Package ‘FREEtree’

May 7, 2026

Type Package

Title Tree Method for High Dimensional Longitudinal Data

Version 0.1.0

Description This tree-based method deals with high dimensional longitudinal data with correlated features through the use of a piecewise random effect model. FREE tree also exploits the network structure of the features, by first clustering them using Weighted Gene Co-expression Network Analysis ('WGCNA'). It then conducts a screening step within each cluster of features and a selecting step among the surviving features, which provides a relatively unbiased way to do feature selection. By using dominant principle components as regression variables at each leaf and the original features as splitting variables at splitting nodes, FREE tree delivers easily interpretable results while improving computational efficiency.

Depends R (>= 3.5.0)

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Encoding UTF-8

LazyData true

Imports glmertree, pre, WGCNA, MASS

RoxygenNote 7.1.0

Suggests knitr, rmarkdown, testthat (>= 2.1.0)

NeedsCompilation no

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Contents

`data` *A dataset containing simulated feature long and wide data. The last six columns contain outcome variable, patient ID, treatment, time and time squared features.*

Description

A dataset containing simulated feature long and wide data. The last six columns contain outcome variable, patient ID, treatment, time and time squared features.

Usage

```
data
```

Format

A data frame with 100 rows and 406 variables:

rand_int control variable (not used)

time time trend variable (1 to 6)

time2 squared time trend variable

treatment binary treatment feature

patient patient ID for 20 patients

y outcome variable

V1 simulated feature correlated to varrying degrees

V2 simulated feature correlated to varrying degrees

V3 simulated feature correlated to varrying degrees

V4 simulated feature correlated to varrying degrees

V5 simulated feature correlated to varrying degrees

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`FREEtree` *Initial FREEtree call which then calls actual FREEtree methods depending on parameters being passed through.*

Description

Initial FREEtree call which then calls actual FREEtree methods depending on parameters being passed through.

Usage

```
FREEtree(
  data,
  fixed_regress = NULL,
  fixed_split = NULL,
  var_select = NULL,
  power = 6,
  minModuleSize = 1,
  cluster,
  maxdepth_factor_screen = 0.04,
```

```
  maxdepth_factor_select = 0.5,
  Fuzzy = TRUE,
  minsize_multiplier = 5,
  alpha_screen = 0.2,
  alpha_select = 0.2,
  alpha_predict = 0.05
)
```

Arguments

`data`	data to train or test FREEtree on.
`fixed_regress`	user specified char vector of regressors that will never be screened out; if fixed_regress = NULL, method uses PC as regressor at screening step.
`fixed_split`	user specified char vector of features to be used in splitting with certainty.
`var_select`	a char vector containing features to be selected. These features will be clustered by WGCNA and the chosen ones will be used in regression and splitting.
`power`	soft thresholding power parameter of WGCNA.
`minModuleSize`	WGCNA's minimum module size parameter.
`cluster`	the variable name of each cluster (in terms of random effect) using glmer's implementation.
`maxdepth_factor_screen`	when selecting features from one module, the maxdepth of the glmertree is set to ceiling function of maxdepth_factor_screen*(features in that module). Default is 0.04.
`maxdepth_factor_select`	Given screened features (from each modules, if Fuzzy=FALSE, that is the selected non-grey features from each non-grey modules), we want to select again from those screened features. The maxdepth of that glmertree is set to be ceiling of maxdepth_factor_select*(#screened features). Default is 0.6. for the maxdepth of the prediction tree (final tree), maxdepth is set to the length of the split_var (fixed+chosen ones).
`Fuzzy`	boolean to indicate desire to screen like Fuzzy Forest if Fuzzy = TRUE; if Fuzzy= FALSE, first screen within non-grey modules and then select the final non-grey features within the selected ones from each non-grey module; Use this final non-grey features as regressors (plus fixed_regress) and use grey features as split_var to select grey features. Then use final non-grey features and selected grey features together in splitting and regression variables, to do the final prediction. Fuzzy=FALSE is used if there are so many non-grey features and you want to protect grey features.
`minsize_multiplier`	At the final prediction tree, the minsize = minsize_multiplier times the length of final regressors. The default is 5. Note that we only set minsize for the final prediction tree instead of trees at the feature selection step since during feature selection, we don't have to be so careful. Note that when tuning the parameters, larger alpha and samller minsize_multiplier will result in deeper tree and therefore may cause overfitting problem. It is recommended to decrease alpha and decrease minsize_multiplier at the same time.

`alpha_screen`	alpha used in screening step.
`alpha_select`	alpha used in selection step.
`alpha_predict`	alpha used in prediction step.

Value

a glmertree object (trained tree).

Examples

```
#locate example data file
dataf <- system.file("data/data.RData", package="FREEtree")
mytree = FREEtree(data,fixed_regress=c("time","time2"), fixed_split=c("treatment"),
                  var_select=paste("V",1:200,sep=""), minModuleSize = 5,
                  cluster="patient", Fuzzy=TRUE, maxdepth_factor_select = 0.5,
                  maxdepth_factor_screen = 0.04, minsize_multiplier = 5,
                  alpha_screen = 0.2, alpha_select=0.2,alpha_predict=0.05)
```

`FREEtree_PC` *Version of FREEtree called when fixed_regress is NULL, uses principal components (PC) as regressors for non-grey modules.*

Description

Version of FREEtree called when fixed_regress is NULL, uses principal components (PC) as regressors for non-grey modules.

Usage

```
FREEtree_PC(
  data,
  fixed_split,
  var_select,
  power,
  minModuleSize,
  cluster,
  maxdepth_factor_screen,
  maxdepth_factor_select,
  Fuzzy,
  minsize_multiplier,
  alpha_screen,
  alpha_select,
  alpha_predict
)
```

Arguments

`data`	data to train or test FREEtree on.
`fixed_split`	user specified char vector of features to be used in splitting with certainty.
`var_select`	a char vector containing features to be selected. These features will be clustered by WGCNA and the chosen ones will be used in regression and splitting.
`power`	soft thresholding power parameter of WGCNA.
`minModuleSize`	WGCNA's minimum module size parameter.
`cluster`	the variable name of each cluster (in terms of random effect) using glmer's implementation.
`maxdepth_factor_screen`	when selecting features from one module, the maxdepth of the glmertree is set to ceiling function of maxdepth_factor_screen*(features in that module). Default is 0.04.
`maxdepth_factor_select`	Given screened features (from each modules, if Fuzzy=FALSE, that is the selected non-grey features from each non-grey modules), we want to select again from those screened features. The maxdepth of that glmertree is set to be ceiling of maxdepth_factor_select*(#screened features). Default is 0.6. for the maxdepth of the prediction tree (final tree), maxdepth is set to the length of the split_var (fixed+chosen ones).
`Fuzzy`	boolean to indicate desire to screen like Fuzzy Forest if Fuzzy = TRUE; if Fuzzy= FALSE, first screen within non-grey modules and then select the final non-grey features within the selected ones from each non-grey module; Use this final non-grey features as regressors (plus fixed_regress) and use grey features as split_var to select grey features. Then use final non-grey features and selected grey features together in splitting and regression variables, to do the final prediction. Fuzzy=FALSE is used if there are so many non-grey features and you want to protect grey features.
`minsize_multiplier`	At the final prediction tree, the minsize = minsize_multiplier times the length of final regressors. The default is 5. Note that we only set minsize for the final prediction tree instead of trees at the feature selection step since during feature selection, we don't have to be so careful. Note that when tuning the parameters, larger alpha and samller minsize_multiplier will result in deeper tree and therefore may cause overfitting problem. It is recommended to decrease alpha and decrease minsize_multiplier at the same time.
`alpha_screen`	alpha used in screening step.
`alpha_select`	alpha used in selection step.
`alpha_predict`	alpha used in prediction step.

Value

a glmertree object (trained tree). dictionary'with keys=name of color,values=names of features of that color

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`FREEtree_time` *Version of FREEtree called when var_select and fixed_regress are specified,*

Description

Version of FREEtree called when var_select and fixed_regress are specified,

Usage

```
FREEtree_time(
  data,
  fixed_regress,
  fixed_split,
  var_select,
  power,
  minModuleSize,
  cluster,
  maxdepth_factor_screen,
  maxdepth_factor_select,
  Fuzzy,
  minsize_multiplier,
  alpha_screen,
  alpha_select,
  alpha_predict
)
```

Arguments

`data`	data to train or test FREEtree on.
`fixed_regress`	user specified char vector of regressors that will never be screened out; if fixed_regress = NULL, method uses PC as regressor at screening step.
`fixed_split`	user specified char vector of features to be used in splitting with certainty.
`var_select`	a char vector containing features to be selected. These features will be clustered by WGCNA and the chosen ones will be used in regression and splitting.
`power`	soft thresholding power parameter of WGCNA.
`minModuleSize`	minimum possible module size parameter of WGCNA.
`cluster`	the variable name of each cluster (in terms of random effect) using glmer's implementation.
`maxdepth_factor_screen`	when selecting features from one module, the maxdepth of the glmertree is set to ceiling function of maxdepth_factor_screen*(features in that module). Default is 0.04.

`maxdepth_factor_select`	Given screened features (from each modules, if Fuzzy=FALSE, that is the selected non-grey features from each non-grey modules), we want to select again from those screened features. The maxdepth of that glmertree is set to be ceiling of maxdepth_factor_select*(#screened features). Default is 0.6. for the maxdepth of the prediction tree (final tree), maxdepth is set to the length of the split_var (fixed+chosen ones).
`Fuzzy`	boolean to indicate desire to screen like Fuzzy Forest if Fuzzy = TRUE; if Fuzzy= FALSE, first screen within non-grey modules and then select the final non-grey features within the selected ones from each non-grey module; Use this final non-grey features as regressors (plus fixed_regress) and use grey features as split_var to select grey features. Then use final non-grey features and selected grey features together in splitting and regression variables, to do the final prediction. Fuzzy=FALSE is used if there are so many non-grey features and you want to protect grey features.
`minsize_multiplier`	At the final prediction tree, the minsize = minsize_multiplier times the length of final regressors. The default is 5. Note that we only set minsize for the final prediction tree instead of trees at the feature selection step since during feature selection, we don't have to be so careful. Note that when tuning the parameters, larger alpha and samller minsize_multiplier will result in deeper tree and therefore may cause overfitting problem. It is recommended to decrease alpha and decrease minsize_multiplier at the same time.
`alpha_screen`	alpha used in screening step.
`alpha_select`	alpha used in selection step.
`alpha_predict`	alpha used in prediction step.

Value

a glmertree object (trained tree). dictionary' with keys=name of color,values=names of features of that color

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`get_split_names` *Method for extracting names of splitting features used in a tree.*

Description

Method for extracting names of splitting features used in a tree.

Usage

```
get_split_names(tree, data)
```

Arguments

`tree`	a tree object.
`data`	train or test set.

Value

names of splitting features extracted from tree object.

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