Package ‘smds’

April 13, 2015

Type Package

Title Symbolic Multidimensional Scaling

Version 1.0

Date 2015-04-10

Author Yoshikazu Terada, Patrick J. F. Groenen

Maintainer Yoshikazu Terada <terada@nict.go.jp>

Depends R (>= 1.8.0), MASS

Description Symbolic multidimensional scaling for interval-valued dissimilarities. The hypersphere model and the hyperbox model are available.

License GPL (>= 2)

NeedsCompilation yes

Repository CRAN

Date/Publication 2015-04-13 12:50:14

R topics documented:

smds-package ................................................................. 2
idistBox ................................................................. 2
idistSph ................................................................. 3
IMDS ................................................................. 4
oil.idiss ................................................................. 6
plot.imds ................................................................. 6

Index 8
smds-package       Symbolic MDS

Description

This package provides the following approaches of symbolic multidimensional scaling. For interval-valued dissimilarities, there are two models: the hypersphere model and the hyperbox model. We can optimize the stress function of each model by the BFGS method or the majorization minimization algorithm.

Details

Package:    smds
Type:    Package
Version:    1.0
Date:    2015-04-10
License:    GPL-2

The function for MDS of interval-valued dissimilarities is \texttt{IMS()}.  

Acknowledgement

This work was supported by Grant-in-Aid for Scientific Research (Grant-in-Aid for Research Activity Start-up: Research Project Number: 2688031).

Author(s)

Yoshikazu Terada and Patrick J. F. Groenen
Maintainer: Yoshikazu Terada <terada@nict.go.jp>

idistBox       Compute the interval distance of the hyperbox model.

Description

Compute the interval distance for given hyperbox objects.

Usage

idistBox(X,R)
idistSph

Arguments

x

The center coordinate matrix

r

The radius matrix.

Value

idistBox returns the interval-valued dissimilarity matrix IDM (an object of class "array": IDM[1,,]: the lower dissimilarity matrix; IDM[2,,]: the upper dissimilarity matrix).

Author(s)

Yoshikazu Terada

idistSph

Compute the interval distance of the hypersphere model.

Description

Compute the interval distance for given hypersphere objects.

Usage

idistSph(x,r)

Arguments

x

The center coordinate matrix

r

The radius vector.

Value

idistSph returns the interval-valued dissimilarity matrix IDM (an object of class "array": IDM[1,,]: the lower dissimilarity matrix; IDM[2,,]: the upper dissimilarity matrix).

Author(s)

Yoshikazu Terada
Describing Multidimensional scaling of interval-valued dissimilarities.

**Usage**

```R
IMDS(idm, p=2, eps = 1e-5, maxit = 1000, model = c("sphere", "box"),
opt.method = c("MM", "BFGS"), ini = "auto", report = 100, grad.num = FALSE,
rel = 0, dil = 1)
```

**Arguments**

- **idm**: The interval-valued dissimilarity matrix (an object of class "array"): `idm[, ,]`: the lower dissimilarity matrix; `idm[, ,]`: the upper dissimilarity matrix.
- **p**: Number of dimensions.
- **eps**: Convergence criterion for the majorization minimization algorithm.
- **maxit**: Maximum number of iterations.
- **model**: If "sphere", then the hypersphere model is used. If "box", then the hyperbox model is used.
- **opt.method**: If "BFGS", then the BFGS method is used for optimizing the stress function. If "MM", then the majorization minimization algorithm is used.
- **ini**: List which consists of an initial center coordinate matrix `ini[[1]]` and an initial radius vector `ini[[2]]` (optional). If "auto", then a configuration of the classical MDS for `(idm[, ,])+(idm[, ,])2` is used as the center coordinate matrix and radii are drawn from the uniform distribution $U(0, 1)$.
- **report**: The frequency of reports. Defaults to every 100 iterations.
- **grad.num**: If FALSE, then exact gradient function is used in the BFGS method. If TRUE, then a numerical gradient is used in the BFGS method.
- **rel**: If acc=1, accelerate by the relaxed update. If acc=0, the relaxed update is not used. Not used for the BFGS method. Defaults to 0.
- **dil**: If acc=1, accelerate by the optimal dilation of the configuration. If acc=0, the optimal dilation is not used. Not used for the BFGS method. Defaults to 1.

**Details**

The default optimization method is a majorization-minimization algorithm with the optimal dilation.

Method "MM" is a majorization-minimization (MM) algorithm for the specified model. If model="box", method "MM" is a MM algorithm, called I-Scal, which is proposed by Groenen et al. (2006). If model="sphere", method "MM" is a MM algorithm which can be considered as I-Scal for the hypersphere model.
Method "BFGS" is a quasi-Newton method (also known as a variable metric algorithm), specifically that published simultaneously in 1970 by Broyden, Fletcher, Goldfarb and Shanno. For more details, see Chapter 15 of Nash (1990).

Value

IMDS returns a list with components:

- **X**: The best coordinate matrix with p columns whose rows give the coordinates of the vertexes.
- **If model="sphere", r**: The best radius vector.
- **If model="box", R**: The best radius matrix with p columns whose rows give the radii of objects.
- **str**: The value of the stress function of IMDS corresponding to X is returned.
- **str.vec**: If "MM", then the vector of values on each iteration is returned.
- **EIDM**: If "MM", then the interval-valued dissimilarity matrix correspondent to the estimated parameters.

Author(s)

Yoshikazu Terada

References


Examples

```r
# Fats and Oil data#
# Apply the hypersphere model via the BFGS method
set.seed(1)
res.bfgs <- IMDS(idm=oil.idiss, p=2, model="sphere", opt.method="BFGS", ini = "auto")
plot(res.bfgs, main="Sph_bfgs")

# Apply the hyperbox model via the BFGS method
set.seed(1)
res.bbox <- IMDS(idm=oil.idiss, p=2, model="box", opt.method="BFGS", ini = "auto")
plot(res.bbox, main="Box_bfgs")
```
set.seed(1)
res.mm <- IMDS(IDM=oil.idiss, p=2, model="box", opt.method="MM", ini = "auto")
plot(res.mm, main="Box_MM")

# oil.idiss

Interval-valued dissimilarity data based on Ichino's fats and oil data

Description
This dataset is interval-valued dissimilarity data of 8 different fats and oil.

Usage
data(oil.idiss)

Format
The interval-valued dissimilarity matrix (an object of class "array": oil.idiss[1,]: the lower dissimilarity matrix; oil.idiss[2,]: the upper dissimilarity matrix).

Examples
data(oil.idiss)

plot.imds
plotting the estimated spheres or boxes.

Description
plotting the estimated hyperspheres or hyperboxes.

Usage
## S3 method for class 'imds'
plot(x, xylim="auto", clab=1:nrow(X), lab.cex=1, lab.col="black", ...)

Arguments

x Object class "imds"
xylim The x limits (xylim[1,1], xylim[1,2]) of the plot. The y limits (xylim[2,1], xylim[2,2]) of the plot. Note that xylim[i,1] > xylim[i,2] (i=1, 2) is allowed and leads to a 'reversed axis'.
clab A character vector for objects.
lab.cex numeric character expansion factor.
lab.col label color.
... further graphical parameters (from par).
Author(s)

Yoshikazu Terada
Index

*Topic datasets
  oil.idiss, 6

idistBox, 2
idistSph, 3
IMDS, 4

oil.idiss, 6

plot.imds, 6

smds (smds-package), 2
smds-package, 2