

# Package: FGalgorithm (via r-universe)

September 5, 2024

**Version** 1.0

**Date** 2013-06-04

**Title** Flury and Gautschi algorithms

**Author** Dariush Najarzadeh

**Maintainer** Dariush Najarzadeh <D\_Najarzadeh@sbu.ac.ir>

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

**License** GPL (>= 2)

**NeedsCompilation** no

**Repository** CRAN

**Date/Publication** 2013-06-04 11:04:39

## Contents

FGalgorithm-package . . . . .	1
FGalgorithm . . . . .	3
<b>Index</b>	<b>4</b>

---

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

---

## Description

The minimization of the objective function

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

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  $A_1, \dots, A_k$  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  $B_0 = [b_1, b_2, \dots, b_p]$ , then the following system of equations holds:

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

where

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

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

Package: FGalgorithm  
 Type: Package  
 Version: 1.0  
 Date: 2012-11-14  
 License: GPL (>= 2)

## Author(s)

Dariush Najarzadeh

Maintainer: Dariush Najarzadeh <D\_Najarzadeh@sbu.ac.ir>

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

**Author(s)**

Dariusz Najjarzadeh

**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
```

# Index

\* **Flury and Gautschi algorithm**

FGalgorithm, [3](#)

FGalgorithm-package, [1](#)

FGalgorithm, [3](#)

FGalgorithm-package, [1](#)