

Package ‘rpartOrdinal’

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Type Package

Title Ordinal classification tree functions

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Depends rpart

Suggests ALL

Description This package contains functions that can be called in conjunction with rpart for deriving a classification tree when the response to be predicted is ordinal.

License GPL (>= 2)

LazyLoad yes

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rpartOrdinal-package *Functions for Deriving a Classification Tree for an Ordinal Response*

Description

This package provides ordinal response splitting methods for use in the rpart function.

Details

Package:	rpartOrdinal
Type:	Package
Version:	2.0
Date:	2010-01-25
License:	GPL version 2 or newer
LazyLoad:	yes

This package contains functions that can be called in conjunction with rpart for deriving a classification tree when the response to be predicted is ordinal.

Author(s)

Kellie J. Archer <kjarcher@vcu.edu>

References

- Breiman L., Friedman J.H., Olshen R.A., Stone C.J. 1984 *Classification and Regression Trees*. Wadsworth International.
- Therneau, T.M. and Atkinson, E.J 1997 *Introduction to Recursive Partitioning using the RPART Routines* Mayo Foundation.
- Archer, K.J. 2010 rpartOrdinal: An R Package for Deriving a Classification Tree for Predicting an Ordinal Response. *Journal of Statistical Software*, **34**(7), 1–17.

See Also

[rpart](#)

Examples

```
library(rpartOrdinal)
```

```

data(lowbwt)
lowbwt$Category<-factor(ifelse(lowbwt$bwt<=2500,3,ifelse(lowbwt$bwt<=3000,2,
                ifelse(lowbwt$bwt<=3500,1,0))),ordered=TRUE)
ord.rpart<-rpart(Category~age+lw+race+smoke+ptl+ht+ui+ftv,data=lowbwt,method=ordinal)
plot(ord.rpart)
text(ord.rpart,pretty=TRUE)

```

fitted.rpart

Predictions from a Fitted Rpart Object

Description

Returns a vector of predicted responses from a fitted rpart object.

Usage

```

## S3 method for class 'rpart'
## S3 method for class 'rpart'
fitted(object, newdata = list(),
        type = c("vector", "prob", "class", "matrix"),
        na.action = na.pass, ...)

```

Arguments

object	fitted model object of class rpart. This is assumed to be the result of some function that produces an object with the same named components as that returned by the rpart function.
newdata	data frame containing the values at which predictions are required. The predictors referred to in the right side of formula(object) must be present by name in newdata. If missing, the fitted values are returned.
type	character string denoting the type of predicted value returned. If the rpart object is a classification tree, then the default is to return prob predictions, a matrix whose columns are the probability of the first, second, etc. class. (This agrees with the default behavior of tree). Otherwise, a vector result is returned.
na.action	a function to determine what should be done with missing values in newdata. The default is to pass them down the tree using surrogates in the way selected when the model was built. Other possibilities are na.omit and na.fail.
...	further arguments passed to or from other methods.

Details

This function is a method for the generic function predict for class rpart. It can be invoked by calling predict for an object of the appropriate class, or directly by calling predict.rpart regardless of the class of the object.

Value

A new object is obtained by dropping `newdata` down the object. For factor predictors, if an observation contains a level not used to grow the tree, it is left at the deepest possible node and `frame$yval` at the node is the prediction.

If `type="class"`: (for a classification tree) a factor of classifications based on the responses.

If `type="vector"`: vector of predicted responses. For regression trees this is the mean response at the node, for Poisson trees it is the estimated response rate, and for classification trees it is the predicted class (as a number).

If `type="prob"`: (for a classification tree) a matrix of class probabilities.

If `type="matrix"`: a matrix of the full responses (`frame$yval2` if this exists, otherwise `frame$yval`). For regression trees, this is the mean response, for Poisson trees it is the response rate and the number of events at that node in the fitted tree, and for classification trees it is the concatenation of the predicted class, the class counts at that node in the fitted tree, and the class probabilities.

Author(s)

very small edits were made by Kellie Archer using Therneau and Atkinson's original `print.rpart` function.

See Also

See Also as [rpart.object](#), [summary.rpart](#)

Examples

```
library(rpartOrdinal)
data(lowbwt)
lowbwt$Category<-factor(iffelse(lowbwt$bwt<=2500,3,iffelse(lowbwt$bwt<=3000,2,
  iffelse(lowbwt$bwt<=3500,1,0))),ordered=TRUE)
ord.rpart<-rpart(Category~age+lw+race+smoke+pt1+ht+ui+ftv,data=lowbwt,method=ordinal)
fitted(ord.rpart)
```

formatg

Response Format Function for RPART Ordinal Method

Description

This function is not invoked directly by the user but is used for its effects in labelling a class response.

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

loss.matrix	<i>Generalized Gini Impurity</i>
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Description

This function implements the Generalized Gini impurity splitting method for use in `rpart`. This method factors in the cost or loss associated with classifying an observation of class `h` as `g`, or $C(g|h)$, into the node impurity measure.

Usage

```
loss.matrix( method, y)
```

Arguments

<code>method</code>	either "linear" for linear loss or "quadratic" for quadratic loss
<code>y</code>	is the ordered factor to be predicted

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

References

- Breiman L., Friedman J.H., Olshen R.A., Stone C.J. 1984 *Classification and Regression Trees*. Wadsworth International.
- Therneau, T.M. and Atkinson, E.J 1997 *Introduction to Recursive Partitioning using the RPART Routines* Mayo Foundation.
- Archer, K.J. 2010 `rpartOrdinal`: An R Package for Deriving a Classification Tree for Predicting an Ordinal Response. *Journal of Statistical Software*, **34**(7), 1–17.

See Also

[rpart](#)

Examples

```
library(rpartOrdinal)
data(lowbwt)
lowbwt$Category<-factor(ifelse(lowbwt$bwt<=2500,3,ifelse(lowbwt$bwt<=3000,2,
  ifelse(lowbwt$bwt<=3500,1,0))),ordered=TRUE)
library(rpart)
linear.loss.rpart<-rpart(Category~age+lwt+race+smoke+ptl+ht+ui+ftv,data=lowbwt,
  parms = list(loss = loss.matrix(method="linear",lowbwt$Category)))
plot(linear.loss.rpart)
text(linear.loss.rpart)
quadratic.loss.rpart<-rpart(Category~age+lwt+race+smoke+ptl+ht+ui+ftv,data=lowbwt,
  parms = list(loss = loss.matrix(method="quad",lowbwt$Category)))
```

```
plot(quadratic.loss.rpart)
text(quadratic.loss.rpart,pretty=TRUE)
```

lowbwt

Low Birthweight Dataset

Description

From Hosmer and Lemeshow, *Applied Logistic Regression, Second Edition*, data from a study of risk factors associated with low birth weight. There are a few discrepancies between this dataset and the birthwt dataset in the MASS package.

Usage

```
data(lowbwt)
```

Format

A data frame with 189 observations on the following 10 variables.

low Factor: Not low birthweight; Low birthweight (<2,500 grams)

age Age of mother, years

lwt Mother's weight at last menstrual period, pounds

race Race of mother(white, black, other)

smoke Smoking status (No, Yes)

pt1 Number of previous premature labours

ht Mother's history of hypertension (No, Yes)

ui Presence of uterine irritability (No, Yes)

ftv Number of physician visits during the first trimester

bwt Birth weight in grams

Source

ftp://ftp.wiley.com/public/sci_tech_med/logistic/

References

Hosmer D.W. and Lemeshow S. 2000 *Applied Logistic Regression, Second Edition*. Wiley-Interscience Publication.

Archer, K.J. 2010 rpartOrdinal: An R Package for Deriving a Classification Tree for Predicting an Ordinal Response. *Journal of Statistical Software*, **34**(7), 1–17.

Examples

```
library(rpartOrdinal)
data(lowbwt)
lowbwt$Category<-factor(ifelse(lowbwt$bwt<=2500,3,ifelse(lowbwt$bwt<=3000,2,
  ifelse(lowbwt$bwt<=3500,1,0))),ordered=TRUE)
attach(lowbwt)
table(Category,smoke) ## Reproduces Table 8.16, p. 293 of Hosmer and Lemeshow
```

o.eval

*Ordinal Evaluation Function for RPART Ordinal Method***Description**

This function is not invoked directly by the user but is used for its effects in the ordinal impurity splitting method.

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

o.init

*Ordinal Initialization Function for RPART Ordinal Method***Description**

This function is not invoked directly by the user but is used for its effects in the ordinal impurity splitting method.

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

o.split

*Ordinal Splitting Function for RPART Ordinal Method***Description**

This function is not invoked directly by the user but is used for its effects in the ordinal impurity splitting method.

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

o.twoing

Ordered Twoing Split function for RPART Ordinal Method

Description

This function is not invoked directly by the user but is used for its effects in the twoing (ordered twoing) splitting method.

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

ordinal

Ordinal Splitting Method for RPART

Description

This function is a valid splitting method for use in the rpart function.

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

References

Archer, K.J. 2010 rpartOrdinal: An R Package for Deriving a Classification Tree for Predicting an Ordinal Response. *Journal of Statistical Software*, **34**(7), 1–17.

Examples

```
library(rpartOrdinal)
data(lowbwt)
lowbwt$Category<-factor(ifelset(lowbwt$bwt<=2500,3,ifelset(lowbwt$bwt<=3000,2,
  ifelset(lowbwt$bwt<=3500,1,0))),ordered=TRUE)
ord.rpart<-rpart(Category~age+lw+race+smoke+ptl+ht+ui+ftv,data=lowbwt,method=ordinal)
plot(ord.rpart)
text(ord.rpart,pretty=TRUE)
```

`ordinal.gamma`*Ordinal Measure of Association: The Gamma Statistic*

Description

The gamma function estimates the gamma statistic, which is a measure of the strength of the association of the cross-tabulation of two ordinal variables.

Usage

```
ordinal.gamma(x, y)
```

Arguments

x	is an ordered factor
y	is an ordered factor

Details

The `ordinal.gamma` function estimates the ordinal measure of association gamma statistic.

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

References

Agresti A. 2002 *Categorical Data Analysis, Second Edition*. John Wiley & Sons.
Archer, K.J. 2010 `rpartOrdinal`: An R Package for Deriving a Classification Tree for Predicting an Ordinal Response. *Journal of Statistical Software*, **34**(7), 1–17.

Examples

```
### Table 2.8 in Agresti
library(rpartOrdinal)
job.satis<-factor(c(1,rep(2,3),rep(3,10),rep(4,6),
                  rep(1,2),rep(2,3),rep(3,10),rep(4,7),
                  1,rep(2,6),rep(3,14),rep(4,12),
                  2,rep(3,9),rep(4,11)),ordered=TRUE,
                 labels=c('Very Dissatisfied','Little Dissatisfied',
                          'Moderately Satisfied','Satisfied'))
income<-factor(c(rep(1,20),rep(2,22),rep(3,33),rep(4,21)),ordered=TRUE,
               labels=c('<15,000','15,000-25,000','25,000-40,000','>40,000'))
table(income,job.satis)
ordinal.gamma(job.satis,income)
```

<code>print.rpart</code>	<i>Print an Rpart Object</i>
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Description

This function prints an rpart object. It is a method for the generic function `print` of class `rpart`.

Usage

```
## S3 method for class 'rpart'
## S3 method for class 'rpart'
print(x, minlength=0, spaces=2, cp, digits= getOption("digits"), ...)
```

Arguments

<code>x</code>	fitted model object of class <code>rpart</code> . This is assumed to be the result of some function that produces an object with the same named components as that returned by the <code>rpart</code> function.
<code>minlength</code>	Controls the abbreviation of labels: see <code>labels.rpart</code> .
<code>spaces</code>	the number of spaces to indent nodes of increasing depth.
<code>digits</code>	the number of digits of numbers to print.
<code>cp</code>	prune all nodes with a complexity less than <code>cp</code> from the printout. Ignored if unspecified.
<code>...</code>	arguments to be passed to or from other methods.

Details

This function is a method for the generic function `print` for class `"rpart"`. It can be invoked by calling `print` for an object of the appropriate class, or directly by calling `print.rpart` regardless of the class of the object.

Value

A semi-graphical layout of the contents of `x$frame` is printed. Indentation is used to convey the tree topology. Information for each node includes the node number, split, size, deviance, and fitted value. For the `"class"` method, the class probabilities are also printed.

Author(s)

very small edits were made by Kellie Archer using Therneau and Atkinson's original `print.rpart` function.

See Also

See Also as [rpart.object](#), [summary.rpart](#)

Examples

```
library(rpartOrdinal)
data(lowbwt)
lowbwt$Category<-factor(iffelse(lowbwt$bwt<=2500,3,iffelse(lowbwt$bwt<=3000,2,
  iffelse(lowbwt$bwt<=3500,1,0))),ordered=TRUE)
ord.rpart<-rpart(Category~age+lw+race+smoke+ptl+ht+ui+ftv,data=lowbwt,method=ordinal)
print(ord.rpart)
```

twoing

Ordered Twoing Splitting Method for RPART

Description

This function invokes ordered twoing splitting and is a valid splitting method for use in the `rpart` function.

Author(s)

Kellie J. Archer, kjarcher@vcu.edu

References

Archer, K.J. 2010 `rpartOrdinal`: An R Package for Deriving a Classification Tree for Predicting an Ordinal Response. *Journal of Statistical Software*, **34**(7), 1–17.

Examples

```
library(rpartOrdinal)
data(lowbwt)
lowbwt$Category<-factor(iffelse(lowbwt$bwt<=2500,3,iffelse(lowbwt$bwt<=3000,2,
  iffelse(lowbwt$bwt<=3500,1,0))),ordered=TRUE)
ordered.twoing.rpart<-rpart(Category~age+lw+race+smoke+ptl+ht+ui+ftv,data=lowbwt,method=twoing)
plot(ordered.twoing.rpart)
text(ordered.twoing.rpart,pretty=TRUE)
```

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