Package `FGalgorithm`

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**Date** 2013-06-04  
**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  
**Repository** CRAN  
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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

\[
\Phi(B) = \prod_{i=1}^{k} \left[ \frac{\det(\text{diag}(B'A_iB))}{\det(B'A_iB)} \right]^{n_i}
\]
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 $A_1, \ldots, A_k$ are positive-definite and are usually sample
covariance matrices and $n_i$s 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:

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

where

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

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).

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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.

Association, 79(388), 892-898.

several positive definite symmetric matrices to nearly diagonal form. SIAM Journal on Scientific
**FGalgorithm**

*Flury and Gautschi algorithms*

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**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 $\Phi$ with respect to the group of orthogonal matrices $B$.

**Author(s)**

Dariush Najarzadeh

**References**


**Examples**

```r
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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