# Package ‘MCAvariants’

August 21, 2023

**Type** Package  
**Title** Multiple Correspondence Analysis Variants  
**Version** 2.6.1  
**Date** 2023-08-19  
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**Description** Provides two variants of multiple correspondence analysis (ca): multiple ca and ordered multiple ca via orthogonal polynomials of Emerson.  

**Depends** R (> 3.0.1), methods, tools  
**Imports** ggplot2, ggrepel, gridExtra, plotly  
**LazyData** true  
**License** GPL (> 2)  
**URL** https://www.R-project.org  
**NeedsCompilation** no  
**Repository** CRAN  
**Date/Publication** 2023-08-21 09:52:37 UTC

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alligator.dat

Description

The data set is a three-way contingency table. It consists of 2 rows (alligators’ size), 5 columns (alligators’ food) by 4 tubes (alligators’ lake). The table should be converted in reduced code table, using the function tableconvert for getting alligatormca.

Usage

data(alligator.dat)

Format

A data frame with 300 alligators on the following 3 variables.

Size  A numeric vector of categories ranging from 1 to 2 (small and large).

Food  A numeric vector of categories ranging from 1 to 5 (type of food: fish, invertebrate, reptile, bird, other.

Lake  a numeric vector of categories ranging from 1 to 4 for the four American lakes: Hancock, Oklawaha, Trafford, George.

Source

Agresti (2007), p. 270

Examples

data(alligator.dat)
#dim(alligator.dat)
#dimnames(alligator.dat)
caplot3d

Three dimensional correspondence plot

Description

This function is used in the plot function plot.CAvariants when the logical parameter is plot3d = TRUE. It produces a 3-dimensional visualization of the association.

Usage

caplot3d(coordR, coordC, inertiaper, firstaxis = 1, lastaxis = 2, thirdaxis = 3)

Arguments

coordR          The row principal or standard coordinates.
coordC          The column principal or standard coordinates.
inertiaper      The percentage of the total inertia explained inertia by each dimension.
firstaxis       The first axis number. By default, firstaxis = 1.
lastaxis        The second axis number. By default, lastaxis = 2.
thirdaxis       The third axis number. By default, thirdaxis = 3.

Note

This function depends on the R library plotly.

Author(s)

Rosaria Lombardo and Eric J. Beh

References

**insertval2**  
*Secondary function to code data*

**Description**

Secondary function to code data in complete disjunctive form

**Usage**

\[\text{insertval2}(x, nmod)\]

**Arguments**

- **x**: Data matrix in reduced coding (primitive coding)
- **nmod**: number of categories of each variable

**Details**

It helps to return a matrix from reduced coding in complete disjunctive coding

**Author(s)**

Rosaria Lombardo

**References**


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**mcabasic**  
*Classical multiple correspondence analysis*

**Description**

This function is used in the main function `MCAvariant` when the input parameter is `catype="mca"`. 

**Usage**

\[\text{mcabasic}(xo, np, nmod, tmod, rows, idr, idc, idcv)\]
Arguments

xo  The starting table of variables in reduced code.
np  The column number of the starting table (coincident with the variable number).
nmod The number of variable categories of each variable.
tmod The total number of variable categories.
rows The row number of the starting table (coincident with the individual number).
idr  The row labels of the data table.
idc  The column labels of the data table.
idcv The labels of the categories of each variable.

Note

This function belongs to the R object class called mcabasicresults.

Author(s)

Rosaria Lombardo

References


mcafun

Classical multiple correspondence analysis

Description

This function is used in the secondary function mcabasic when the input parameter of MCAvariants is catype="mca". It performs the singular value decomposition of the weighted super-indicator matrix and compute principal axes, coordinates, weights of rows and columns and total inertia.

Usage

mcafun(xo, Burt, np, idr, idc, nmod)

Arguments

xo  The super-indicator data table.
Burt The Burt data table.
np  The number of categorical variables.
idr  The row labels of data table.
idc  The column labels of data table.
nmmod The category number of each variable.
MCAvariants

Author(s)
Rosaria Lombardo

References

MCAvariants

Classic and Ordered Multiple Correspondence Analysis

Description
It performs Classic Multiple Correspondence analysis for nominal variables (setting catype = "mca") and Ordered Multiple Correspondence analysis via orthogonal polynomials (setting catype="omca"). When the categorical variables are nominal and ordinal, you can specify writing FALSE or TRUE in the input parameter vordered.

Usage
MCAvariants(Xtable, catype = "omca", np = 5, vordered=c(TRUE,TRUE,TRUE,TRUE,TRUE))

Arguments
- Xtable: The two-way contingency table.
- catype: The input parameter for specifying what variant of multiple correspondence analysis is considered. By default, catype = "mca".
- np: The input parameter for specifying the number of categorical variables. By default, np = 5.
- vordered: The flag parameter for specifying what variable is ordered, the ordered variables should be in column close each other. By default, all the five variables are ordered: vordered = c(TRUE,TRUE,TRUE,TRUE,TRUE).

Value
Description of the output returned
- Xtable: The starting table of variables in reduced (primitive) code.
- rows: The row number of the starting table.
- cols: The column number of the starting table (coincident with the variable number).
- rowlabels: The label of the row individuals.
- columnlabels: The label of the column variable categories.
- Rprinccoord: The coordinates of individuals.
- Cprinccoord: The category variable coordinates.
miocount

inertiaXsum  The total inertia when multiple correspondence analysis is performed on the indicator table.
inertiaBurtsum  The total inertia when multiple correspondence analysis is performed on the Burt table.
inertias  Benzecri's Adjusted Inertia values, percentages and cumulative values.
inertiasAdjusted  The adjusted inertia values.
catype  The kind of multiple correspondence analysis chosen, classical or ordered, that is catype is "mca" or "omca".
printdims  The dimension of a matrix in print. By default it is equal to 3.
comp  The polynomial components of inertia when catype is "omca". The total inertia is partitioned in terms of polynomial components.
componentpvalue1  The p-value of the polynomial components of total inertia, when catype is "omca".
degreef  The degree of freedom of polynomial components of total inertia when, catype is "omca".

Note

This function recalls internally two other functions, depending on the setting of the input parameter catype, it recalls multiple correspondence analysis or ordered multiple correspondence analysis. It gives the output object necessary for printing and plotting the results. These two important functions are print.MCAvariants and plot.MCAvariants.

Author(s)

Rosaria Lombardo and Eric J Beh

References


miocount  The counting function

Description

The function that counts the number of individuals in each clusters automatically generated in ordered multiple correspondence analysis.

Usage

miocount(x)
Arguments

- **x**: The coordinates of axes

**Note**

This function is used in the function `omcabasic` when in the main function `MCAvariants` the input parameter is `catype="omca"`.

**Author(s)**

Rosaria Lombardo

**References**


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### `omcabasic`

*Ordered multiple correspondence analysis via orthogonal polynomials*

**Description**

This function is used in the main function `MCAvariants` when the input parameter is `catype="omca"`. It requires that all categorical variables are ordered variables. It performs the hybrid decomposition of the weighted super-indicator matrix and compute polynomial axes, coordinates, weights of rows and columns and total inertia.

**Usage**

```r
omcabasic(xo,np , nmod , tmod , rows, idr, idc, idcv,vordered)
```

**Arguments**

- **xo**: The starting table of variables in reduced code.
- **np**: The column number of the starting table (coincident with the variable number). By default, `np=5`.
- **nmod**: The number of variable categories of each variable.
- **tmod**: The total number of variable categories.
- **rows**: The row number of the starting table (coincident with the individual number).
- **idr**: The row labels of the data table.
- **idc**: The column labels of the data table.
- **idcv**: The labels of the categories of each variable.
- **vordered**: The flag parameter for specifying what variable is ordered. By default, all the five variables are ordered: `vordered = c(TRUE,TRUE,TRUE,TRUE,TRUE)`. 

**orthopoly**

**Note**

This function belongs to the R object class called mcabasicresults.

**Author(s)**

Rosaria Lombardo

**References**


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**orthopoly**

**Orthogonal polynomials**

**Description**

This function is called from the function omca. It allows the analyst to compute the orthogonal polynomials of each ordered categorical variable. The number of the polynomials is equal to the variable category less one. The function computes the polynomial transformation of the ordered categorical variable.

**Usage**

`orthopoly(marginals, scores)`

**Arguments**

- `scores` The ordered scores of an ordered variable. By default `mj=NULL`, the natural scores (1,2,...) are computed.
- `marginals` The marginals, relative frequencies of the ordered variable.

**Value**

Describe the value returned

- `B` the matrix of the orthogonal polynomials without the trivial polynomial.

**Note**

Note that the sum of the marginals of the ordered variables should be one. At the end, the various polynomial matrices will be stored in a super-diagonal matrix.

**Author(s)**

Rosaria Lombardo and Eric J Beh
References

Beh EJ and Lombardo R 2014 Correspondence analysis, Theory, Practice and New Strategies. Wiley.

Examples

orthopoly(marginals=c(.1,.2,.3,.2,.2), scores=c(1,2,3,4,5))

plot.MCAvariants

Main plot function for classical and ordered multiple correspondence analysis

Description

This function allows the analyst to produce the suitable graphical displays with respect to the classical and ordered multiple correspondence analysis. The main plot function called from the main function MCAvariants. It produces classical graphical displays for catype = "mca" and catype = "omca".

Usage

## S3 method for class 'MCAvariants'
plot(x, catype = "mca", firstaxis = 1, lastaxis = 2, thirdaxis = 3, cex = 0.8, cex.lab = 0.8, prop = 1, plot3d = FALSE, plotind= FALSE, M=2,...)

Arguments

x
Represents the set of the output parameters of the main function MCAvariants of the R object class mcacorporateris.
catype
The input parameter specifying what variant of correspondence analysis is requested.
firstaxis
The dimension reflected along the horizontal axis.
lastaxis
The dimension reflected along the vertical axis.
thirdaxis
The third axis number when plot3d = TRUE. By default, thirdaxis = 3.
cex
The parameter that specifies the size of character labels of points in graphical displays. By default, it is equal to 1.
cex.lab
The parameter cex.lab that specifies the size of character labels of axes in graphical displays. By default, cex.lab = 0.8.
prop
The scaling parameter for specifying the limits of the plotting area. By default, it is equal to 1.
plot3d
The logical parameter specifies whether a 3D plot is to be included in the output or not. By default, plot3d = FALSE.
plotind The logical parameter specifies whether a plot of individuals is to be included in the output or not. By default, plotind = FALSE.

M The number of axes M considered when portraying the elliptical confidence regions.
By default, it is equal to $M = 2$.

... Further arguments passed to or from other methods.

Details
It produces classical graphical displays. Further when catype is equal to "omca", the individual clusters are portrayed.

Author(s)
Rosaria Lombardo and Eric J Beh

References

Examples
data(satisfaction)
res1=MCAvariants(satisfaction, catype = "mca", np=5)
plot(res1)
res2=MCAvariants(satisfaction, catype = "omca", np = 5, vordered=c(TRUE,TRUE,TRUE,TRUE,TRUE))
plot(res2)

print.MCAvariants
Main printing function

Description
This function prints results of classical or ordered multiple correspondence analysis. The input parameter is the name of the output of the main function MCAvariants.

Usage
## S3 method for class 'MCAvariants'
print(x, printdims = 2,...)

Arguments
x The output of the main function CAvariants.
printdims The number of dimensions, printdims, that are used to generate the correspondence plot and for summarising the numerical output of the analysis. By default, printdims = 2.

... Further arguments passed to or from other methods.
print.MCAvariants

Details

This function uses another function (called printwithaxes) for specifying the number of matrix dimensions to print.

Value

The value of output returned depends on the kind of multiple correspondence analysis performed.

DataTable
The Burt data table.

Row coordinates
Rows in principal coordinates: the first 10.

Column coordinates
Column in principal coordinates.

Polynomials
Polynomial functions of each variable. When catype is omca.

Linear Percentage of Clusters
The percentage of individuals belonging to each cluster. When catype is omca.

Polynomial Components of Total Inertia
The decomposition of total inertia via orthogonal polynomials. When catype is omca.

Degree of Freedom
Degree of Freedom of Polynomial Component. When catype is omca.

Inertia values
Inertia values of super-indicator and Burt table.

Benzecri’s Inertia values
Adjusted Inertia values, percentages and cumulative.

Total Degree of Freedom
The degree of freedom of total inertia.

Total inertia of X
Total inertia of Super-Indicator table

Total inertia of B
Total inertia of BURT table.

Chi-square values
Chi-square values of BURT Inertia.

Total Chi-square values
Chi-square values of total Inertia of Burt table.

Author(s)

Rosaria Lombardo

References

Examples

```r
res=MCAvariants(satisfaction, catype = "omca", np = 5, vordered=c(TRUE,TRUE,TRUE,TRUE,TRUE))
print(res)
```

---

**printwithaxes**

<table>
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<th>Secondary printing function</th>
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</table>

**Description**

The function is called from the main print function `printmca corporateris`. It adds the names to objects.

**Usage**

`printwithaxes(res, thenames)`

**Arguments**

- `res` An R object.
- `thenames` A character vector of up to the same length as `x`.

**Note**

It is called from `printmca corporateris`.

**Author(s)**

Rosaria Lombardo

**References**

satisfaction  Patient Satisfaction

Description
The data set consists of 235 rows and 5 columns. The rows represent the individuals (patients in an hospital) and the columns concern the five variables of satisfaction (Tangibility, Reliability, Capacity of Response, Capacity of Assurance and Empathy).

Usage
data(satisfaction)

Format
A data frame with 235 observations on the following 5 variables.
- **TANG**: a numeric vector of ordered categories ranging from 1 to 5.
- **REL**: a numeric vector of ordered categories ranging from 1 to 5.
- **CRES**: a numeric vector of ordered categories ranging from 1 to 5.
- **CASS**: a numeric vector of ordered categories ranging from 1 to 5.
- **EMPAT**: a numeric vector of ordered categories ranging from 1 to 5.

Source

Examples
data(satisfaction)
#dim(satisfaction)
#dimnames(satisfaction)

---

**tableconvert**  Convert contingency table in table of reduced code

Description
This simple piece of R code converts a two-way or three-way contingency table into what is required to analyse MCA (table of reduced code: n by number of variables).

Usage
tableconvert(N)
Arguments

N  A two-way or three-way contingency table to convert in a table n by np, where np is the number of the categorical variables.

Author(s)

Rosaria Lombardo and Eric J Beh

References


Examples

alligatormca<-tableconvert(alligator.dat)
dimnames(alligatormca)<-list(paste("a", 1:300,sep = ""),c("Size","Food","Lake"))
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