Package 'cds'

April 15, 2025

Type Package

Title Constrained Dual Scaling for Detecting Response Styles

Version 1.0.4

Date 2025-04-15

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Description This is an implementation of constrained dual scaling for detecting response styles in categorical data, including utility functions. The procedure involves adding additional columns to the data matrix representing the boundaries between the rating categories. The resulting matrix is then doubled and analyzed by dual scaling. One-dimensional solutions are sought which provide optimal scores for the rating categories. These optimal scores are constrained to follow monotone quadratic splines. Clusters are introduced within which the response styles can vary. The type of response style present in a cluster can be diagnosed from the optimal scores for said cluster, and this can be used to construct an imputed version of the data set which adjusts for response styles.

Depends R(>= 4.4), parallel

Imports MASS, limSolve, clue, colorspace, copula, graphics, methods, stats

LazyLoad yes

LazyData yes

ByteCompile yes

License GPL (>= 2)

RoxygenNote 7.3.2

Encoding UTF-8

NeedsCompilation no

Repository CRAN

Date/Publication 2025-04-15 19:40:02 UTC

Contents

`cds-package` *Constrained Dual Scaling for Successive Categories*

Description

Fit constrained dual scaling for detecting response styles.

Author(s)

Pieter C. Schoonees

References

Departmental report available

Schoonees, P.C., Velden, M. van de & Groenen, P.J.F. (2013). Constrained Dual Scaling for Detecting Response Styles in Categorical Data. (EI report series EI 2013-10). Rotterdam: Econometric Institute.

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addbounds *Augment with Boundaries Between Rating Scale Categories and Rank*

Description

Adds `q - 1` boundaries between the `q` ratings to the columns of matrix `x`, and convert the rows to rankings, starting with 0 for the lowest ranking. Ties are handled by averaging the total rank for all tied observations.

Usage

```
addbounds(x, q = max(x), ties = "average")
```

Arguments

`x`	matrix (or data frame) of `n` rows and `m` columns, or an object that can be coerced to a matrix via `as.matrix`.
`q`	scalar; the number of rating scale categories. Defaults to the maximum entry in `x`.
`ties`	character; handling of ties in `rank`

Details

Any `x` which is not a matrix or data frame will cause an error.

Value

A matrix of size `n` by `m + q - 1`

Author(s)

Pieter C. Schoonees

Examples

```
set.seed(1234)
mat <- matrix(sample(1:9, 12, replace = TRUE), nrow = 4, ncol = 3)
addbounds(mat, q = 9)
```

approxloads *Low Rank Approximation LL' of a Square Symmetrix Matrix R*

Description

Uses the eigendecomposition of a square, symmetrix matrix R to obtain the loadings matrix L such that R is approximated by LL', with L restricted to have `r` columns. Hence LL' is a rank `r` approximation of R. The eigendecomposition of R is used to obtain L from the first `r` eigenvectors and eigenvalues. In case `procr.target` is not `NULL`, L is further rotated through orthogonal Procrustes analysis to match as closely as possible the matrix `procr.target` through `orthprocr`.

Usage

```
approxloads(R, r = 3, procr.target = NULL, refl.target = NULL)
```

Arguments

`R`	Square, symmetric matrix R to be approximated
`r`	The required rank of the approximation
`procr.target`	Optional; the target matrix for L in the orthogonal Procrustes analysis
`refl.target`	Optional; the matrix to check against for possible reflections of the loading vectors.

Examples

```
R <- rcormat(10, r = 3)
all.equal(R$L, approxloads(R$R, r = 3, procr.target = R$L))
```

calc.wt.bubbles *Calculate the Weights for Bubble Plots*

Description

Calculate weights for the bubbles in the plot method of `cds` objects. The relative frequencies within a dset of groups are used to calculate the size of the bubble so that the area of the bubble is proportional to the relative frequency of the rating category within that group.

Usage

```
calc.wt.bubbles(dat, grp, q, fact = 0.12)
```

Arguments

dat	A data set from which to derive the relative frequencies
grp	A vector giving the group memberships.
q	An integer such that the rating scale is 1:q.
fact	A schrinkage factor.

Author(s)

Pieter Schoonees

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cds *Constrained Dual Scaling for Successive Categories with Groups*

Description

Uses an alternating nonnegative least squares algorithm combined with a k-means-type algorithm to optimize the constrained group dual scaling criterion outlined in the reference. Parallel computations for random starts of the grouping matrix is supported via package **parallel**.

Usage

```
cds(
  x,
  K = 4,
  q = NULL,
  eps.ALS = 0.001,
  eps.G = 1e-07,
  nr.starts.G = 20,
  nr.starts.a = 5,
  maxit.ALS = 20,
  maxit = 50,
  Gstarts = NULL,
  astarts = NULL,
  parallel = FALSE,
  random.G = FALSE,
  times.a.multistart = 1,
  info.level = 1,
  mc.preschedule = TRUE,
  seed = NULL,
  LB = FALSE,
  reorder.grps = TRUE,
  rescale.a = TRUE,
  tol = sqrt(.Machine$double.eps),
  update.G = TRUE
)
```

Arguments

x	an object of class "dsdata" (see cds.sim()), or a matrix (or object coercible to a matrix) containing the data for n individuals on m objects. The data does not yet contain any additional columns for the rating scale.
K	The number of response style groups to look for. If a vector of length greater than one is given, the algorithm is run for each element and a list of class cdslist is returned.
q	The maximum rating (the scale is assumed to be 1:q).
eps.ALS	Numerical convergence criterion for the alternating least squares part of the algorithm (updates for row and column scores).
eps.G	Numerical convergence criterion for the k-means part of the algorithm.
nr.starts.G	Number of random starts for the grouping matrix.
nr.starts.a	Number of random starts for the row scores.
maxit.ALS	Maximum number of iterations for the ALS part of the algorithm. A warning is given if this maximum is reached. Often it is not a concern if this maximum is reached.
maxit	Maximum number of iterations for the k-means part of the algorithm.
Gstarts	Facility to supply a list of explicit starting values for the grouping matrix G. Each start consists of a two element list: i giving and integer number the start, and G giving the starting configuration as an indicator matrix.
astarts	Supply explicit starts for the a vectors, as a list.
parallel	logical. Should parallelization over starts for the grouping matrix be used?
random.G	logical. Should the k-means part consider the individuals in a random order?
times.a.multistart	The number of times that random starts for the row scores are used. If == 1, then random starts are only used once for each start of the grouping matrix.
info.level	Verbosity of the output. Options are 1, 2, 3 and 4.
mc.preschedule	Argument to mclapply under Unix.
seed	Random seed for random number generators. Only partially implemented.
LB	logical. Load-balancing used in parallelization or not? Windows only.
reorder.grps	logical. Use the Hungarian algorithm to reorder group names so that the trace of the confusion matrix is maximized.
rescale.a	logical. Rescale row score to length sqrt(2n) if TRUE (after the algorithm has converged).
tol	tolerance tol passed to lsei of the **limSolve** package. Defaults to sqrt(.Machine$double.eps)
update.G	Logical indicating whether or not to update the G matrix from its starting configuration. Useful when clustering is known apriori or not desired.

Details

See the reference for more details.

Value

Object of class ds with elements:

G	Grouping indicator matrix.
K	Number of groups K.
opt.crit	Optimum value of the criterion.
a	The 2n-vector of row scores.
bstar	The m-vector of object scores.
bkmat	The matrix of group-specific boundary scores for the ratings.
alphamat	The estimated spline coefficients for each group.
iter	The number of iterations used for the optimal random start wrt the grouping matrix.
time.G.start	The number of seconds it took for the algorithm to converge for this optimal random start.
grp	The grouping of the individuals as obtained by the algorithm.
kloss	Loss value from G update (not equivalent to that of ALS updates).
hitrate, confusion	Confusion and hitrates of original data object contained a grouping vector.
loss.G	Optimality criterion values for the random starts of G.
q	The number of ratings in the Likert scale 1:q
time.total	Total time taken for the algorithm over all random starts
call	The function call.
data	The input data object.

Author(s)

Pieter C. Schoonees

References

Schoonees, P.C., Velden, M. van de & Groenen, P.J.F. (2013). Constrained Dual Scaling for Detecting Response Styles in Categorical Data. (EI report series EI 2013-10). Rotterdam: Econometric Institute.

Examples

```
set.seed(1234)
dat <- cds.sim()
out <- cds(dat)
```

cds.sim *Grouped Simulation with Response Styles*

Description

Simulate response data for a group of response styles.

Usage

```
cds.sim(
  nr.indv = c(100, 100, 100),
  m = 25,
  scales = 1:7,
  err.coeff = 0.1,
  alphamat = rbind(c(4, 4, 1), c(1, 4, 4), c(1, 2, 1)),
  true.mu = NULL,
  random = TRUE,
  same.mu = TRUE,
  use.copula = FALSE,
  reverse.thresh = 1
)
```

Arguments

nr.indv	A vector giving the number of respondents in each group.
m	The number of objects.
scales	The rating scale used, 1:q.
err.coeff	The standard error used in the underlying normal noise.
alphamat	The matrix of spline parameters defining the response styles, with each row containing a response style. No intercepts should be included.
true.mu	Optional; a matrix or vector giving the true underlying preferences for the objects.
random	Logical indicating whether to apply the response styles in random order
same.mu	Logical indicating whether a universal value for mu should be assumed.
use.copula	Logical indicating whether to use a correlated dependence structure through a copula.
reverse.thresh	A numeric value giving the proportion of observations for which the dependece structure should be reversed. Only applicable when copula is TRUE.

Value

An object of class cdsdata, inheriting from class icdsdata, which is a list with the following slots:

prers The pre-response style simulated data

postrs The data after adding the response styles

postbl The same as `postrs` in this case

Fr.cent.rs The centred Fr matrix for `postrs`

Fr.rs The Fr matrix for `postrs`

Fr.cent.bl The same as `Fr.cent.rs`, for compatibility with `icds`

Fr.bl The same as `Fr.rs`, for compatibility with `icds`

mu Matrix of the true underlying preference structure for the obects

block Numeric vector identifying the different blocks for incompleteness, in this case a vector of ones

grp.rs The response style grouping vector

alphamat Matrix of spline parameters for the response styles

scales The rating scale 1:q used

m Number of objects

munique The number of objects seen within each block - equal to zero in this case

m0 The number of objects seen by all subjects - equal to `m` in this case

true.tau Actual tau used in the simulation with copulae

call The function call

See Also

`createcdsdata`

`clean.scales` *Impute Optimal Scores for Rating Categories*

Description

Replace original ratings with optimal scores based on `cds` output..

Usage

```
clean.scales(object, data, K, col.subset = NULL, ...)

## S3 method for class 'cds'
clean.scales(object, data, K, col.subset = NULL, ...)

## S3 method for class 'cdslist'
clean.scales(object, data, K, col.subset = NULL, ...)
```

Arguments

object	An object of class cds
data	An object of class cdsdata to be cleaned, or the original data.
K	The number of classes in the solution that must be kept.
col.subset	An optional subset
...	Additional arguments.

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cl_class_ids.cds *S3 Methods for Integration into* **clue** *Framework*

Description

These methods integrate the class cds into the framwork set out in package **clue**. Use can therefore by made of cl_agreement to calculate concordance measures between different solutions.

Usage

```
## S3 method for class 'cds'
cl_class_ids(x)

## S3 method for class 'cds'
is.cl_partition(x)

## S3 method for class 'cds'
is.cl_hard_partition(x)

## S3 method for class 'cdsdata'
cl_class_ids(x)

## S3 method for class 'cdsdata'
is.cl_partition(x)

## S3 method for class 'cdsdata'
is.cl_hard_partition(x)
```

Arguments

x	An object of class cds

create.ind *Create Indicator Matrix*

Description

Create an indicator matrix.

Usage

```
create.ind(grp)
```

Arguments

grp	A grouping vector.

create.rs *Create a response style*

Description

Creates a response style by cutting up a quadratic monotone spline.

Usage

```
create.rs(
  alpha = matrix(c(1, 2, 1), nrow = 1),
  nr.scale = 7,
  tvec = c(0, 0.5, 1),
  xvec = 0:nr.scale/nr.scale,
  scale = TRUE
)
```

Arguments

alpha	vector of spline coefficients
nr.scale	number of rating categories; numeric
tvec	knots for spline functions
xvec	evaluation points for basis functions
scale	logical; scale or not

Author(s)

Pieter C. Schoonees

createcdsdata *Create a cdsdata Object*

Description

Create a cdsdata object from a data frame or matrix.

Usage

```
createcdsdata(x, q = NULL)
```

Arguments

x	A data frame or matrix containing the data.
q	Optional; the maximum rating category, so that the rating scale used for all items are 1:q.

datsim *Simulate Data for a Single Response Style*

Description

Simulate data containing a single repsponse style.

Usage

```
datsim(
  nr.indv = 100,
  m = 5,
  scales = 1:7,
  err.coeff = 0.1,
  resp.style = c(-Inf, 1/7, 2/7, 3/7, 4/7, 5/7, 6/7, Inf),
  true.mu = NULL,
  a = 0,
  b = 1,
  plot.graph = FALSE,
  use.copula = FALSE,
  reverse.thresh = 1,
  ...
)
```

Arguments

nr.indv	Integer giving the number of individuals required in the sample.
m	The number of items.
scales	The rating scale used for all items.
err.coeff	The standard error used in simulating the truncated normal distribution.
resp.style	A set of cut points across the interval [0, 1] defining the response style transformation.
true.mu	Optional vector of length m giving the true preferences for the items.
a	Lower boundary of the truncation interval for the simulated true preferences.
b	Upper boundary for the truncation interval for the simulated true preferences.
plot.graph	Logical indicating whether to visualize the response style in a plot.
use.copula	Logical indicating whether to simulate dependent items using a copula.
reverse.thresh	A proportion giving the proportion of item preferences which should be reversed to induce a negative association.
...	Additional arguments passed to plot.

Author(s)

Pieter C. Schoonees

References

Schoonees, P.C., Velden, M. van de & Groenen, P.J.F. (2013). Constrained Dual Scaling for Detecting Response Styles in Categorical Data. (EI report series EI 2013-10). Rotterdam: Econometric Institute.

G.start *Constrained Dual Scaling for a Single Random G Start*

Description

Run algorithm for a single G matrix.

Usage

```
G.start(
  X,
  nr.starts.a,
  astarts,
  maxit,
  n,
  m,
  q,
```

```
  Fr.cent,
  maxit.ALS,
  Mmat,
  eps.G,
  info.level,
  times.a.multistart,
  eps.ALS,
  const,
  K,
  random.G,
  tol,
  update.G
)
```

Arguments

X	List of two elements, namely i giving the number of the start and G given the starting configuration
nr.starts.a	The number or random starts for a to use in the ALS.
astarts	Explicit starts for a, if applicable.
maxit	The maximum number of iterations with respect to G.
n	The number of respondents.
m	The number of items.
q	The maximum rating category such that the rating scale is 1:q.
Fr.cent	The centred Fr matrix.
maxit.ALS	The maximum number of ALS iterations.
Mmat	The basis matrix for the quadratic monotone splines.
eps.G	The absolute error tolerance for the G updates.
info.level	Integer controlling the amount of information printed.
times.a.multistart	The number of times random starts for a is used.
eps.ALS	The absolute error tolerance for the ALS.
const	The constant part of the loss function.
K	The number of groups.
random.G	The random argument passed to updateG.
tol	tolerance tol passed to lsei of the **limSolve** package)
update.G	Logical indicating whether or not to update the starting configuration G in X

gen.cop *Generate a Copula*

Description

Generate correlated data multivariate categorical data via a copula.

Usage

```
gen.cop(
  n,
  tauvek = c(0.2, 0.35),
  nr.cols = c(10, 10),
  true.mu = runif(sum(nr.cols)),
  err.coeff = 0.1,
  random = FALSE,
  reverse = TRUE,
  reverse.thresh = 0.75
)
```

Arguments

n	Integer; the number of samples to draw.
tauvek	A vector of association parameters for each of the Clayton copulae (see copClayton), of the same length as nr.cols.
nr.cols	A vector giving the number of columns to draw from each of the copulae.
true.mu	A vector giving the mean for each of the columns in the data.
err.coeff	The standard errors for underlying normal distribution.
random	Logical indicating whether or not the samples should be presented in random order.
reverse	Logical indicating whether some of the simulated variables should be reversed to have negative association or not.
reverse.thresh	The proportion of columns to reverse.

genPCA *Generate PCA data and Calculates Correlation Matrices*

Description

Generate a response style data set from a specific correlation matrix, clean the data with constrained dual scaling and report the original, cleaned and contaminated correlation matrices in a list.

Usage

```
genPCA(
  nr.indv = rep(100, 5),
  m = 10,
  q = 7,
  r = 3,
  err.coeff = 0.1,
  alphamat = rbind(c(0.5, 2, 4), c(10, 2, 10), c(1, 2, 1), c(4, 2, 0.5), c(0.1, 2,
    0.1))[1:length(nr.indv), ],
  randomize = TRUE,
  ...
)
```

Arguments

nr.indv	Vector; number of individuals in each response style group. It is passed to simpca.
m	scalar; Number of items.
q	scalar; Number of rating categories, such that the rating scale is 1:q.
r	scalar; Rank of simulated correlation matrices.
err.coeff	scalar; Standard deviation used in simulations that is passed on to simpca.
alphamat	matrix; Contains the spline parameters for the different response styles that is passed to simpca.
randomize	logical; See simpca.
...	Arguments passed to cds.

Value

A list with components:

Rsim	Correlation matrix from which the sample was generated
Rclean	Correlation matrix for the cleaned data
Rcont	Correlation matrix for the contaminated data

Author(s)

Pieter C. Schoonees

group.ALS *Alternating Least Squares with Groups for Constrained Dual Scaling*

Description

Alternating least-sqaures for estimating row and column scores in constrained dual scaling, where different groups are allowed for.

Usage

```
group.ALS(
  a,
  m,
  q,
  G,
  Fr.cent,
  eps = 0.1,
  maxit = 50,
  Mmat,
  info.level = 2,
  const,
  K,
  n,
  tol
)
```

Arguments

a	A 2n-vector of row scores.
m	Integer; the number of items.
q	Integer; the rating scale from 1:q.
G	An indicator matrix of size n by K.
Fr.cent	The centred F_r matrix.
eps	The numerical tolerance level for the loss.
maxit	Integer; the maximum number of iterations allowed.
Mmat	Matrix of spline basis functions.
info.level	Integer controlling the amount of information printed.
const	The constant part of the loss function.
K	The number of latent classes.
n	The number of samples.
tol	tolerance tol passed to lsei of the **limSolve** package

indmat *Create an Indicator Matrix*

Description

Creates an indicator matrix from a grouping vector.

Usage

```
indmat(grp.vec, K = length(unique(grp.vec)))
```

Arguments

grp.vec	Numeric vector giving the group membership.
K	Scalar indicating the number of groups. Defaults to the number of unique elements in grp.vec.

ispline *Quadratic monotone spline basis function for given knots.*

Description

Calculate basis functions for monotone quadratic splines.

Usage

```
ispline(xvec, tvec = c(0, 0.5, 1), intercept = TRUE)
```

Arguments

xvec	Vector at which to evaluate the basis functions.
tvec	Vector of spline knots: lower endpoint, interior knot, upper endpoint.
intercept	Logical; should an intercept be included or not?

Lfun *Calculate Constrained Dual Scaling Loss*

Description

Calculate the loss function for constrained dual scaling.

Usage

```
Lfun(a.cur, bkmat, G, Fr.cent, n, m, q, const, K)
```

Arguments

a.cur	The current value for a.
bkmat	Current value of bkmat.
G	Current value G.
Fr.cent	Current value of the centred Fr.
n	Number of respondents.
m	Number of items.
q	Number for rating scale categories so that the rating scale is 1:q.
const	Constant part of the loss function
K	Number of response style groups.

Lfun.G.upd *Calculate Loss for G Update*

Description

Loss function used for updating G. This is not equivalent to the original loss function, as only a part of the total loss depends on G.

Usage

```
Lfun.G.upd(G, a.cur, bwts2, Fr.bk, n, m, q, K)
```

Arguments

G	The current value for G.
a.cur	The current value for a.
bwts2	The current value of the squared b weights.
Fr.bk	Current product between Fr.cent and bk.
n	Number of respondents.
m	Number of items.
q	Number for rating scale categories so that the rating scale is 1:q.
K	Number of response style groups.

orthprocr *Orthogonal Procrustes Analysis*

Description

Simple function to rotate matrix X so that it matches the target matrix Z as closely as possible, by minimizing ||Z - XQ|| where Z and X are of the same size and Q is an orthogonal matrix. The algorithm is based on the singular value decomposition (SVD) (see e.g. the reference).

Usage

```
orthprocr(Z, X)
```

Arguments

Z	The target matrix
X	The matrix to be rotated, which must be of the same size as Z.

Value

A list with the following 2 elements:

Q	The rotation matrix
XQ	The matrix X after rotation

References

Gower, J. C. and Hand, D.J. (1996). Biplots (Vol. 54). CRC Press.

plot.cds *Plot cds Objects*

Description

Plot method for cds objects

Usage

```
## S3 method for class 'cds'
plot(
  x,
  which = 1L:3L,
  type = "l",
  lty = 1,
  lwd = 2,
```

```
  show.legend = TRUE,
  col = colorspace::rainbow_hcl(nr),
  bty.legend = "n",
  intercept = ncol(x$alphamat) == 4,
  scale = FALSE,
  add = FALSE,
  exp.factor = 1.2,
  bubble.fact = 0.12,
  cont.factor = 0.01,
  pch = 15,
  ...
)
```

Arguments

x	An object of class cds.
which	A numeric vector: a subset of 1:3 specifying the plots to produce.
type	Passed to matplot.
lty	Passed to matplot.
lwd	Passed to matplot.
show.legend	Logical; should a legend be added to the plot or not.
col	Passed to matplot.
bty.legend	Passed to legend.
intercept	Logical indicating whether to plot the intercept.
scale	Logical indicating whether an intercept should be included or not.
add	Logical; add to plot or not?
exp.factor	Factor for expanding the x- and y-limits.
bubble.fact	Passed to calc.wt.bubbles as argument fact.
cont.factor	Continuity correction to apply in case one of the alpha's are equal to zero.
pch	Plotting character to use.
...	Additional arguments passed to points.

---

plot.cdslist *Plot a* cdslist *Object*

Description

Create a scree plot and bubble plots for all elements in a cdslist object.

Usage

```
## S3 method for class 'cdslist'
plot(x, which = 2L, ...)
```

Arguments

x	An object of class cdslist.
which	The which argument passed to plot.cds.
...	Additional arguments passed to plot.cds.

---

print.cds *Print cds Object*

Description

Print method for cds objects.

Usage

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

Arguments

x	A cds object.
...	Unimplemented.

---

print.cdsdata *Print dsdata Objects*

Description

This is a simple print method for object that inherits from the class cdsdata.

Usage

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

Arguments

x	A cdsdata object
...	Unimplemented.

rcormat *Randomly Generate Low-Rank Correlation Matrix*

Description

Generate a correlation matrix as R = LL' where the rows of L are of length 1, L is of rank `r` and the matrix L is sparse (depending on `sparse.prop`. The loadings in L are sampled from a standard normal distribution, after which `sparse.prop` is used to set a randomly chosen number of loadings in each row equal to zero. To ensure that a correlation matrix results, the rows are normalized.

Usage

```
rcormat(m, r = 3L, sparse.prop = 0.5)
```

Arguments

`m`	integer; the number of variables.
`r`	integer; the required rank.
`sparse.prop`	the proportion of zeros in the rows of the matrix.

Value

A list with the following components:

`R`	The sampled correlation matrix
`L`	The loading matrix

Examples

```
R <- rcormat(m = 10)$R
eigen(R)
```

rcovmat *Construct a Structured Covariance Matrix for Simulations*

Description

Construct a low-rank covariance matrix with specified eigenvalues, where the eigenvectors are simulated from uniform distributions.

Usage

```
rcovmat(
  eigs = k:1,
  m = 10,
  k = 2,
  perc = list(c(0.4, 0.2, 0.4), c(0.2, 0.4, 0.4)),
  limits = list(l1 = c(0.5, 1), l2 = c(-1, -0.5), l3 = c(-0.1, 0.1)),
  random = TRUE
)
```

Arguments

eigs	Vector of k eigenvalues.
m	Integer; the number of rows and columns of the matrix.
k	Integer; the rank of the matrix.
perc	List of k vectors giving the sampling proportions for the uniform sampling of the eigenvectors, for each dimension.
limits	List of length 2 vectors, one for each uniform sample, giving the lower and upper bounds of the uniform distribution.
random	Logical; randomize the order of the loading per dimension or not.

---

sensory *sensory Data*

Description

Data from 268 panellists rating each of 20 different products on 7 attributes. It is presented in a `data.frame` with 268 observations on 140 variables. Each observation represents a different trained panellist. The columns correspond to products and items. The 20 different products are coded by alphabetic letters from A to T, and the items are coded from 1 to 7. So item C5 corresponds to product C being rated on item 5.

Examples

```
data(sensory)
```

sensory.aux *Auxiliary Information for* sensory *Data*

Description

Auxiliary Information for sensory Data

Format

A data frame with 268 observations on the following 3 variables.

Gender a factor with levels F for females and M for males

Age a factor for age with levels 14 to 24,25 to 34, 35 to 44, and 45 to 55

Consumption a factor for consumption with levels Heavy consumer, Light consumer, and Medium consumer

Source

obtained ~~

Examples

```
data(sensory.aux)
```

simpca *Simulate Data with a Specific Principal Components Structure and Response Style Contamination*

Description

Simulate normally distributed data with specific covariance structure and randomly sampled means. Adds response style contamination.

Usage

```
simpca(
  nr.indv = rep(200, 5),
  m = 10,
  q = 7,
  R = rcormat(m = m),
  err.coeff = 0.1,
  alphamat = rbind(c(0.5, 2, 4), c(10, 2, 10), c(1, 2, 1), c(4, 2, 0.5), c(0.1, 2,
    0.1))[1:length(nr.indv), ],
  randomize = FALSE
)
```

Arguments

nr.indv	Numeric vector of group sizes.
m	Integer; then number of variables to simulate.
q	Integer; the rating scale used 1:q.
R	List with entry named 'R' which is the simulated correlation matrix
err.coeff	Standard error for each variable, added unto R.
alphamat	Matrix containing splines coefficients for te construction of respone styles.
randomize	logical; should the rows of the data be randomly permuted or not?

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trQnorm *Truncated Normal Quantiles*

Description

Quantile function of the truncated normal distribution.

Usage

```
trQnorm(p, mean = 1, sd = 1, a = 0, b = 1)
```

Arguments

p	Vector of probabilities.
mean	The mean of the distribution.
sd	The standard deviation.
a	Lower truncation point.
b	Upper truncation point.

Author(s)

Pieter C. Schoonees

trRnorm *Truncated Normal Sampling*

Description

Random numbers from truncated univariate normal.

Usage

```
trRnorm(n, mu = 0, sd = 1, a = -Inf, b = Inf)
```

Arguments

n	The number of points to sample.
mu	The mean of the distribution.
sd	The standard deviation.
a	The lower truncation point.
b	The upper truncation point.

updateG *Update the Grouping Matrix*

Description

Updates the grouping matrix.

Usage

```
updateG(G, a, bwts2, Fr.bk, const, n, m, q, random = FALSE, info.level = 3)
```

Arguments

G	Grouping matrix.
a	Current value of the row scores.
bwts2	Squared column weights.
Fr.bk	Product of Fr and bkmat.
const	Constant part of the loss function.
n	The number of observations.
m	The number of items.
q	The number of rating categories.
random	Logical indicating whether to randomize the observations.
info.level	Integer controlling the amount of printed.

Author(s)

Pieter Schoonees

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