in its caption.

Some covariates may feature zero variation in some leaf. This generally happens to dummy variables used to split some nodes. In this case, when table == "avg_char" a warning message is produced displaying the names of the covariates with zero variation in one or more leaves. The user should correct the table by removing the associated standard errors.

Compilation of the LATEX code requires the following packages: booktabs, float, adjustbox, multirow.

Value
Prints LATEX code.
Author(s)

Riccardo Di Francesco

References


See Also

build_aggtree, inference_aggtree

Examples

```r
## Generate data.
set.seed(1986)

n <- 1000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))
D <- rbinom(n, size = 1, prob = 0.5)
mu0 <- 0.5 * X[, 1]
mu1 <- 0.5 * X[, 1] + X[, 2]
y <- mu0 + D * (mu1 - mu0) + rnorm(n)

## Construct sequence of groupings. CATEs estimated internally,
groupings <- build_aggtree(y, D, X, method = "aipw")

## Analyze results with 4 groups.
results <- inference_aggtree(groupings, n_groups = 4)

## Print results.
print(results, table = "diff")
print(results, table = "avg_char")
```

---

**sample_split**

**Description**

Splits the sample into training and honest subsamples.

**Usage**

```r
sample_split(n, training_frac = 0.5)
```
subtree

Arguments

n Size of the sample to be split.
training_frac Fraction of units for the training sample.

Value

A list storing the indexes for the two different subsamples.

Author(s)

Riccardo Di Francesco

Description

Extracts a subtree with a user-specified number of leaves from an rpart object.

Usage

subtree(tree, leaves = NULL, cv = FALSE)

Arguments

tree An rpart object.
leaves Number of leaves of the desired subtree.
cv If TRUE, leaves is ignored and a cross-validation criterion is used to select a partition.

Value

The subtree, as an rpart object.

Author(s)

Riccardo Di Francesco

See Also

generate node_membership leaf_membership
Examples

```r
## Generate data.
set.seed(1986)
n <- 3000
k <- 3

X <- matrix(rnorm(n * k), ncol = k)
colnames(X) <- paste0("x", seq_len(k))

y <- exp(X[, 1]) + 2 * X[, 2] * X[, 2] > 0 + rnorm(n)

## Construct tree.
library(rpart)
tree <- rpart(y ~ ., data = data.frame(y, X), cp = 0)

## Extract subtree.
sub_tree <- subtree(tree, leaves = 4)
sub_tree_cv <- subtree(tree, cv = TRUE)
```

---

summary.aggTrees  

Summary Method for aggTrees Objects

Description

Summarizes an aggTrees object.

Usage

```r
## S3 method for class 'aggTrees'
summary(object, ...)
```

Arguments

- `object`: aggTrees object.
- `...`: Further arguments passed to or from other methods.

Value

Prints the summary of an aggTrees object.

Author(s)

Riccardo Di Francesco

References

summary.aggTrees

See Also

build_aggtree, inference_aggtree
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