Package ‘OrdLogReg’

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**OrdLogReg-package**  
*Ordinal Logic Regression*

**Description**

Develops a classification model for ordinal responses. A logic regression trees is constructed for ordinal categories in the data and then all trees are used to predict the class of observations.

**Details**

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**Author(s)**

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**References**


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**OLRdata**  
*Example Data for Ordinal Logic Regression*

**Description**

OLRdata is simulated data including 50 binary predictors and an ordinal response with 4 possible categories where the ratio of observations in each category is 1:1:1:1. The dataset contains 400 observations and 50 binary predictors. Columns 1,2,...,50 are the binary predictors and column 51 is the response. Each predictor was simulated as an independent Bernoulli random variable with success probability 0.5. The response variable is simulated from the model

\[
Y_4 = (X_{10} \& X_{45}) \lor (X_{25} \& X_{45})
\]

\[
Y_3 = (X_{15} \& X_{35})
\]

\[
Y_2 = (X_5 \& \neg X_{20}) \lor (\neg X_{20} \& X_{30} \& \neg X_{40})
\]

Note, Y was also simulated such that 10% of the time it did not correctly match the model shown.
An Example of an Ordinal Logic Regression Model

Description
The Ord.logreg model for data with an ordinal response with 4 categories and 10% error. The response in the data used to construct the model follows the underlying logical relationship:

\[
Y_4 = (X_{10} \& X_{45}) \lor (X_{25} \& X_{45}) \\
Y_3 = (X_{15} \& X_{35}) \\
Y_2 = (X_{5} \& !X_{20}) \lor (!X_{20} \& X_{30} \& !X_{40})
\]

The Ord.logreg model was constructed using 5-fold cross validation considering tree sizes of 1 to 8 leaves.

Usage
```r
data(OLRmod)
```

Examples
```r
data(OLRmod)
print(OLRmod)
```

Test Data for Ordinal Logic Regression

Description
OLRtestdata is simulated data including 50 binary predictors and an ordinal response with 4 possible categories where the ratio of observations in each category is 1:1:1:1. The dataset contains 400 observations and 50 binary predictors. Columns 1,2,...,50 are the binary predictors and column 51 is the response. Each predictor was simulated as an independent Bernoulli random variable with success probability 0.5. The response variable is simulated from the model:

\[
Y_4 = (X_{10} \& X_{45}) \lor (X_{25} \& X_{45}) \\
Y_3 = (X_{15} \& X_{35}) \\
Y_2 = (X_{5} \& !X_{20}) \lor (!X_{20} \& X_{30} \& !X_{40})
\]

Note, Y was also simulated such that 10% of the time it did not correctly match the model shown.

Examples
```r
data(OLRtestdata)
```
**Description**

Constructs an ordinal logic regression model for identification of binary predictors and predictor interactions for an ordinal response.

**Usage**

```r
ordNlogreg(resp, xs, nleaf, useNcv = TRUE, kfold = 5, annealNparams)
```

**Arguments**

- `resp`: vector of ordinal response values. Note the reference category should be assigned a value of 0.
- `xs`: matrix or data frame of zeros and ones for all predictor variables.
- `nleaf`: numeric value or vector. If `useNcv` = FALSE, `nleaf` can be either a single numeric value or vector (length is the number of categories -1). A single value means that the maximum possible number of leaves in all trees will be "nleaf". The default value is 8 when `useNcv` = FALSE. If `useNcv` = TRUE, `nleaf` is a vector of the minimum and maximum values to be considered in the trees. The default value is c(1,8).
- `useNcv`: logical. If `useNcv` = TRUE, cross-validation will be used to determine the best choice of model size for each tree in the ordinal logic regression model.
- `kfold`: If `useNcv` = TRUE, `kfold` is the number of times the data are to be split during cross-validation to determine appropriate tree size. Note, if `useNcv` = FALSE, this argument will be ignored.
- `annealNparams`: a list containing the parameters for simulated annealing. See the help file for the function `logregNannealNcontrol` in the `logicreg` package. If missing, default annealing parameters are set at `start`=1, `end`=-2, and `iter`=50000.

**Value**

An object of class "ordNlogreg" which is a list including values:

- `mod.dat`: For data with K response categories, a list of the K-1 predictor datasets used to fit each logic regression tree in the model.
- `model`: A list of K-1 logic regression trees associated with the largest K-1 response categories.
- `ys`: A list of the K-1 binary response vectors (based on the original ordinal response) generated to fit each of the K-1 logic regression trees.
- `mod.preds`: A vector containing the names of the predictors used in each of the K-1 logic regression trees.
pos A vector of indicators of whether or not a predictor in an individual tree represents a predictor or its complement. A value of 1 indicates that the predictor occurs as the complement.

leaves A vector of the maximum number of leaves used for each of the K-1 logic regression trees.

CV A statement describing if cross-validation was used.

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See Also
print.Ord.logreg, predict.Ord.logreg, plot.Ord.logreg

Examples

data(OLRdata)

#typically >25000 would be used for the annealing algorithm.
#Number of iterations here is set to 2500 for faster run time
#Fitting model without cross-validation
cont<-logreg.anneal.control(start=1, end=-2, iter=2500)
Xs<-OLRdata[,c(1:50)]
Ys<-OLRdata$Y
OLRmod1<-Ord.logreg(resp=Ys, Xs=Xs, use.cv=FALSE, anneal.params=cont)
print(OLRmod1)

#Fitting a model without cross-validation but setting the maximum number of leaves per tree
OLRmod2<-Ord.logreg(resp=Ys, Xs=Xs, nleaf=c(3,4,3), use.cv=FALSE, anneal.params=cont)
print(OLRmod2)

#Fitting model with cross-validation
OLRmod3<-Ord.logreg(resp=Ys, Xs=Xs, use.cv=TRUE, anneal.params=cont)
print(OLRmod3)

plot.Ord.logreg  

Plot an Ord.logreg Object

Description
Plots the trees in an Ord.logreg object.

Usage

## S3 method for class 'Ord.logreg'
plot(x, one.plot = TRUE, ...)


Arguments

- **x**: An object of class `Ord.logreg`.
- **one.plot**: logical. If `one.plot=TRUE`, up to 4 trees are plotted in the same graphics window. If there are more than 4 trees in the model, 4 trees are plotted in each graphic window. If `one.plot=FALSE`, all trees are plotted in separate graphics windows.

... Not currently used.

Author(s)

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See Also

`Ord.logreg`

Examples

data(olrmod)

# Plotting all trees in the same window
plot(olrmod)

# Plotting all trees in separate windows
plot(olrmod, one.plot=FALSE)

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**predict.Ord.logreg**

*Prediction of Response Using Ord.logreg*

Description

Computes predicted values for new data for an ordinal logic regression model fitted using `Ord.logreg`

Usage

```r
## S3 method for class 'Ord.logreg'
predict(object, newdata, ...)
```

Arguments

- **object**: An object of class `Ord.logreg`.
- **newdata**: A matrix or data frame containing new predictor values. If not given, predictions will be made for the original data used to construct the model.

... Not currently used.
Value

predicted.category
A vector of predicted classes for each observation in the new data.

prediction.matrix
A matrix of indicators of whether or not a tree in the ordinal logic regression model made a positive prediction. The last column in the matrix represents the tree that predicts the highest class, the second to last column represents the tree that predicts the second highest class, etc. A value of 1 indicates the tree predicted that the observation was of the tree-specific class.

Author(s)

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See Also

Ord.logreg

Examples

data(OLRmod)

#Prediction on original data used to fit the model
predict(OLRmod)

#prediction on new data
data(OLRtestdata)
predict(OLRmod, newdata=OLRtestdata[,1:50])

print.Old.logreg

Prints output for an ordinal logistic regression model

Description

This function prints and Ord.logreg object. It is a method for a generic function print of class Ord.logreg.

Usage

## S3 method for class 'Ord.logreg'
print(x, ...)

Arguments

x
An object of class Ord.logreg

... Not currently used.
This function is a method for the generic function print for class "Ord.logreg". It can be invoked by calling print for an object of the appropriate class.

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See Also
Ord.logreg

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