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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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**

```r
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

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[,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")
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