Package 'OGI'

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Type Package

Title Objective General Index

Version 1.0.0

Description Consider a data matrix of n individuals with p variates. The objective general index (OGI) is a general index that combines the p variates into a univariate index in order to rank the n individuals. The OGI is always positively correlated with each of the variates.
More details can be found in Sei (2016) <doi:10.1016/j.jmva.2016.02.005>.

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Encoding UTF-8

LazyData true

Imports lpSolve (>= 5.6.13), stats (>= 3.3.3), graphics (>= 3.3.3), methods (>= 3.3.3)

Suggests ade4 (>= 1.7.8), bnlearn (>= 4.2), testthat(>= 1.0.2)

RoxygenNote 6.0.1

NeedsCompilation no

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Contents

cov2biu *Bi-unit Canonical Form*

Description

`cov2biu(S)` returns the bi-unit canonical form of `S`.

Usage

```
cov2biu(S, nu = rep(1, nrow(S)), force = FALSE, detail = FALSE)
```

Arguments

`S`	Covariance matrix, especially it is positive semi-definite.
`nu`	Numeric vector of subjective importance. It determines the importance of each of the variates.
`force`	Logical: if force=FALSE, `S` should be strictly positive definite. Default: FALSE.
`detail`	Logical: if detail=TRUE, it returns the list of the bi-unit form and the weight vectors. Default: FALSE.

Value

Numeric matrix of the bi-unit canonical form DSD of S.

Examples

```
S = matrix(0, 5, 5)
S[1,1] = 1
for(j in 2:5) S[1,j] = S[j,1] = -0.5
for(i in 2:5){
  for(j in 2:5){
    if(i == j) S[i,j] = 1
    else S[i,j] = 0.5
  }
}
B=cov2biu(S)
B
```

cov2weight *Weight Vectors of the Bi-unit Canonical Form*

Description

cov2weight(S) returns the numeric vector in which the diagonal elements of the matrix D are arranged, where DSD is the bi-unit canonical form of S.

Usage

```
cov2weight(S, Dvec = rep(1, nrow(S)), nu = rep(1, nrow(S)), tol = 1e-06,
  force = FALSE)
```

Arguments

S	Covariance matrix, especially it is positive semi-definite.
Dvec	Numeric vector of initial values of iteration.
nu	Numeric vector of subjective importance. It determines the importance of each of the variates.
tol	Numeric number of tolerance. If the minimum eigenvalue of S is less than tol, S is considered not to be positive definite.
force	Logical: if force=FALSE, S should be strictly positive definite. Default: FALSE.

Value

Numeric vector of diagonal elements of D, which appears in the bi-unit canonical form DSD of S.

Examples

```
S = matrix(0, 5, 5)
S[1,1] = 1
for(j in 2:5) S[1,j] = S[j,1] = -0.5
for(i in 2:5){
  for(j in 2:5){
    if(i == j) S[i,j] = 1
    else S[i,j] = 0.5
  }
}
weight=cov2weight(S)
weight
```

ogi *Objective General Index*

Description

`ogi(X)` returns the objective general index (OGI) of the covariance matrix `S` of `X`.

Usage

```
ogi(X, se = FALSE, force = FALSE, se.loop = 1000, nu = rep(1, ncol(X)),
  center = TRUE, mar = FALSE)
```

Arguments

`X`	Numeric or ordered matrix.
`se`	Logical: if se=TRUE, it additionally computes `w.se` and `v.se` by bootstrap. Default: FALSE.
`force`	Logical: if force=FALSE, `S` should be strictly positive definite. Default: FALSE.
`se.loop`	Iteration number in bootstrap for computation of standard error.
`nu`	Numeric vector of subjective importance. It determines the importance of each column of `X`.
`center`	Logical: if center=TRUE, `ogi(X)$Z` is centered. Default:TRUE.
`mar`	Logical: if mar=TRUE, each of ordered categorical variates of `X` (if exists) is marginally converted into a numeric vector in advance by the univariate OGI quantification. If mar=FALSE, the simultaneous OGI quantification is applied. Default:FALSE.

Details

Consider a data matrix of n individuals with p variates. The objective general index (OGI) is a general index that combines the p variates into a univariate index in order to rank the n individuals. The OGI is always positively correlated with each of the variates. For more details, see the references.

Value

`value`	The objective general index (OGI).
`X`	The input matrix `X`.
`scaled`	The product of `Z %*% diag(weight)`, where `Z` and `weight` are as follows.
`Z`	Numerical matrix converted from `X`. If center = TRUE, it is centered.
`weight`	The output of `cov2weight(S, nu=nu, force=force)`, where `S` is the covariance matrix of `X`.
`rel.weight`	The product of `weight * sqrt(diag(S))`, where `S` is the covariance matrix of `X`.
`biu`	The bi-unit canonical form of the covariance matrix of `X`.

idx	Numeric vector. If X has ordered categorical variates, idx has (number of levels) -1 number of indexes.
w.se	If requested, w.se is numeric vector of the standard error of weight. It is calculated by bootstrap.
v.se	If requested, v.se is numeric vector of the standard error of value. It is calculated by bootstrap.

References

Sei, T. (2016). An objective general index for multivariate ordered data, Journal of Multivariate Analysis, 147, 247-264. http://www.sciencedirect.com/science/article/pii/S0047259X16000269

Examples

```
CT = matrix(c(
2,1,1,0,0,
8,3,3,0,0,
0,2,1,1,1,
0,0,0,1,1,
0,0,0,0,1), 5, 5, byrow=TRUE)
X = matrix(0, 0, 2)
for(i in 1:5){
  for(j in 1:5){
    if(CT[i,j]>0){
      X = rbind(X, matrix(c(6-i,6-j), CT[i,j], 2, byrow=TRUE))
    }
  }
}
X0 = X
X = as.data.frame(X0)
X[,1] = factor(X0[,1], ordered=TRUE)
X[,2] = factor(X0[,2], ordered=TRUE)
ogiX = ogi(X)
par(pty="s", cex=1.7, mar=c(4.5,3,1,1))
plot(ogiX$scaled, xlim=c(-3,3), ylim=c(-3,3), xlab="Geometry", ylab="Probability")
for(t in 1:nrow(ogiX$scaled)){
  xy = ogiX$scaled[t,]
  g = rep(sum(xy)/2, 2)
  segments(xy[1], xy[2], g[1], g[2], lty=2)
}
arrows(-3, -3, 3, 3)
text(2.5, 2, "OGI/2")
ogiX


f = ordered(1:10)
f[sample(1:10, 20, replace=TRUE)]
Y = ogi(f)$value
plot((1:10)/(10+1), Y, type="b")
xs = (1:1000)/1001
points(xs, qnorm(xs), type="l", col="red")
```

```
X = USJudgeRatings
ogiX = ogi(X)
nameX = ordered(names(X), names(X))
plot(nameX, ogiX$weight, las=3, cex.axis=0.8, ylim=c(0,1.2), ylab="weight")
```

Index