Package 'FGalgorithm'

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Title Flury and Gautschi algorithms

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Description This is a package for implementation of Flury-Gautschi algorithms.

License GPL (>= 2)

NeedsCompilation no

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`FGalgorithm-package` *Execute the Flury and Gautschi diagonalisation algorithm, which tries to simultaneously diagonalize a set of symmetric positive definite matrices.*

Description

The minimization of the objective function

$$\Phi(B) = \prod_{i=1}^{k} \left[\frac{\det(diag(B' A_i B))}{\det(B' A_i B)} \right]^{n_i}$$

is required for a potpourri of statistical problems. This algorithm (Flury & Gautschi, 1984) is designed to find an orthogonal matrix B_0 of dimension $p \times p$ such that

$$\Phi(B) \geq \Phi(B_0)$$

for all orthogonal matrices B. The matrices A_1,...,A_k are positive-definite and are usually sample covariance matrices and n_is are positive real numbers.

It can be shown (Flury, 1983) that if $B_0 = [b_1, b_2, \ldots, b_p]$, then the following system of equations holds:

$$b_l{}' \left[\sum_{i=1}^{k} n_i \frac{\lambda_{il} - \lambda_{ij}}{\lambda_{il}\lambda_{ij}} A_i \right] b_j = 0 \qquad (l, j = 1, \ldots, p; l \neq j)$$

where

$$\lambda_{ih} = b_h{}' A_i b_h \qquad (i = 1, \ldots, k; h = 1, \ldots, p).$$

In other words, Flury and Gautschi algorithms find the solution B_0 of the above system of equations. Also, this algorithm can be used to find the maximum likelihood estimates of common principal components in k groups (Flury,1984).

Details

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Author(s)

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References

Flury, B. N. (1983), "A generalization of principal component analysis to k groups", Technical Report No. 83-14, Dept. of Statistics, Purdue University.

Flury, B. N. (1984). Common principal components in k groups. Journal of the American Statistical Association, 79(388), 892-898.

Flury, B. N., & Gautschi, W. (1984). An algorithm for simultaneous orthogonal transformation of several positive definite symmetric matrices to nearly diagonal form. SIAM Journal on Scientific and Statistical Computing, 7(1), 169-184.

FGalgorithm *Flury and Gautschi algorithms*

Description

Find the orthogonal matrix B_0 such that minimize $\Phi(B)$.

Usage

```
FGalgorithm(eF, eG, p, n , A)
```

Arguments

eF,eG	small positive constants controlling error terms.
p	dimensionality.
n	a numeric vector containing the positive integers.
A	a list of length k of positive definite symmetric matrices.

Value

Orthogonal matrix B_0 such that minimize Φ with respect to the group of orthogonal matrices B.

Author(s)

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References

Flury, B. N., & Gautschi, W. (1986). An algorithm for simultaneous orthogonal transformation of several positive definite symmetric matrices to nearly diagonal form. SIAM Journal on Scientific and Statistical Computing, 7(1), 169-184.

Examples

```
n<-numeric(3)
n[[1]]<-50
n[[2]]<-50
n[[3]]<-50
A<-vector("list",length=3)
A[[1]]<-var(iris[51:100,1:4])
A[[2]]<-var(iris[101:150,1:4])
A[[3]]<-var(iris[1:50,1:4])
B0<-FGalgorithm(1e-5,1e-5,4,n,A)
B0
```

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