Package ‘ca’

February 19, 2015

Version 0.58
Date 2014-12-31
Title Simple, Multiple and Joint Correspondence Analysis
Author Michael Greenacre [aut], Oleg Nenadic [aut, cre], Michael Friendly [ctb]
Maintainer Oleg Nenadic <onenadi@uni-goettingen.de>
Depends R (>= 2.8.0)
Suggests rgl (>= 0.64-10)
Description A package for computation and visualization of simple, multiple and joint correspondence analysis.
LazyLoad yes
LazyData yes
License GPL
URL http://www.carme-n.org/
Repository CRAN
Repository/R-Forge/Project ca0
Repository/R-Forge/Revision 15
Repository/R-Forge/DateTimeStamp 2014-12-31 16:27:06
Date/Publication 2014-12-31 18:09:36
NeedsCompilation no

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Author dataset

This data matrix contains the counts of the 26 letters of the alphabet (columns of matrix) for 12 different novels (rows of matrix). Each row contains letter counts in a sample of text from each work, excluding proper nouns.

Usage

data("author")

Format

Data frame containing the 12 x 26 matrix.

Source


Simple correspondence analysis

Computation of simple correspondence analysis.
Usage

ca(obj, ...)

## S3 method for class 'matrix'
c(a(obj, nd = NA, suprow = NA, supcol = NA, subsetrow = NA, subsetcol = NA, ...))

## S3 method for class 'data.frame'
c(a(obj, ...))

## S3 method for class 'table'
c(a(obj, ...))

## S3 method for class 'xtabs'
c(a(obj, ...))

## S3 method for class 'formula'
c(a(formula, data, ...))

Arguments

obj,formula The function is generic, accepting various forms of the principal argument for specifying a two-way frequency table. Currently accepted forms are matrices, data frames (coerced to frequency tables), objects of class "xtabs" or "table" and one-sided formulae of the form ~ F1 + F2, where F1 and F2 are factors.

nd Number of dimensions to be included in the output; if NA the maximum possible dimensions are included.

suprow Indices of supplementary rows.

supcol Indices of supplementary columns.

subsetrow Row indices of subset.

subsetcol Column indices of subset.

data A data frame against which to preferentially resolve variables in the formula

... Other arguments passed to the ca.matrix method

Details

The function ca computes a simple correspondence analysis based on the singular value decomposition.

The options suprow and supcol allow supplementary (passive) rows and columns to be specified. Using the options subsetrow and/or subsetcol result in a subset CA being performed.

Value

sv Singular values

nd Dimension of the solution
rownames Row names
rowmass Row masses
rowdist Row chi-square distances to centroid
rowinertia Row inertias
rowcoord Row standard coordinates
rowsup Indices of row supplementary points
colnames Column names
colmass Column masses
coldist Column chi-square distances to centroid
colinertia Column inertias
colcoord Column standard coordinates
colsup Indices of column supplementary points

References


See Also

svd, plot.ca, plot3d.ca, summary.ca, print.ca

Examples

data("author")
ca(author)
plot(ca(author))

# table method
haireye <- margin.table(HairEyeColor, 1:2)
ca(haireye)
iterate.mjca

Updating a Burt matrix in Joint Correspondence Analysis

Description

Updating a Burt matrix in Joint Correspondence Analysis based on iteratively weighted least squares.

Usage

iterate.mjca(B, lev.n, nd = 2, maxit = 50, epsilon = 0.0001)

Arguments

B A Burt matrix.
lev.n The number of levels for each factor from the original response pattern matrix.
nd The required dimensionality of the solution.
maxit The maximum number of iterations.
epsilon A convergence criterion for the maximum absolute difference of updated values compared to the previous values. The iteration is completed when all differences are smaller than epsilon.

Details

The function iterate.mjca computes the updated Burt matrix. This function is called from the function mjca when the option lambda="JCA", i.e. when a Joint Correspondence Analysis is performed.

Value

B.star The updated Burt matrix
crit Vector of length 2 containing the number of iterations and epsilon

See Also

mjca
Description

Computation of multiple and joint correspondence analysis.

Usage

mjca(obj, nd = 2, lambda = c("adjusted", "indicator", "Burt", "JCA"),
  supcol = NA, subsetcol = NA,
  ps = ":", maxit = 50, epsilon = 0.0001, reti = FALSE)

Arguments

obj A response pattern matrix (data frame containing factors), or a frequency table (a table object)
nd Number of dimensions to be included in the output; if NA the maximum possible dimensions are included.
lambda Gives the scaling method. Possible values include "indicator", "Burt", "adjusted" and "JCA". Using lambda = "JCA" results in a joint correspondence analysis using iterative adjustment of the Burt matrix in the solution space.
supcol Indices of supplementary columns.
subsetcol Indices of subset categories.
ps Separator used for combining variable and category names.
maxit The maximum number of iterations (Joint Correspondence Analysis).
epsilon A convergence criterion (Joint Correspondence Analysis).
reti Logical indicating whether the indicator matrix should be included in the output.

Details

The function mjca computes a multiple or joint correspondence analysis based on the eigenvalue decomposition of the Burt matrix.

Value

sv Eigenvalues (lambda = "indicator") or singular values (lambda = "Burt", "adjusted" or "JCA")
lambda Scaling method
inertia.e Percentages of explained inertia
inertia.t Total inertia
inertia.et Total percentage of explained inertia with the nd-dimensional solution
levelnames Names of the factor/level combinations, joined using ps
factors A matrix containing the names of the factors and the names of the factor levels
levels.n Number of levels in each factor
nd User-specified dimensionality of the solution
nd.max Maximum possible dimensionality of the solution
rownames Row names
rowmass Row masses
rowdist Row chi-square distances to centroid
rowinertia Row inertias
rowcoord Row standard coordinates
rowpcoord Row principal coordinates
rowctr Row contributions
rowcor Row squared correlations
colnames Column names
colmass Column masses
coldist Column chi-square distances to centroid
colinertia Column inertias
colcoord Column standard coordinates
colpcoord Column principal coordinates
colctr column contributions
colcor Column squared correlations
colsup Indices of column supplementary points (of the Burt and Indicator matrix)
subsetcol Indices of subset columns
Burt Burt matrix
Burt.upd The updated Burt matrix (JCA only)
subinertia Inertias of sub-matrices
JCA.iter Vector of length two containing the number of iterations and the epsilon (JCA only)
indmat Indicator matrix if reti was set to TRUE
call Return of match.call

References


See Also
eigen.plot.mjca.summary.mjca.print.mjca

Examples

data("wg93")
mjca(wg93[,1:4])

### Different approaches to multiple correspondence analysis:
# Multiple correspondence analysis based on the indicator matrix:
mjca(wg93[,1:4], lambda = "indicator")

# Multiple correspondence analysis based on the Burt matrix:
mjca(wg93[,1:4], lambda = "Burt")

# "Adjusted" multiple correspondence analysis (default setting):
mjca(wg93[,1:4], lambda = "adjusted")

# Joint correspondence analysis:
mjca(wg93[,1:4], lambda = "JCA")

### Subset analysis and supplementary variables:
# Subset analysis:
mjca(wg93[,1:4], subsetcol = (1:20)[-seq(3,18,5)])

# Supplementary variables:
mjca(wg93, supcol = 5:7)

# Combining supplementary variables and a subset analysis:
mjca(wg93, supcol = 5:7, subsetcol = (1:20)[-seq(3,18,5)])

# Table input
data(UCBAAdmissions)
mjca(UCBAAdmissions)
plot(mjca(UCBAAdmissions))

pchlist

Listing the set of available symbols.

Description
A plot of the available symbols for use with the option pch.

Usage
pchlist()
Details

This function generates a numbered list of the plotting symbols available for use in the functions plot.ca and plot3d.ca.

See Also

plot.ca, plot3d.ca

Examples

pchlist()

plot.ca

Plotting 2D maps in correspondence analysis

Description

Graphical display of correspondence analysis results in two dimensions

Usage

## S3 method for class 'ca'
plot(x, dim = c(1,2), map = "symmetric", what = c("all", "all"),
     mass = c(FALSE, FALSE), contrib = c("none", "none"),
     col = c("blue", "red"), pch = c(16, 21, 17, 24),
     labels = c(2, 2), arrows = c(FALSE, FALSE),
     lines = c(FALSE, FALSE), xlab = ".", ylab = ".",
     col.lab = c("blue", "red"), ...)

Arguments

x Simple correspondence analysis object returned by ca

dim Numerical vector of length 2 indicating the dimensions to plot on horizontal and vertical axes respectively; default is first dimension horizontal and second dimension vertical.

map Character string specifying the map type. Allowed options include "symmetric" (default) "rowprincipal" "colprincipal" "symbiplot" "rowgab" "colgab" "rowgreen" "colgreen"
what  Vector of two character strings specifying the contents of the plot. First entry sets the rows and the second entry the columns. Allowed values are "all" (all available points, default) "active" (only active points are displayed) "passive" (only supplementary points are displayed) "none" (no points are displayed) The status (active or supplementary) of rows and columns is set in ca using the options suprow and supcol.

mass  Vector of two logicals specifying if the mass should be represented by the area of the point symbols (first entry for rows, second one for columns)

contrib  Vector of two character strings specifying if contributions (relative or absolute) should be represented by different colour intensities. Available options are "none" (contributions are not indicated in the plot). "absolute" (absolute contributions are indicated by colour intensities). "relative" (relative contributions are indicated by colour intensities). If set to "absolute" or "relative", points with zero contribution are displayed in white. The higher the contribution of a point, the closer the corresponding colour to the one specified by the col option.

col  Vector of length 2 specifying the colours of row and column point symbols, by default blue for rows and red for columns. Colours can be entered in hexadecimal (e.g. "#FF0000"), rgb (e.g. rgb(1, 0, 0)) values or by R-name (e.g. "red").

pch  Vector of length 4 giving the type of points to be used for row active and supplementary, column active and supplementary points. See pchlist for a list of symbols.

labels  Vector of length two specifying if the plot should contain symbols only (0), labels only (1) or both symbols and labels (2). Setting labels to 2 results in the symbols being plotted at the coordinates and the labels with an offset.

arrows  Vector of two logicals specifying if the plot should contain points (FALSE, default) or arrows (TRUE). First value sets the rows and the second value sets the columns.

lines  Vector of two logicals specifying if the plot should join the points with lines (FALSE, default) or arrows (TRUE). First value sets the rows and the second value sets the columns.

xlab, ylab  Labels for horizontal and vertical axes. The default, "_auto_" means that the function auto-generates a label of the form Dimension X (xx.xx %

col.lab  Vector of length 2 specifying the colours of row and column point labels

...  Further arguments passed to plot and points.

Details

The function plot.ca makes a two-dimensional map of the object created by ca with respect to two selected dimensions. By default the scaling option of the map is "symmetric", that is the so-called symmetric map. In this map both the row and column points are scaled to have inertias (weighted variances) equal to the principal inertia (eigenvalue or squared singular value) along the principal axes, that is both rows and columns are in principal coordinates. Other options are as follows:
• "rowprincipal" or "colprincipal" - these are the so-called asymmetric maps, with either rows in principal coordinates and columns in standard coordinates, or vice versa (also known as row-metric-preserving or column-metric-preserving respectively). These maps are biplots;

• "symbiplot" - this scales both rows and columns to have variances equal to the singular values (square roots of eigenvalues), which gives a symmetric biplot but does not preserve row or column metrics;

• "rowgab" or "colgab" - these are asymmetric maps (see above) with rows (respectively, columns) in principal coordinates and columns (respectively, rows) in standard coordinates multiplied by the mass of the corresponding point. These are also biplots and were proposed by Gabriel & Odoroff (1990);

• "rowgreen" or "colgreen" - these are similar to "rowgab" and "colgab" except that the points in standard coordinates are multiplied by the square root of the corresponding masses, giving reconstructions of the standardized residuals.

This function has options for sizing and shading the points. If the option mass is TRUE for a set of points, the size of the point symbol is proportional to the relative frequency (mass) of each point. If the option contrib is "absolute" or "relative" for a set of points, the colour intensity of the point symbol is proportional to the absolute contribution of the points to the planar display or, respectively, the quality of representation of the points in the display. To globally resize all the points (and text labels), use par("cex") before the plot.

Value

In addition to the side effect of producing the plot, the function invisibly returns the coordinates of the plotted points, a list of two components, with names rows and cols. These can be used to further annotate the plot using base R plotting functions.

References


See Also

casummary.ca, print.ca, plot3d.ca, pchlist

Examples

data("smoke")

# A two-dimensional map with standard settings
plot(ca(smoke))

# Mass for rows and columns represented by the size of the point symbols
plot(ca(smoke), mass = c(TRUE, TRUE))
# Displaying the column profiles only with masses represented by size of point
# symbols and relative contributions by colour intensity.
# Since the arguments are recycled it is sufficient to give only one argument
# for mass and contrib.
data("author")
plot(ca(author), what = c("none", "all"), mass = TRUE, contrib = "relative")

---

### plot.mjca

#### Plotting 2D maps in multiple and joint correspondence analysis

**Description**

Graphical display of multiple and joint correspondence analysis results in two dimensions

**Usage**

```r
## S3 method for class 'mjca'
plot(x, dim = c(1,2), map = "symmetric", centroids = FALSE,
     what = c("none", "all"), mass = c(FALSE, FALSE),
     contrib = c("none", "none"), col = c("#000000", "#FF0000"),
     pch = c(16, 1, 17, 24), labels = c(2, 2),
     arrows = c(FALSE, FALSE), xlab = "_auto_", ylab = "_auto_", ...)
```

**Arguments**

- `x`  
  Multiple or joint correspondence analysis object returned by `mjca`

- `dim`  
  Numerical vector of length 2 indicating the dimensions to plot on horizontal and vertical axes respectively; default is first dimension horizontal and second dimension vertical.

- `map`  
  Character string specifying the map type. Allowed options include
  - "symmetric" (default)
  - "rowprincipal"
  - "colprincipal"
  - "symbiplot"
  - "rowgab"
  - "colgab"
  - "rowgreen"
  - "colgreen"

- `centroids`  
  Logical indicating if column centroids should be added to the plot

- `what`  
  Vector of two character strings specifying the contents of the plot. First entry sets the rows and the second entry the columns. Allowed values are
  - "all" (all available points, default)
  - "active" (only active points are displayed)
  - "passive" (only supplementary points are displayed)
The status (active or supplementary) of columns is set in `mjca` using the option `supcol`.

- **mass** Vector of two logicals specifying if the mass should be represented by the area of the point symbols (first entry for rows, second one for columns).
- **contrib** Vector of two character strings specifying if contributions (relative or absolute) should be represented by different colour intensities. Available options are "none" (contributions are not indicated in the plot), "absolute" (absolute contributions are indicated by colour intensities), "relative" (relative contributions are indicated by colour intensities). If set to "absolute" or "relative", points with zero contribution are displayed in white. The higher the contribution of a point, the closer the corresponding colour to the one specified by the `col` option.
- **col** Vector of length 2 specifying the colours of row and column point symbols, by default black for rows and red for columns. Colours can be entered in hexadecimal (e.g. "#FF0000"), rgb (e.g. rgb(1, 0, 0)) values or by R-name (e.g. "red").
- **pch** Vector of length 4 giving the type of points to be used for row active and supplementary, column active and supplementary points. See `pchlist` for a list of symbols.
- **labels** Vector of length two specifying if the plot should contain symbols only (0), labels only (1) or both symbols and labels (2). Setting labels to 2 results in the symbols being plotted at the coordinates and the labels with an offset.
- **arrows** Vector of two logicals specifying if the plot should contain points (FALSE, default) or arrows (TRUE). First value sets the rows and the second value sets the columns.
- **xlab, ylab** Labels for horizontal and vertical axes. The default, "_auto_" means that the function auto-generates a label of the form Dimension X (xx.xx %)

Further arguments passed to `plot` and `points`.

### Details

The function `plot.mjca` makes a two-dimensional map of the object created by `mjca` with respect to two selected dimensions. By default the scaling option of the map is "symmetric", that is the so-called symmetric map. In this map both the row and column points are scaled to have inertias (weighted variances) equal to the principal inertia (eigenvalue) along the principal axes, that is both rows and columns are in principal coordinates. Other options are as follows:

- `rowprincipal` or `colprincipal` - these are the so-called asymmetric maps, with either rows in principal coordinates and columns in standard coordinates, or vice versa (also known as row-metric-preserving or column-metric-preserving respectively). These maps are biplots;

- `symbiplot` - this scales both rows and columns to have variances equal to the singular values (square roots of eigenvalues), which gives a symmetric biplot but does not preserve row or column metrics;

- `rowgab` or `colgab` - these are asymmetric maps (see above) with rows (respectively, columns) in principal coordinates and columns (respectively, rows) in standard coordinates.
multiplied by the mass of the corresponding point. These are also biplots and were proposed by Gabriel & Odoroff (1990):

- "rowgreen" or "colgreen" - these are similar to "rowgab" and "colgab" except that the points in standard coordinates are multiplied by the square root of the corresponding masses, giving reconstructions of the standardized residuals.

This function has options for sizing and shading the points. If the option mass is TRUE for a set of points, the size of the point symbol is proportional to the relative frequency (mass) of each point. If the option contrib is "absolute" or "relative" for a set of points, the colour intensity of the point symbol is proportional to the absolute contribution of the points to the planar display or, respectively, the quality of representation of the points in the display. To globally resize all the points (and text labels), use par("cex") before the plot.

Value

In addition to the side effect of producing the plot, the function invisibly returns the coordinates of the plotted points, a list of two components, with names rows and cols. These can be used to further annotate the plot using base R plotting functions.

References


See Also

mjca, summary.mjca, print.mjca, pchlist

Examples

data("wg93")

# A two-dimensional map with standard settings
plot(mjca(wg93[,1:4]))

plot3d.ca

Plotting 3D maps in correspondence analysis

Description

Graphical display of correspondence analysis in three dimensions
Usage

```r
## S3 method for class 'ca'
plot3d(x, dim = c(1, 2, 3), map = "symmetric", what = c("all", "all"),
       contrib = c("none", "none"), col = c("#6666FF","#FF6666"),
       labcol = c("#0000FF","#FF0000"), pch = c(16, 1, 18, 9),
       labels = c(2, 2), sf = 0.00002, arrows = c(FALSE, FALSE), ...)
```

Arguments

- **x**: Simple correspondence analysis object returned by `ca`
- **dim**: Numerical vector of length 2 indicating the dimensions to plot
- **map**: Character string specifying the map type. Allowed options include
  - "symmetric" (default)
  - "rowprincipal"
  - "colprincipal"
  - "symbiplot"
  - "rowgab"
  - "colgab"
  - "rowgreen"
  - "colgreen"
- **what**: Vector of two character strings specifying the contents of the plot. First entry sets the rows and the second entry the columns. Allowed values are
  - "none" (no points are displayed)
  - "active" (only active points are displayed, default)
  - "supplementary" (only supplementary points are displayed)
  - "all" (all available points)
  The status (active or supplementary) is set in `ca`.
- **contrib**: Vector of two character strings specifying if contributions (relative or absolute) should be indicated by different colour intensities. Available options are
  - "none" (contributions are not indicated in the plot).
  - "absolute" (absolute contributions are indicated by colour intensities).
  - "relative" (relative contributions are indicated by colour intensities).
  If set to "absolute" or "relative", points with zero contribution are displayed in white. The higher the contribution of a point, the closer the corresponding colour to the one specified by the `col` option.
- **col**: Vector of length 2 specifying the colours of row and column profiles. Colours can be entered in hexadecimal (e.g. "#FF0000"), rgb (e.g. rgb(1,0,0)) values or by R-name (e.g. "red").
- **labcol**: Vector of length 2 specifying the colours of row and column labels.
- **pch**: Vector of length 2 giving the type of points to be used for rows and columns.
- **labels**: Vector of length two specifying if the plot should contain symbols only (0), labels only (1) or both symbols and labels (2). Setting `labels` to 2 results in the symbols being plotted at the coordinates and the labels with an offset.
- **sf**: A scaling factor for the volume of the 3d primitives.
arrows Vector of two logicals specifying if the plot should contain points (FALSE, default) or arrows (TRUE). First value sets the rows and the second value sets the columns.

Further arguments passed to the rgl functions.

See Also
ca

print.ca

Printing ca objects

Description
Printing method for correspondence analysis objects

Usage

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

Arguments

x Simple correspondence analysis object returned by ca

... Further arguments are ignored

Details
The function print.ca gives the basic statistics of the ca object. First the eigenvalues (that is, principal inertias) and their percentages with respect to total inertia are printed. Then for the rows and columns respectively, the following are printed: the masses, chi-square distances of the points to the centroid (i.e., centroid of the active points), point inertias (for active points only) and principal coordinates on the first nd dimensions requested (default = 2 dimensions). The function summary.ca gives more detailed results about the inertia contributions of each point on each principal axis. For supplementary points, masses and inertias are not applicable.

See Also
ca

Examples
data("smoke")
print(ca(smoke))
Description

Printing method for multiple and joint correspondence analysis objects

Usage

```r
## S3 method for class 'mjca'
print(x, ...)
```

Arguments

- `x`: Multiple or joint correspondence analysis object returned by `mjca`
- `...`: Further arguments are ignored

Details

The function `print.mjca` gives the basic statistics of the `mjca` object. First the eigenvalues (that is, principal inertias) and their percentages with respect to total inertia are printed. Then for the rows and columns respectively, the following are printed: the masses, chi-square distances of the points to the centroid (i.e., centroid of the active points), point inertias (for active points only) and principal coordinates on the first `nd` dimensions requested (default = 2 dimensions). The function `summary.mjca` gives more detailed results about the inertia contributions of each point on each principal axis.

For supplementary points, masses and inertias are not applicable.

See Also

`mjca`

Examples

```r
data("wg93")
print(mjca(wg93[,1:4]))
# equivalent to:
mjca(wg93[,1:4])
```
print.summary.ca

Printing summaries of `ca` objects

Description

Printing method for summaries of correspondence analysis objects

Usage

```r
## S3 method for class 'summary.ca'
print(x, ...)
```

Arguments

- `x`: Summary of a simple correspondence analysis object returned by `summary.ca`
- `...`: Further arguments are ignored

See Also

`ca`, `summary.ca`

print.summary.mjca

Printing summaries of `mjca` objects

Description

Printing method for summaries of multiple and joint correspondence analysis objects

Usage

```r
## S3 method for class 'summary.mjca'
print(x, ...)
```

Arguments

- `x`: Summary of a multiple or joint correspondence analysis object returned by `summary.mjca`
- `...`: Further arguments are ignored

See Also

`mjca`, `summary.mjca`
**smoke**

---

**Smoke dataset**

**Description**

Artificial dataset in Greenacre (1984)

**Usage**

`data(smoke)`

**Format**

Table containing 5 rows (staff group) and 4 columns (smoking categories), giving the frequencies of smoking categories in each staff group in a fictional organization.

**References**


---

**summary.ca**

**Summarizing simple correspondence analysis**

**Description**

Printed output summarizing the results of `ca`, including a scree-plot of the principal inertias and row and column contributions.

**Usage**

```r
## S3 method for class 'ca'
summary(object, scree = TRUE, rows=TRUE, columns=TRUE, ...)
```

**Arguments**

- `object`: Simple correspondence analysis object returned by `ca`.
- `scree`: Logical flag specifying if a scree-plot should be included in the output.
- `rows`: Logical: should row contribution summaries be included?
- `columns`: Logical: should column contribution summaries be included?
- `...`: Further arguments (ignored)
Details

The function `summary.mjca` gives the detailed numerical results of the `ca` function. All the eigenvalues (principal inertias) are listed, their percentages with respect to total inertia, and a bar chart (also known as a scree plot). Then for the set of rows and columns a table of results is given in a standard format, where quantities are either multiplied by 1000 or expressed in permills (thousandths): the mass of each point (x1000), the quality of display in the solution subspace of nd dimensions, the inertia of the point (in permills of the total inertia), and then for each dimension of the solution the principal coordinate (x1000), the (relative) contribution COR of the principal axis to the point inertia (x1000) and the (absolute) contribution CTR of the point to the inertia of the axis (in permills of the principal inertia).

For supplementary points, masses, inertias and absolute contributions (CTR) are not applicable, but the relative contributions (COR) are valid as well as their sum over the set of chosen nd dimensions (QLT).

Examples

data("smoke")
summary(ca(smoke))

```
summary.mjca  Summarying multiple and joint correspondence analysis
```

Description

Textual output summarizing the results of `mjca`, including a scree-plot of the principal inertias and row and column contributions.

Usage

```
## S3 method for class 'mjca'
summary(object, scree = TRUE, rows = FALSE, columns = TRUE, ...)
```

Arguments

- `object`: Multiple or joint correspondence analysis object returned by `mjca`.
- `scree`: Logical flag specifying if a scree-plot should be included in the output.
- `rows`: Logical specifying whether the results for the rows should be included in the output (default = FALSE).
- `columns`: Logical specifying whether the results for the columns should be included in the output (default = TRUE).
- `...`: Further arguments (ignored)
Details

The function `summary.mjca` gives the detailed numerical results of the `mjca` function. All the eigenvalues (principal inertias) are listed, their percentages with respect to total inertia, and a bar chart (also known as a scree plot). Then for the set of rows and columns a table of results is given in a standard format, where quantities are either multiplied by 1000 or expressed in permills (thousandths): the mass of each point (x1000), the quality of display in the solution subspace of nd dimensions, the inertia of the point (in permills of the total inertia), and then for each dimension of the solution the principal coordinate (x1000), the (relative) contribution COR of the principal axis to the point inertia (x1000) and the (absolute) contribution CTR of the point to the inertia of the axis (in permills of the principal inertia).

For supplementary points, masses, inertias and absolute contributions (CTR) are not applicable, but the relative contributions (COR) are valid as well as their sum over the set of chosen nd dimensions (QLT).

Examples

```r
data("wg93")
summary(mjca(wg93[,1:4]))
```

---

Description

This data frame contains records of four questions on attitude towards science with responses on a five-point scale (1=agree strongly to 5=disagree strongly) and three demographic variables (sex, age and education).

Usage

```r
data(wg93)
```

Format

Data frame (871x7).

Source

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