Package 'OrdinalLogisticBiplot'

February 19, 2015

Type Package

Title Biplot representations of ordinal variables

Version 0.4

Date 2015-15-01

Author Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

Description Analysis of a matrix of polytomous items using Ordinal Logistic Biplots (OLB)
The OLB procedure extends the binary logistic biplot to ordinal (polytomous) data.
The individuals are represented as points on a plane and the variables are represented as lines rather than vectors as in a classical or binary biplot, specifying the points for each of the categories of the variable.
The set of prediction regions is established by stripes perpendicular to the line between the category points, in such a way that the prediction for each individual is given by its projection into the line of the variable.

License GPL (>= 2)

Encoding latin1

Repository CRAN

Depends R (>= 2.15.1),mirt,MASS,NominalLogisticBiplot

LazyData yes

Archs i386, x64

NeedsCompilation no

Date/Publication 2015-01-16 22:11:44

R topics documented:

`OrdinalLogisticBiplot-package`

Ordinal Logistic Biplot representations for polytomous ordered data.

Description

Analysis of a matrix of polytomous ordered items using Ordinal Logistic Biplots (OLB). The OLB procedure extends the binary logistic biplot to ordinal (polytomous) data.

Details

Package:	OrdinalLogisticBiplot
Type:	Package
Version:	0.4
Date:	2015-01-16
License:	GPL (>=2)

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

See Also

`OrdinalLogisticBiplot`,`OrdinalLogBiplotEM`

Examples

```
data(LevelSatPhd)
olbo = OrdinalLogisticBiplot(LevelSatPhd,sFormula=NULL,numFactors=2,
method="EM",penalization=0.2,show=FALSE)
summary(olbo)
plot(olbo,PlotInd=TRUE,xlimi=-1,xlimu=1,ylimi=-1,ylimu=1,margin = 0.2,
ColorVar = c("red","green","black","blue","yellow"),CexVar = c(0.7),showIIC=FALSE)
```

`BiplotDensity` *Density plot of a data set with overlaid contours.*

Description

This function draws for a set of points a density contour lines plot. The densities can be calculated for the whole set of points or for the groups defined by a nominal variable.

Usage

```
BiplotDensity(X, y = NULL, nlevels = max(y), grouplabels = 1:nlevels,
  ncontours = 6, groupcols = 1:nlevels, img = TRUE, separate = FALSE,
  ncolors = 20, ColorType = 4, xliml = -1, xlimu = 1, yliml = -1,
  ylimu = 1, plotInd = FALSE)
```

Arguments

`X`	A matrix with the coordinates for the plane in which the the contour lines will be plotted.
`y`	Categorical variable used for defining clusters. If NULL, the density is calculated for the whole set of points.
`nlevels`	Number of clusters.
`grouplabels`	Set of labels for the centers of each cluster. It should be a vector with "nlevels" components.
`ncontours`	Number of contours that will be used in the representation.
`groupcols`	Vector whith a set of colors for the clusters.
`img`	Should the density be plotted (with different colors) together with the contour lines?. Default value is TRUE.
`separate`	Should the density for each cluster be represented on a different picture?. Default value is FALSE.
`ncolors`	Number of colors for the densities.
`ColorType`	Type of color schema for the density image. It should be a number between 1 and 5.
`xliml`	Minimum value on the x-axis.
`xlimu`	Maximum value on the x-axis.
`yliml`	Minimum value on the y-axis.
`ylimu`	Maximum value on the y-axis.
`plotInd`	Should the individuals be plotted?

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

Examples

```
data(LevelSatPhd)
olbo = OrdinalLogisticBiplot(LevelSatPhd)
x = olbo$RowCoords[, 1]
y = olbo$RowCoords[, 2]
plot(x,y, cex = 0, xlim=c(-1,1),ylim=c(-1,1))
X = olbo$RowCoords
y = as.matrix(as.numeric(LevelSatPhd[,4]))
gcols = c("midnightblue","black","red","gray87")
BiplotDensity(X,y,groupcols = gcols)
```

CheckDataSet *Check a data set.*

Description

This function checks if a data set is a data frame or a matrix and it saves the data as a matrix of integers, and stores the names of rows, colums and levels for each variable as vectors to use them later.

Usage

```
CheckDataSet(datanom)
```

Arguments

datanom	It can be a data frame or a matrix.

Details

The function checks if some variable has NA values and it deletes the corresponding row. It also checks for missing categories and recodifies the variable keeping the original labels for levels.

Value

An object of class "data.ordinal". This has components:

datanom	Matrix of integers with the values of the variables
RowNames	Vector with the names of the rows
ColumNames	Vector with the names of the variables
LevelNames	Levels of each variable

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

Examples

```
data(LevelSatPhd)
dataChecked = CheckDataSet(LevelSatPhd)
```

`LevelSatPhd` *Data set extracted from the Careers of doctorate holders survey carried out by Spanish Statistical Office in 2008.*

Description

The sample data, as part of a large survey, corresponds to 100 people who have the PhD degree and it shows the level of satisfaction of the doctorate holders about some issues.

Usage

```
data(LevelSatPhd)
```

Format

This data frame contains 100 observation for the following 5 ordinal variables, with four categories each: (1= "Very Satisfied", 2= "Somewhat Satisfied",3="Somewhat dissatisfied", 4="Very dissatisfied")

Salary

Benefits

Job Security

Job Location

Working conditions

Source

Spanish Statistical Institute. Survey of PDH holders, 2006. URL: http://www.ine.es.

Examples

```
data(LevelSatPhd)
```

`OrdinalLogBiplotEM` *Alternated EM algorithm for Ordinal Logistic Biplots*

Description

This function computes, with an alternated algorithm, the row and column parameters of an Ordinal Logistic Biplot for ordered polytomous data. The row coordinates (E-step) are computed using multidimensional Gauss-Hermite quadratures and Expected *a posteriori* (EAP) scores and parameters for each variable or items (M-step) using Ridge Ordinal Logistic Regression to solve the separation problem present when the points for different categories of a variable are completely separated on the representation plane and the usual fitting methods do not converge. The separation problem is present in almost every data set for which the goodness of fit is high.

Usage

```
OrdinalLogBiplotEM(x,dim = 2, nnodos = 15, tol = 0.001, maxiter = 100,
                   penalization = 0.2,show=FALSE,initial=1,alfa=1)
```

Arguments

`x`	Matrix with the ordinal data. The matrix must be in numerical form.
`dim`	Dimension of the solution.
`nnodos`	Number of nodes for the multidimensional Gauss-Hermite quadrature.
`tol`	Value to stop the process of iterations.
`maxiter`	Maximum number of iterations in the process of solving the regression coefficients.
`penalization`	Penalization used in the diagonal matrix to avoid singularities.
`show`	Boolean parameter to specify if the user wants to see every iteration.
`initial`	Method used to choose the initial ability in the algorithm. Default value is 1.
`alfa`	Optional parameter to calculate row and column coordinates in Simple correspondence analysis if the initial parameter is equal to 1.

Value

An object of class `"ordinal.logistic.biplot.EM"`.This has components:

`RowCoordinates`	Coordinates for the rows or individuals
`ColumnParameters`	List with information about the Ordinal Logistic Models calculated for each variable including: estimated parameters with thresholds, percents of correct classifications,and pseudo-Rsquared
`loadings`	factor loadings
`LogLikelihood`	Logarithm of the likelihood
`r2`	R squared coefficient
`Ncats`	Number of the categories of each variable

Author(s)

Jose Luis Vicente-Villardon, Julio Cesar Hernandez Sanchez

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

References

Bock,R. & Aitkin,M. (1981),*Marginal maximum likelihood estimation of item parameters: Application of an EM algorithm*, Phychometrika 46(4), 443-459.

See Also

pordlogist

Examples

```
data(LevelSatPhd)
dataSet = CheckDataSet(LevelSatPhd)
datanom = dataSet$datanom
olb = OrdinalLogBiplotEM(datanom,dim = 2, nnodos = 10,
      tol = 0.001, maxiter = 100, penalization = 0.2)
olb
```

OrdinalLogisticBiplot *Ordinal Logistic Biplot for ordered polytomous data*

Description

Function that calculates the parameters of the Ordinal Logistic Biplot.

Usage

```
OrdinalLogisticBiplot(datanom,sFormula=NULL,numFactors=2,
method="EM",rotation="varimax",metfsco="EAP",
nnodos = 10, tol = 1e-04, maxiter = 100,
penalization = 0.1,cte=TRUE, show=FALSE,ItemCurves = FALSE,initial=1,alfa=1)
```

Arguments

datanom	The data set; it can be a *matrix* with integers or a *data frame* with factors. All variables have to be ordinal.
sFormula	This parameter follows the unifying interface for selecting variables from a data frame for a plot, test or model. The most common formula is of type y ~ x1+x2+x3. It has a default value of NULL if it is not specified.
numFactors	Number of dimensions of the solution. It should be lower than the number of variables. It has a default value of 2.
method	This parameter can be: "EM" or "MIRT". Method to compute the row coordinates.

rotation	Rotation method to used with "MIRT" option in "coordinates". No effect fror other options.
metfsco	Calculation method for the fscores with "MIRT" option in "coordinates". No effect for other options.
nnodos	Number of nodes for gauss quadrature in the EM algorithm.
tol	Tolerance for the EM algorithm.
maxiter	Maximum number of iterations in the EM algorithm.
penalization	Penalization for the ridge regression for each variable.
cte	Include constant in the logistic regression model. Default is TRUE.
show	Show intermediate computations. Default is FALSE.
ItemCurves	Show item information curves. Default is FALSE.
initial	Method used to choose the initial ability in the EM algorithm. Default value is 1.
alfa	Optional parameter to calculate row and column coordinates in Simple correspondence analysis if the initial parameter is equal to 1. Default value is 1.

Details

The general algorithm used is essentially an alternated procedure in which parameters for rows and columns are computed in alternated steps repeated until convergence. Parameters for the rows are calculated by expectation (E-step) and parameters for the columns are computed by maximization (M-step), i. e., by Ordinal Logistic Regression.

There are several options for the computation:

1.- Using the package **mirt** to obtain the row scores, i. e. using a solution obtained from a latent trait model. The column (item) parameters should be directly used by our biplot procedure but, because of the characteristics of the package that performs a default rotation after parameter estimation, we have to reestimate the item parametes to be coherent to the scores.

2.- Using our implementation of the EM algorithm alternating expected a porteriori scores and Ridge Ordinal Logistic Regression for each variable. We use here a Cumulative link model ,that is, a logistic regression model for cumulative logits.

Equations defining the set of probability response surfaces for the cumulative probabilities are sigmoidal as in the binary case (Vicente-Villardon et al.2006) and then they share its geometry. All categories have a different constant but the same slopes, that means that the prediction direction is common to all categories and just the prediction markers are different. The representation subspace can be divided into prediction regions, for each category, delimited by parallel straight lines.

Value

An object of class "ordinal.logistic.biplot". This has some components:

dataSet	Data set of study with all the information about the name of the levels and names of the variables and individuals
RowCoords	Coordinates for the rows in the reduced space
NCats	Number of categories of each variable from the data set

estimObject	Object with all the estimated information using EM alternated algorithm or MIRT procedure
Fitting	matrix with the percentage of correct clasifications and pseudo R squared valued for each variable
coefs	matrix with the estimated coefficients
thresholds	matrix with the estimated intercept limits
NumFactors	Number of dimensions selected for the study
Coordinates	Type of coordinates to calculate the row positions
Rotation	Type of rotation if we have chosen mirt coordinates
Methodfscores	Method of calculation of the fscores in mirt process
NumNodos	Number of nodes for the gauss quadrature in EM algorithm
tol	Cut point to stop the EM-algorithm
maxiter	Maximum number of iterations in the EM-algorithm
penalization	Value for the correction of the ridge regression
cte	Boolean value to choose if the model for each variable will have independent term
show	Boolean value to indicate if we want to see the results of our analysis
ItemCurves	Boolean value to specify if item information curves will be plotted
LogLik	Logarithm of the likelihood
FactorLoadingsComm	Factor loadings and communalities

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

References

Vicente-Villardon, J., Galindo, M.P & Blazquez-Zaballos, A. (2006), *Logistic biplots*,Multiple Correspondence Analysis and related methods pp. 491–509.

Demey, J., Vicente-Villardon, J. L., Galindo, M.P. & Zambrano, A. (2008) *Identifying Molecular Markers Associated With Classification Of Genotypes Using External Logistic Biplots*. Bioinformatics, 24(24), 2832-2838.

Baker, F.B. (1992): Item Response Theory. Parameter Estimation Techniques. Marcel Dekker. New York.

Gabriel, K. (1971), *The biplot graphic display of matrices with application to principal component analysis.*, Biometrika 58(3), 453–467.

Gabriel, K. R. (1998), *Generalised bilinear regression*, Biometrika 85(3), 689–700.

Gabriel, K. R. & Zamir, S. (1979), *Lower rank approximation of matrices by least squares with any choice of weights*, Technometrics 21(4), 489–498.

Gower, J. & Hand, D. (1996), *Biplots, Monographs on statistics and applied probability*. 54. London: Chapman and Hall., 277 pp.

Chalmers,R,P (2012). *mirt: A Multidimensional Item Response Theory Package for the R Environment*. Journal of Statistical Software, 48(6), 1-29. URL http://www.jstatsoft.org/v48/i06/.

See Also

OrdinalLogBiplotEM

Examples

```
data(LevelSatPhd)
olbo = OrdinalLogisticBiplot(LevelSatPhd)
summary(olbo)
```

`plot.ordinal.logistic.biplot` *Graphical representation of an Ordinal Logistic Biplot.*

Description

This function plots an Ordinal Logistic Biplot. There are parameters related to the way in which the biplot is plotted. All the posible parameters have default values.

Usage

```
## S3 method for class 'ordinal.logistic.biplot'
plot(x, planex = 1, planey = 2,
AtLeastR2 = 0.01, xlimi = -1.5, xlimu = 1.5, ylimi = -1.5,
ylimu = 1.5, margin = 0, ShowAxis = TRUE, PlotVars = TRUE,
PlotInd = TRUE, LabelVar = TRUE, LabelInd = TRUE, CexInd = NULL,
CexVar = NULL, ColorInd = NULL, ColorVar = NULL, PchInd = NULL,
PchVar = NULL, showIIC = FALSE, iicxi = -1.5, iicxu = 1.5,
legendPlot = FALSE,PlotClus = FALSE,Clusters=NULL,
chulls = TRUE,centers = TRUE,colorCluster = NULL,
ConfidentLevel=NULL,addToExistingPlot=FALSE,...)
```

Arguments

`x`	An object of the class ordinal.logistic.biplot.
`planex`	Dimension for X axis.
`planey`	Dimension for Y axis.

AtLeastR2	It establishes the cutting value to plot a variable attending to its Nagelkerke pseudo R squared value. A variable is plotted if its pseudo R squared is higher than this value.
xlimi	Minimum value on the x-axis.
xlimu	Maximum value on the x-axis.
ylimi	Minimum value on the y-axis.
ylimu	Maximum value on the y-axis.
margin	This value stablishes the space between the plotted items and the border of the window.
ShowAxis	Should the axis be shown?
PlotVars	Should the variables (items) be plotted?
PlotInd	Should the individuals be plotted?
LabelVar	Should the variable labels be shown?
LabelInd	Should the individual labels be shown?
CexInd	Size of the individual points. It can be an array with the cex information for each row.
CexVar	Size of the category points. It can be an array with the cex information for each variable.
ColorInd	Color of the individual points. It can be an array with the color information for each row.
ColorVar	Color for the variables. It can be an array with the color information for each variable.
PchInd	Symbol for the individuals. It can be an array with the pch information for each row.
PchVar	Symbol for the variables. It could be an array with the pch information for each variable.
showIIC	Boolean parameter to decide if the user wants to see the item information curves for each variable. Default value is FALSE.
iicxi	Lower limit for the X-axis when plotting item information curves.
iicxu	Upper limit for the X-axis when plotting item information curves.
legendPlot	Boolean parameter to show the legend of the plot. Default value is FALSE.
PlotClus	Boolean parameter to show the clusters studied. Default value is FALSE.
Clusters	Variable with the cluster asociated for each item. Default value is NULL.
chulls	Boolean parameter to specify if convex hulls figures will be plotted . Default value is FALSE.
centers	Boolean parameter to plot the centers of each cluster. Default value is NULL.
colorCluster	Color for every cluster. It can be an array with the color information for each cluster. Default value is NULL.
ConfidentLevel	Value between 0 and 1 to avoid extreme values for the plot. Default value is NULL.
addToExistingPlot	Boolean parameter to decide if the plotted items will be added to an existing plot or not. Default value is FALSE.
...	Additional parameters to plot.

Details

The function without parameters plots the ordinal.logistic.biplot object with labels in the original data and default values for colors, symbols and sizes for points and lines. Other values of colors, symbols and sizes can be supplied. A single value applies to all the points but an array with different values can be used to improve the undestanding of the plot.-

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

See Also

OrdinalLogisticBiplot

Examples

```
data(LevelSatPhd)
olbo = OrdinalLogisticBiplot(LevelSatPhd,penalization=0.2)
plot(olbo,PlotInd=TRUE,xlimi=-1.5,xlimu=1.5,ylimi=-1.5,ylimu=1.5,
  margin = 0.2, ColorVar = c("red","green","black","blue","yellow"),
  CexVar = c(0.7),showIIC=FALSE)
```

PlotClusters *Graphical representation of clusters of individuals.*

Description

This function uses a nominal variable to represent groups or clusters of individuals. The clusters can be the result of a clustering algorithm or the groups defined by a external nominal variable. The centroids and convex hulls for each cluster can be represented.

Usage

```
PlotClusters(A, Groups = ones(c(nrow(A), 1)),
        colors = NULL, chulls = TRUE, centers = TRUE, ConfidentLevel = 0.95)
```

Arguments

A	A matrix with the coordinates of each point. It should have only two columns.
Groups	Clustering variable: the cluster for each observation.
colors	It is a vector used to specify the color for each cluster.
chulls	Should convex hulls regions for each cluster be plotted?
centers	Should centroids of each cluster be plotted?
ConfidentLevel	Numerical value between 0 and 1. If it's value is 0.95, five percent of the points with higher distances to the center of each cluster will not be used to calculate centroids and convex hulls.

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

Examples

```
data(LevelSatPhd)
olbo = OrdinalLogisticBiplot(LevelSatPhd)
x = olbo$RowCoords[, 1]
y = olbo$RowCoords[, 2]
plot(x,y, cex = 0.8, pch=17, xlim=c(-2,2),ylim=c(-2,2))
GroupsF = as.factor(LevelSatPhd[,4])
PlotClusters(olbo$RowCoords, Groups = GroupsF,
    colors = c(1,2,3,4),chulls = TRUE,centers = TRUE,ConfidentLevel=NULL)
```

---

plotOrdinalFittedVariable

Function that gives the posibility for the user for plotting in the reduced space an ordered and fitted categorical variable.

Description

Graphical representation of a polytomous ordered variable previously fitted in the reduced space, according to the Ordinal Logistic Biplot theory. It can be choosen some parameters related to the way in which the variable is plotted.

Usage

```
plotOrdinalFittedVariable(nameVariable, coeffic, D,numFactors, planex = 1, planey = 2,
xi = -3.5, xu = 3.5, yi = -3.5, yu = 3.5, margin = 0,
CexVar = 0.7, ColorVar = "blue",
PchVar = 0.7, addToPlot = FALSE, showIIC = TRUE,
iicxi = -2.5, iicxu = 2.5)
```

Arguments

nameVariable	Name of the variable the user wants to plot.
coeffic	Vector with the estimated coefficients and the thresholds in this order.
D	Parameter of the graded response model. In case of coefficients have been estimated by Mirt this parameter should be 1.702. In other cases it should be 1.
numFactors	Number of dimensions of the solution
planex	Dimension for X axis.
planey	Dimension for Y axis.
xi	Minimum value on the x-axis.

xu	Maximum value on the x-axis.
yi	Minimum value on the y-axis.
yu	Maximum value on the y-axis.
margin	This value stablishes the space between the plotted items and the border of the window.
CexVar	Size of the category points. It can be an array with the cex information for each variable.
ColorVar	Color for the variables. It can be an array with the color information for each variable.
PchVar	Symbol for the variables. It could be an array with the pch information for each variable.
addToPlot	Boolean parameter to decide if the user wants to add the ordinal variable representation to an existing plot.
showIIC	Boolean parameter to decide if the user wants to see the item information curves for each variable. Default value is FALSE.
iicxi	Lower limit for the X-axis when plotting item information curves.
iicxu	Upper limit for the X-axis when plotting item information curves.

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

Examples

```
data(LevelSatPhd)
olbo = OrdinalLogisticBiplot(LevelSatPhd,sFormula=NULL,
      numFactors=2,method="EM",penalization=0.2)
nameVariable="Salary"
coeffic = c(olbo$coefs[1,],olbo$thresholds[1,])
plotOrdinalFittedVariable(nameVariable,coeffic,D=1,numFactors = 2)
```

---

plotOrdinalVariable *This function plots in the reduced space an ordered categorical variable.*

Description

Graphical representation of a polytomous ordered variable in the reduced space, according to Vicente-Villardon & Hernandez-Sanchez(2014) methodology. It can be choosen some parameters related to the way in which the variable is plotted.

Usage

```
plotOrdinalVariable(ordinalfVar,nameVariable,estimRows,planex = 1,planey = 2,
  xi=-3.5,xu=3.5,yi=-3.5,yu=3.5,margin=0,CexVar=0.7,ColorVar="blue",
  PchVar=0.7,addToPlot=FALSE,showIIC = TRUE,iicxi=-2.5,iicxu=2.5,
  tol = 1e-04, maxiter = 100, penalization = 0.1)
```

Arguments

ordinalfVar	The ordinal variable. It must be an ordered factor.
nameVariable	Name of the variable that the user wants to represent.
estimRows	Matrix with the estimated coordinates for the individuals in the reduced dimension.
planex	Dimension for X axis.
planey	Dimension for Y axis.
xi	Minimum value on the x-axis.
xu	Maximum value on the x-axis.
yi	Minimum value on the y-axis.
yu	Maximum value on the y-axis.
margin	This value stablishes the space between the plotted items and the border of the window.
CexVar	Size of the category points. It can be an array with the cex information for each variable.
ColorVar	Color for the variables. It can be an array with the color information for each variable.
PchVar	Symbol for the variables. It could be an array with the pch information for each variable.
addToPlot	Boolean parameter to decide if the user wants to add the ordinal variable representation to an existing plot.
showIIC	Boolean parameter to decide if the user wants to see the item information curves for each variable. Default value is FALSE.
iicxi	Lower limit for the X-axis when plotting item information curves.
iicxu	Upper limit for the X-axis when plotting item information curves.
tol	Tolerance for the iterations.
maxiter	Maximum number of iterations.
penalization	Penalization used to avoid singularities.

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

References

Vicente-Villardon, J. L. & Hernandez, J. C. & (2014) Logistic Biplots for ordinal data with an application to job satisfaction of doctorate degree holders in Spain. Preprint available at arXiv.

Examples

```
data(LevelSatPhd)
olbo = OrdinalLogisticBiplot(LevelSatPhd,sFormula=NULL,
  numFactors=2,method="EM")
ordinalfVar = factor(LevelSatPhd[,1],ordered=TRUE)
levels(ordinalfVar) = c("VS","SS","SD","VD")
estimRows = olbo$RowCoords
nameVariable = "Salary"
plotOrdinalVariable(ordinalfVar,nameVariable,estimRows,planex = 1,
  planey = 2,xi=-1.5,xu=1.5,yi=-1.5,yu=1.5,
  margin=0.2,CexVar=0.7,showIIC = TRUE)
```

---

pordlogist *Ordinal logistic regression with ridge penalization*

Description

This function performs a logistic regression between a dependent ordinal variable y and some independent variables x, and solves the separation problem using ridge penalization.

Usage

```
pordlogist(y, x, penalization = 0.1, tol = 1e-04, maxiter = 200, show = FALSE)
```

Arguments

y	Dependent variable.
x	A matrix with the independent variables.
penalization	Penalization used to avoid singularities.
tol	Tolerance for the iterations.
maxiter	Maximum number of iterations.
show	Should the iteration history be printed?.

Details

The problem of the existence of the estimators in logistic regression can be seen in Albert (1984); a solution for the binary case, based on the Firth's method, Firth (1993) is proposed by Heinze(2002). All the procedures were initially developed to remove the bias but work well to avoid the problem of separation. Here we have chosen a simpler solution based on ridge estimators for logistic regression Cessie(1992).

Rather than maximizing $L_j(\mathbf{G}|\,\mathbf{b}_{j0},\mathbf{B}_j)$ we maximize

$$L_j(\mathbf{G}|\,\mathbf{b}_{j0},\mathbf{B}_j) - \lambda\left(\|\mathbf{b}_{j0}\|^2 + \|\mathbf{B}_j\|^2\right)$$

Changing the values of λ we obtain slightly different solutions not affected by the separation problem.

Value

An object of class "pordlogist". This has components:

nobs	Number of observations
J	Maximum value of the dependent variable
nvar	Number of independent variables
fitted.values	Matrix with the fitted probabilities
pred	Predicted values for each item
Covariances	Covariances matrix
clasif	Matrix of classification of the items
PercentClasif	Percent of good classifications
coefficients	Estimated coefficients for the ordinal logistic regression
thresholds	Thresholds of the estimated model
logLik	Logarithm of the likelihood
penalization	Penalization used to avoid singularities
Deviance	Deviance of the model
DevianceNull	Deviance of the null model
Dif	Diference between the two deviances values calculated
df	Degrees of freedom
pval	p-value of the contrast
CoxSnell	Cox-Snell pseudo R squared
Nagelkerke	Nagelkerke pseudo R squared
MacFaden	Nagelkerke pseudo R squared
iter	Number of iterations made

Author(s)

Jose Luis Vicente-Villardon, Julio Cesar Hernandez Sanchez

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

References

Albert,A. & Anderson,J.A. (1984),*On the existence of maximum likelihood estimates in logistic regression models*, Biometrika 71(1), 1–10.

Bull, S.B., Mak, C. & Greenwood, C.M. (2002), *A modified score function for multinomial logistic regression*, Computational Statistics and dada Analysis 39, 57–74.

Firth, D.(1993), *Bias reduction of maximum likelihood estimates*, Biometrika 80(1), 27–38

Heinze, G. & Schemper, M. (2002), *A solution to the problem of separation in logistic regression*, Statistics in Medicine 21, 2109–2419

Le Cessie, S. & Van Houwelingen, J. (1992), *Ridge estimators in logistic regression*, Applied Statistics 41(1), 191–201.

See Also

OrdinalLogBiplotEM,CheckDataSet

Examples

```
data(LevelSatPhd)
dataSet = CheckDataSet(LevelSatPhd)
datanom = dataSet$datanom
olb = OrdinalLogBiplotEM(datanom,dim = 2, nnodos = 10,
            tol = 0.001, maxiter = 100, penalization = 0.2)
model = pordlogist(datanom[, 1], olb$RowCoordinates, tol = 0.001,
        maxiter = 100, penalization = 0.2)
model
```

---

summary.ordinal.logistic.biplot

Summary Method Function for Objects of Class 'ordinal.logistic.biplot'

Description

This function shows a summary of the principal results for the estimation for individuals and variables, like some Pseudo R-squared indices, the percent of correct classifications for each regression, the logLikelihood and "Estimate coefficients", "Std. Error", "z value" or "Pr(>|z|)" values.

Usage

```
## S3 method for class 'ordinal.logistic.biplot'
summary(object,data = FALSE,rowCoords = FALSE,
coefs = FALSE,loadCommun = FALSE,...)
```

Arguments

object	This parameter keeps the ordinal logistic biplot object
data	Boolean parameter to show the number of observations. Default value is FALSE.
rowCoords	Boolean parameter to show the coordinates of the individuals. Default value is FALSE.
coefs	Boolean parameter to show the coefficients of the object. Default value is FALSE.
loadCommun	Boolean parameter to show the factor loadings and communalities. Default value is FALSE.
...	Additional parameters to summary.

Details

This function is a method for the generic function summary() for class "ordinal.logistic.biplot". It can be invoked by calling summary(x) for an object x of the appropriate class.

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

See Also

OrdinalLogisticBiplot

Examples

```
data(LevelSatPhd)
olbo = OrdinalLogisticBiplot(LevelSatPhd,sFormula=NULL,numFactors=2,
method="EM",penalization=0.2,show=FALSE)
summary(olbo)
```

---

summary.pordlogist *Summary Method Function for Objects of Class 'pordlogist'*

Description

This function shows a summary of the principal results for the estimation for individuals and variables, like number of observations, the number of iterations, the covariances matrix, some Pseudo R-squared indices with the correct classification percentage of each regression and the logLikelihood with "Estimate coefficients", "Std. Error", "z value" or "Pr(>|z|)" values.

Usage

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

Arguments

object	This parameter keeps 'pordlogist' object for a variable.
...	Additional parameters to summary.

Details

This function is a method for the generic function summary() for class "pordlogist". It can be invoked by calling summary(x) for an object x of the appropriate class.

Author(s)

Julio Cesar Hernandez Sanchez, Jose Luis Vicente-Villardon

Maintainer: Julio Cesar Hernandez Sanchez <juliocesar_avila@usal.es>

See Also

pordlogist,CheckDataSet,OrdinalLogBiplotEM

Examples

```
data(LevelSatPhd)
dataSet = CheckDataSet(LevelSatPhd)
datanom = dataSet$datanom
olb = OrdinalLogBiplotEM(datanom,dim = 2, nnodos = 10, tol = 0.001,
  maxiter = 100, penalization = 0.2)
model = pordlogist(datanom[, 1], olb$RowCoordinates, tol = 0.001,
  maxiter = 100, penalization = 0.2)
summary(model)
```

Index