

Package ‘BMconcor’

July 21, 2025

Title CONCOR for Structural- And Regular-Equivalence Blockmodeling

Version 2.0.0

Description The four functions `svdcp()` ('cp' for column partitioned), `svdbip()` or `svdbip2()` ('bip' for bi-partitioned), and `svdbips()` ('s' for a simultaneous optimization of a set of 'r' solutions), correspond to a singular value decomposition (SVD) by blocks notion, by supposing each block depending on relative subspaces, rather than on two whole spaces as usual SVD does. The other functions, based on this notion, are relative to two column partitioned data matrices x and y defining two sets of subsets x_i and y_j of variables and amount to estimate a link between x_i and y_j for the pair (x_i, y_j) relatively to the links associated to all the other pairs. These methods were first presented in: Lafosse R. & Hanafi M.,(1997) <<https://eudml.org/doc/106424>> and Hanafi M. & Lafosse, R. (2001) <<https://eudml.org/doc/106494>>.

License GPL (>= 3)

URL <https://fatelarico.github.io/BMconcor/>

Encoding UTF-8

RoxygenNote 7.3.1

NeedsCompilation no

Author Roger Lafosse [aut],
Fabio Ashtar Telarico [cre, aut] (ORCID:
<<https://orcid.org/0000-0002-8740-7078>>)

Maintainer Fabio Ashtar Telarico <Fabio-Ashtar.Telarico@fdv.uni-lj.si>

Repository CRAN

Date/Publication 2024-05-02 13:22:42 UTC

Contents

| | |
|------------------------|---|
| concor | 2 |
| concorcano | 3 |
| concoreg | 4 |
| concorgm | 5 |
| concorgmcano | 7 |
| concorgmreg | 8 |

| | |
|--------------|-----------|
| concors | 9 |
| concorscano | 10 |
| concorsreg | 12 |
| svdbip | 13 |
| svdbip2 | 14 |
| svdbips | 15 |
| svdcp | 16 |
| Index | 18 |

| | |
|--------|---|
| concor | <i>Relative links of several subsets of variables</i> |
|--------|---|

Description

Relative links of several subsets of variables Y_j with another set X . SUCCESSIVE SOLUTIONS

Usage

concor(x, y, py, r)

Arguments

- x are the n times p and n times q matrices of p and q centered column
- y See x
- py The partition vector of y. A row vector containing the numbers q_i for $i = 1, \dots, k_y$ of the k_y subsets y_i of y : $\sum(q_i) = \sum(py) = q$.
- r The number of wanted successive solutions

Details

The first solution calculates $1+k_x$ normed vectors: the vector $u[:, 1]$ of R_p associated to the k_y vectors $v_i[:, 1]$'s of R_{q_i} , by maximizing $\sum_i \text{cov}(x * u[:, k], y_i * v_i[:, k])^2$, with $1+k_y$ norm constraints on the axes. A component $(x)(u[:, k])$ is associated to k_y partial components $(y_i)(v_i[:, k])$ and to a global component $y * V[:, k]$. $\text{cov}((x)(u[:, k]), (y)(V[:, k]))^2 = \sum \text{cov}((x)(u[:, k]), (y_i)(v_i[:, k]))^2$. $(y)(V[:, k])$ is a global component of the components $(y_i)(v_i[:, k])$. The second solution is obtained from the same criterion, but after replacing each y_i by $y_i - (y_i)(v_i[:, 1])(v_i[:, 1]')$. And so on for the successive solutions 1,2,...,r. The biggest number of solutions may be $r = \inf(n, p, q_i)$, when the $(x')(y_i')(s)$ are supposed with full rank; then $r_{\max} = \min(c(\min(py), n, p))$. For a set of r solutions, the matrix $u'X'YV$ is diagonal and the matrices $u'X'Y_j v_j$ are triangular (good partition of the link by the solutions). concor.m is the svdcp.m function applied to the matrix $x'y$.

Value

- A list with following components:
- u A p times r matrix of axes in Rp relative to x; (u^{prime})(u) = Identity
 - v A q times r matrix of ky row blocks vi (qi x r) of axes in Rqi relative to yi; vi^{prime}*vi = Identity
 - V A q times r matrix of axes in Rq relative to y; Vprime*V = Identity
 - cov2 A ky times r matrix; each column k contains ky squared covariances $\text{cov}(x * u[,k], y_i * v_i[,k])^2$, the partial measures of link

Author(s)

Lafosse, R.

References

Lafosse R. & Hanafi M.(1997) Concordance d'un tableau avec K tableaux: Definition de K+1 uples synthetiques. Revue de Statistique Appliquee vol.45,n.4.

Examples

```
# To make some "GPA" : so, by posing the compromise X = Y,
# "procrustes" rotations to the "compromise X" then are :
# Yj*(vj*u').
x <- matrix(runif(50),10,5);y <- matrix(runif(90),10,9)
x <- scale(x);y <- scale(y)
co <- concor(x,y,c(3,2,4),2)
```

| | |
|------------|--|
| concorcano | <i>Canonical analysis of several sets with another set</i> |
|------------|--|

Description

Relative proximities of several subsets of variables Yj with another set X. SUCCESSIVE SOLUTIONS

Usage

```
concorcano(x, y, py, r)
```

Arguments

- x are the n times p and n times q matrices of p and q centered column
- y See x
- py The partition vector of y. A row vector containing the numbers qi for i = 1, . . . ,ky of the ky subsets yi of y : $\text{sum}(q_i)=\text{sum}(p_y)=q$.
- r The number of wanted successive solutions

Details

The first solution calculates a standardized canonical component $cx[, 1]$ of x associated to ky standardized components $cyi[, 1]$ of y_i by maximizing $\sum_i \rho(cx[, 1], cyi[, 1])^2$. The second solution is obtained from the same criterion, with ky orthogonality constraints for having $\rho(cyi[, 1], cyi[, 2])=0$ (that implies $\rho(cx[, 1], cx[, 2])=0$). For each of the $1+ky$ sets, the r canonical components are 2 by 2 zero correlated. The ky matrices $(cx)'*cyi$ are triangular. This function uses `concor` function.

Value

A list with following components:

| | |
|-------------------|---|
| <code>cx</code> | a n times r matrix of the r canonical components of x |
| <code>cy</code> | a $n.ky$ times r matrix. The ky blocks cyi of the rows $n*(i-1)+1 : n*i$ contain the r canonical components relative to Y_i |
| <code>rho2</code> | a ky times r matrix; each column k contains ky squared canonical correlations $\rho(cx[, k], cyi[, k])^2$ |

Author(s)

Lafosse, R.

References

Hanafi & Lafosse (2001) Generalisation de la regression lineaire simple pour analyser la dependance de K ensembles de variables avec un $K+1$ eme. *Revue de Statistique Appliquee* vol.49, n.1

Examples

```
x <- matrix(runif(50),10,5);y <- matrix(runif(90),10,9)
x <- scale(x);y <- scale(y)
ca <- concorcano(x,y,c(3,2,4),2)
```

concoreg

Redundancy of sets y_j by one set x

Description

Regression of several subsets of variables Y_j by another set X . SUCCESSIVE SOLUTIONS

Usage

```
concoreg(x, y, py, r)
```

Arguments

| | |
|----|--|
| x | are the n times p and n times q matrices of p and q centered column |
| y | See x |
| py | The partition vector of y. A row vector containing the numbers qi for i = 1, . . . , ky of the ky subsets yi of y : $\sum(q_i) = \sum(py) = q$. |
| r | The number of wanted successive solutions |

Value

A list with following components:

| | |
|--------|--|
| cx | a n times r matrix of the r explanatory components |
| v | is a $q \times r$ matrix of ky row blocks v_i ($q_i \times r$) of axes in Rqi relative to yi; $v'_i * v_i = Id$ |
| V | is a $q \times r$ matrix of axes in Rq relative to y; $V' * V = Id$ |
| varexp | is a $ky \times r$ matrix; each column k contains ky explained variances $\rho(cx[,k], y_i * v_i[,k])^2 \text{var}(y_i * v_i[,k])$ |

Author(s)

Lafosse, R.

References

Lafosse R. & Hanafi M. (1997) Concordance d'un tableau avec K tableaux: Definition de K+1 uples synthetiques. Revue de Statistique Appliquee vol.45,n.4.

Chessel D. & Hanafi M. (1996) Analyses de la Co-inertie de K nuages de points. Revue de Statistique Appliquee vol.44, n.2. (this ACOM analysis of one multiset is obtained by the command : `concoreg(Y,Y,py,r)`)

Examples

```
x <- matrix(runif(50),10,5); y <- matrix(runif(90),10,9)
x <- scale(x); y <- scale(y)
co <- concoreg(x,y,c(3,2,4),2)
```

concoregm

Analyzing a set of partial links between Xi and Yj

Description

Analyzing a set of partial links between Xi and Yj, SUCCESSIVE SOLUTIONS

Usage

```
concorgm(x, px, y, py, r)
```

Arguments

| | |
|-----------|--|
| x | are the n times p and n times q matrices of p and q centered column |
| px | A row vector which contains the numbers p_i , $i=1,\dots,k_x$, of the k_x subsets x_i of x : $\sum(p_i)=\sum(px)=p$. px is the partition vector of x |
| y | See x |
| py | The partition vector of y . A row vector containing the numbers q_i for $i = 1, \dots, k_y$ of the k_y subsets y_i of y : $\sum(q_i)=\sum(py)=q$. |
| r | The number of wanted successive solutions $r_{\max} \leq \min(\min(px), \min(py), n)$ |

Details

The first solution calculates $1+k_x$ normed vectors: the vector $u[:, 1]$ of R_p associated to the k_y vectors $v_i[:, 1]$'s of R_{q_i} , by maximizing $\sum(\text{cov}((x)(u[, k]), (y_i)(v_i[, k]))^2)$, with $1+k_y$ norm constraints on the axes. A component $(x)(u[, k])$ is associated to k_y partial components $(y_i)(v_i[, k])$ and to a global component $y*V[, k]$. $\text{cov}((x)(u[, k]), (y)(V[, k]))^2 = \sum(\text{cov}((x)(u[, k]), (y_i)(v_i[, k]))^2)(y)(V[, k])$ is a global component of the components $(y_i)(v_i[, k])$. The second solution is obtained from the same criterion, but after replacing each y_i by $y_i - (y_i)(v_i[, 1])(v_i[, 1]')$. And so on for the successive solutions $1, 2, \dots, r$. The biggest number of solutions may be $r = \inf(n, p, q_i)$, when the $(x')(y_i')(s)$ are supposed with full rank; then $r_{\max} = \min(c(\min(py), n, p))$. For a set of r solutions, the matrix $u'X'YV$ is diagonal and the matrices $u'X'Y_jv_j$ are triangular (good partition of the link by the solutions). `concor.m` is the `svdcp.m` function applied to the matrix $x'y$.

Value

A list with following components:

| | |
|-------------|--|
| u | a p times r matrix of axes in R_p relative to x ; $u^{\text{prime}}*u = \text{Identity}$ |
| v | a q times r matrix of k_y row blocks v_i ($q_i \times r$) of axes in R_{q_i} relative to y_i ; $v_i^{\text{prime}}*v_i = \text{Identity}$ |
| cov2 | a k_y times r matrix; each column k contains k_y squared covariances $\text{cov}((x)(u[, k]), (y_i)(v_i[, k]))^2$, the partial measures of link |

Author(s)

Lafosse, R.

References

Kissita, Cazes, Hanafi & Lafosse (2004) Deux methodes d'analyse factorielle du lien entre deux tableaux de variables partitionn?es. *Revue de Statistique Appliqu?e*, Vol 52, n. 3, 73-92.

Examples

```
x <- matrix(runif(50),10,5);y <- matrix(runif(90),10,9)
x <- scale(x);y <- scale(y)
cg <- concorgm(x,c(2,3),y,c(3,2,4),2)
cg$cov2[1,1,]
```

concorgmcano

*Canonical analysis of subsets Yj with subsets Xi***Description**

Canonical analysis of subsets Yj with subsets Xi. Relative valuations by squared correlations of the proximities of subsets Xi with subsets Yj. SUCCESSIVE SOLUTIONS

Usage

```
concorgmcano(x, px, y, py, r)
```

Arguments

| | |
|----|--|
| x | are the n times p and n times q matrices of p and q centered column |
| px | The row vector which contains the numbers pi, i=1,...,kx, of the kx subsets xi of x : $\sum_i p_i = \text{sum}(px) = p$. px is the partition vector of x |
| y | See x |
| py | The partition vector of y. A row vector containing the numbers qi for i = 1, . . . , ky of the ky subsets yi of y : $\text{sum}(q_i) = \text{sum}(py) = q$. |
| r | The number of wanted successive solutions $r_{\max} \leq \min(\min(px), \min(py), n)$ |

Details

For the first solution, $\text{sum}_i \text{sum}_j \text{rho2}(cx_i[, 1], cy_j[, 1])$ is the optimized criterion. The other solutions are calculated from the same criterion, but with orthogonalities for having two by two zero correlated the canonical components defined for each xi, and also for those defined for each yj. Each solution associates kx canonical components to ky canonical components. When kx = 1 (px=p), take concorcano function This function uses the concorgm function

Value

A list with following components:

| | |
|------|---|
| cx | is a n.kx times r matrix of kx row blocks cxi (n x r). Each row block contains r partial canonical components |
| cy | is a n.ky times r matrix of ky row blocks cyj (n x r). Each row block contains r partial canonical components |
| rho2 | is a kx time ky tims r array; for a fixed solution k, rho2[, , k] contains kxky squared correlations $\text{rho2}(cx[n*(i-1)+1 : n*i, k], cy[n*(j-1)+1 : n*j, k])$, simultaneously calculated between all the yj with all the xi |

Author(s)

Lafosse, R.

References

Kissita G., Analyse canonique generalisee avec tableau de reference generalisee. Thesis, Ceremade Paris 9 Dauphine (2003).

Examples

```
x <- matrix(runif(50),10,5);y <- matrix(runif(90),10,9)
x <- scale(x);y <- scale(y)
cc <- concordmcano(x,c(2,3),y,c(3,2,4),2)
cc$rho2[1,1,]
```

concordmreg

Regression of subsets Yj by subsets Xi

Description

Regression of subsets Yj by subsets Xi for comparing all the explanatory-explained pairs (Xi,Yj).
SUCCESSIVE SOLUTIONS

Usage

```
concordmreg(x, px, y, py, r)
```

Arguments

| | |
|----|--|
| x | are the n times p and n times q matrices of p and q centered column |
| px | A row vector which contains the numbers pi, i = 1,...,kx, of the kx subsets xi of x : sum(pi)=sum(px)=p. px is the partition vector of x |
| y | See x |
| py | The partition vector of y. A row vector containing the numbers qi for i = 1, . . . ,ky of the ky subsets yi of y : sum(qi)=sum(py)=q. |
| r | The number of wanted successive solutions |

Details

For the first solution, $\sum_i \sum_j \rho_2(cx_i[, 1], y_j * v_j[, 1]) \text{var}(y_j * v_j[, 1])$ is the optimized criterion. The second solution is calculated from the same criterion, but with $y_j - y_j * v_j[, 1] * v_j[, 1]'$ instead of the matrices yj and with orthogonalities for having two by two zero correlated the explanatory components defined for each matrix xi. And so on for the other solutions. One solution k associates kx explanatory components (in cx[,k]) to ky explained components. When kx =1 (px = p), take concordmreg function This function uses the concordm function

Value

A list with following components:

| | |
|---------------------|---|
| <code>cx</code> | a n times r matrix of the r explanatory components |
| <code>v</code> | is a $q \times r$ matrix of q_y row blocks v_i ($q_i \times r$) of axes in R_{qi} relative to y_i ; $v_i' * v_i = Id$ |
| <code>varexp</code> | is a $k_x \times k_y \times r$ array; for a fixed solution k , the matrix <code>varexp[, , k]</code> contains $k_x k_y$ explained variances obtained by a simultaneous regression of all the y_j by all the x_i , so the values $\rho_2(cx[n*(i-1)+1 : n*i, k], y_j * v_j[, k])var(y_j * v_j[, k])$ |

Author(s)

Lafosse, R.

References

Hanafi & Lafosse (2004) Regression of a multi-set by another based on an extension of the SVD. COMPSTAT'2004 Symposium

Examples

```
x <- matrix(runif(50),10,5);y <- matrix(runif(90),10,9)
x <- scale(x);y <- scale(y)
cr <- concorgmreg(x,c(2,3),y,c(3,2,4),2)
cr$varexp[1,1,]
```

concors

simultaneous concorgm

Description

concorgm with the set of r solutions simultaneously optimized

Usage

```
concors(x, px, y, py, r)
```

Arguments

| | |
|-----------------|---|
| <code>x</code> | are the n times p and n times q matrices of p and q centered column |
| <code>px</code> | A row vector which contains the numbers p_i , $i=1,\dots,k_x$, of the k_x subsets x_i of x : $\sum(p_i)=\sum(px)=p$. <code>px</code> is the partition vector of x |
| <code>y</code> | See <code>x</code> |
| <code>py</code> | The partition vector of y . A row vector containing the numbers q_i for $i = 1, \dots, k_y$ of the k_y subsets y_i of y : $\sum(q_i)=\sum(py)=q$. |
| <code>r</code> | The number of wanted successive solutions $r_{max} \leq \min(\min(px), \min(py), n)$ |

Details

This function uses the svdbips function

Value

A list with following components:

- u a p times r matrix of axes in Rp relative to x; $u^{prime} * u = Identity$
- v a q times r matrix of ky row blocks vi (qi x r) of axes in Rqi relative to yi;
vi^{prime} * vi = Identity
- cov2 a ky times r matrix; each column k contains ky squared covariances $cov(x * u[, k], y_i * v_i[, k])^2$, the partial measures of link

Author(s)

Lafosse, R.

References

Lafosse R. & Hanafi M.(1997) Concordance d’un tableau avec K tableaux: Definition de K+1 uples synthetiques. Revue de Statistique Appliquee vol.45,n.4.

Examples

```
x <- matrix(runif(50),10,5);y <- matrix(runif(90),10,9)
x <- scale(x);y <- scale(y)
cs <- concors(x,c(2,3),y,c(3,2,4),2)
cs$cov2[1,1,]
```

| | |
|-------------|----------------------------------|
| concorscano | <i>simultaneous concorgmcano</i> |
|-------------|----------------------------------|

Description

concorgmcano with the set of r solutions simultaneously optimized

Usage

```
concorscano(x, px, y, py, r)
```

Arguments

| | |
|-----------------|--|
| <code>x</code> | are the n times p and n times q matrices of p and q centered column |
| <code>px</code> | A row vector which contains the numbers p_i , $i=1,\dots,kx$, of the kx subsets x_i of x : $\text{sum}(p_i)=\text{sum}(px)=p$. px is the partition vector of x |
| <code>y</code> | See x |
| <code>py</code> | The partition vector of y . A row vector containing the numbers q_i for $i = 1, \dots, ky$ of the ky subsets y_i of y : $\text{sum}(q_i)=\text{sum}(py)=q$. |
| <code>r</code> | The number of wanted successive solutions $r_{\max} \leq \min(\min(px), \min(py), n)$ |

Details

This function uses the `concors` function

Value

A list with following components:

| | |
|-------------------|--|
| <code>cx</code> | a n times r matrix of the r canonical components of x |
| <code>cy</code> | a $n.ky$ times r matrix. The ky blocks cy_i of the rows $n*(i-1)+1 : n*i$ contain the r canonical components relative to Y_i |
| <code>cov2</code> | a ky times r matrix; each column k contains ky squared covariances $\text{cov}(x * u[,k], y_i * v_i[,k])^2$, the partial measures of link |

Author(s)

Lafosse, R.

References

Hanafi & Lafosse (2001) Generalisation de la regression lineaire simple pour analyser la dependance de K ensembles de variables avec un $K+1$ eme. *Revue de Statistique Appliquee* vol.49, n.1

Examples

```
x <- matrix(runif(50),10,5);y <- matrix(runif(90),10,9)
x <- scale(x);y <- scale(y)
cca <- concorscano(x,c(2,3),y,c(3,2,4),2)
cca$rho2[1,1,]
```

concorsreg

*Redundancy of sets yj by one set x***Description**

Regression of several subsets of variables Yj by another set X. SUCCESSIVE SOLUTIONS

Usage

```
concorsreg(x, px, y, py, r)
```

Arguments

| | |
|----|---|
| x | are the n times p and n times q matrices of p and q centered column |
| px | The row vector which contains the numbers p_i , $i = 1, \dots, k_x$, of the k_x subsets x_i of x : $\sum_i p_i = \text{sum}(px) = p$. px is the partition vector of x |
| y | See x |
| py | The partition vector of y. A row vector containing the numbers q_i for $i = 1, \dots, k_y$ of the k_y subsets y_i of y : $\text{sum}(q_i) = \text{sum}(py) = q$. |
| r | The number of wanted successive solutions |

Value

A list with following components:

| | |
|--------|---|
| cx | a n times r matrix of the r explanatory components |
| v | is a $q \times r$ matrix of k_y row blocks v_i ($q_i \times r$) of axes in R_{q_i} relative to y_i ; $v_i' * v_i = \text{Id}$ |
| varexp | is a $k_y \times r$ matrix; each column k contains k_y explained variances $\rho(cx[, k], y_i * v_i[, k])^2 \text{var}(y_i * v_i[, k])$ |

Author(s)

Lafosse, R.

Examples

```
x <- matrix(runif(50),10,5);y <- matrix(runif(90),10,9)
x <- scale(x);y <- scale(y)
crs <- concorsreg(x,c(2,3),y,c(3,2,4),2)
crs$varexp[1,1,]
```

| | |
|--------|---|
| svdbip | <i>SVD for one bipartitioned matrix x</i> |
|--------|---|

Description

SVD for bipartitioned matrix x. r successive Solutions

Usage

svdbip(x, K, H, r)

Arguments

| | |
|---|---|
| x | a p times q matrix |
| K | is a row vector which contains the numbers pk, k=1,...,kx, of the partition of x with kx row blocks : $\sum(pk)=p$ |
| H | is a row vector which contains the numbers qh, h=1,...,ky, of the partition of x with ky column blocks : $\sum(qh)=q$ |
| r | The number of wanted successive solutions |

Details

The first solution calculates $kx+ky$ normed vectors: kx vectors $uk[:, 1]$ of R^{pk} associated to ky vectors $vh[:, 1]$'s of R^{qh} , by maximizing $\sum_k \sum_h (u_k[:, 1]^{prime} * x_{kh} * v_h[:, 1])^2$, with $kx+ky$ norm constraints. A value $(u_k[:, 1]^{prime} * x_{kh} * v_h[:, 1])^2$ measures the relative link between R^{pk} and R^{qh} associated to the block x_{kh} . The second solution is obtained from the same criterion, but after replacing each x_{kh} by $x_{kh} - x_{kh}v_hv_h' - ukuk'x_{kh} + ukuk'x_{kh}v_hv_h'$. And so on for the successive solutions 1,2,...,r . The biggest number of solutions may be $r=\inf(pk,qh)$, when the x_{kh} 's are supposed with full rank; then $rmax=\min([\min(K), \min(H)])$. When $K=p$ (or $H=q$, with $t(x)$), svdcp function is better. When $H=q$ and $K=p$, it is the usual svd (with squared singular values). Convergence of algorithm may be not global. So the below proposed initialisation of the algorithm may be not very suitable for some data sets. Several different random initialisations with normed vectors might be considered and the best result then choosen.

Value

A list with following components:

| | |
|---|--|
| u | a p times r matrix of kx row blocks uk ($pk \times r$); $uk' * uk = Identity$. |
| v | a q times r matrix of ky row blocks vi ($qi \times r$) of axes in R_{qi} relative to yi ; $vi^{prime} * vi = Identity$ |
| s | a kx times ky times r array; with r fixed, each matrix contains $kxky$ values $(u_h' * x_{kh} * v_k)^2$, the partial (squared) singular values relative to x_{kh} . |

Author(s)

Lafosse, R.

References

Kissita G., Cazes P., Hanafi M. & Lafosse (2004) Deux methodes d'analyse factorielle du lien entre deux tableaux de variables partitionees. Revue de Statistique Appliquee.

Examples

```
x <- matrix(runif(200),10,20)
s <- svdbip(x,c(3,4,3),c(5,15),3)
```

svdbip2

SVD for bipartitioned matrix x

Description

SVD for bipartitioned matrix x. r successive Solutions. As SVDBIP, but with another algorithm and another initialisation

Usage

```
svdbip2(x, K, H, r)
```

Arguments

| | |
|---|--|
| x | a p times q matrix |
| K | is a row vector which contains the numbers pk, k=1,...,kx, of the partition of x with kx row blocks : sum(pk)=p |
| H | is a row vector which contains the numbers qh, h=1,...,ky, of the partition of x with ky column blocks : sum(qh)=q |
| r | The number of wanted successive solutions |

Details

The first solution calculates $k_x + k_y$ normed vectors: k_x vectors $u_k[:, 1]$ of R^{p_k} associated to k_y vectors $v_h[:, 1]$'s of R^{q_h} , by maximizing $\sum_k \sum_h (u_k[:, 1]' * x_{kh} * v_h[:, 1])^2$, with $k_x + k_y$ norm constraints. A value $(u_k[:, 1]' * x_{kh} * v_h[:, 1])^2$ measures the relative link between R^{p_k} and R^{q_h} associated to the block x_{kh} . The second solution is obtained from the same criterion, but after replacing each x_{kh} by $x_{kh} - x_{kh} v_h v_h' - u_k u_k' x_{kh} + u_k u_k' x_{kh} v_h v_h'$. And so on for the successive solutions 1,2,...,r . The biggest number of solutions may be $r = \inf(pk, qh)$, when the x_{kh} 's are supposed with full rank; then $r_{max} = \min(\lfloor \min(K), \min(H) \rfloor)$. When $K=p$ (or $H=q$, with $t(x)$), svdcp function is better. When $H=q$ and $K=p$, it is the usual svd (with squared singular values). Convergence of algorithm may be not global. So the below proposed initialisation of the algorithm may be not very suitable for some data sets. Several different random initialisations with normed vectors might be considered and the best result then choosen

Value

A list with following components:

- u a p times r matrix of k_x row blocks u_k ($p_k \times r$); $u_k' * u_k = \text{Identity}$.
- v a q times r matrix of k_y row blocks v_i ($q_i \times r$) of axes in R_{q_i} relative to y_i ;
 $v_i^{\text{prime}} * v_i = \text{Identity}$
- s a k_x times k_y times r array; with r fixed, each matrix contains $k_x k_y$ values
 $(u_h' * x_{kh} * v_k)^2$, the partial (squared) singular values relative to x_{kh} .

Author(s)

Lafosse, R.

References

Kissita G., Analyse canonique generalisee avec tableau de reference generalisee. Thesis, Ceremade Paris 9 Dauphine (2003)

Examples

```
x <- matrix(runif(200),10,20)
s2 <- svdbip2(x,c(3,4,3),c(5,5,10),3);s2$s2
s1 <- svdbip(x,c(3,4,3),c(5,5,10),3);s1$s2
```

svdbips

SVD for bipartitioned matrix x

Description

SVD for bipartitioned matrix x. SIMULTANEOUS SOLUTIONS. ("simultaneous svdbip")

Usage

```
svdbips(x, K, H, r)
```

Arguments

- x a p times q matrix
- K is a row vector which contains the numbers p_k , $k=1,...,k_x$, of the partition of x
with k_x row blocks : $\text{sum}(p_k)=p$
- H is a row vector which contains the numbers q_h , $h=1,...,k_y$, of the partition of x
with k_y column blocks : $\text{sum}(q_h)=q$
- r The number of wanted successive solutions

Details

One set of r solutions is calculated by maximizing $\sum_i \sum_k \sum_h (u_k[,i]' * x_{kh} * v_h[,i])^2$, with $kx+ky$ orthonormality constraints (for each u_k and each v_h). For each fixed r value, the solution is totally new (does'nt consist to complete a previous calculus of one set of $r-1$ solutions). $rmax = \min(\lfloor \min(K), \min(H) \rfloor)$. When $r=1$, it is svdbip (thus it is svdcp when $r=1$ and $kx=1$). Convergence of algorithm may be not global. So the below proposed initialisation of the algorithm may be not very suitable for some data sets. Several different random initialisations with normed vectors might be considered and the best result then choosen....

Value

A list with following components:

- `u` a p times r matrix of kx row blocks u_k ($p_k \times r$); $u_k' * u_k = \text{Identity}$.
- `v` a q times r matrix of ky row blocks v_i ($q_i \times r$) of axes in R_{q_i} relative to y_i ; $v_i^{\text{prime}} * v_i = \text{Identity}$
- `s` a kx times ky times r array; with r fixed, each matrix contains $kxky$ values $(u_h' * x_{kh} * v_k)^2$, the partial (squared) singular values relative to x_{kh} .

Author(s)

Lafosse, R.

References

Lafosse R. & Ten Berge J. A simultaneous CONCOR method for the analysis of two partitioned matrices. submitted.

Examples

```
x <- matrix(runif(200),10,20)
s1 <- svdbip(x,c(3,4,3),c(5,5,10),2);sum(sum(sum(s1$s2)))
ss <- svdbips(x,c(3,4,3),c(5,5,10),2);sum(sum(sum(ss$s2)))
```

svdcp

SVD for a Column Partitioned matrix x

Description

SVD for a Column Partitioned matrix x . r global successive solutions

Usage

```
svdcp(x, H, r)
```


Arguments

| | |
|---|---|
| x | a p times q matrix |
| H | is a row vector which contains the numbers qh, h=1,...,ky, of the partition of x with ky column blocks : $\sum(qh)=q$ |
| r | The number of wanted successive solutions |

Details

The first solution calculates $1+kx$ normed vectors: the vector $u[,1]$ of R^p associated to the kx vectors $v_i[,1]$'s of R^{q_i} . by maximizing $\sum_i (u[,1]' * x_i * v_i[,1])^2$, with $1+kx$ norm constraints. A value $(u[,1]' * x_i * v_i[,1])^2$ measures the relative link between R^p and R^{q_i} associated to x_i . It corresponds to a partial squared singular value notion, since $\sum_i (u[,1]' * x_i * v_i[,1])^2 = s^2$, where s is the usual first singular value of x . The second solution is obtained from the same criterion, but after replacing each x_i by $x_i - x_i * v_i[,1] * v_i[,1]'$. And so on for the successive solutions 1,2,...,r . The biggest number of solutions may be $r = \inf(p, q_i)$, when the x_i 's are supposed with full rank; then $r_{\max} = \min(\min(H), p)$.

Value

A list with following components:

| | |
|---|--|
| u | a p times r matrix of kx row blocks u_k ($p \times r$); $u_k' * u_k = \text{Identity}$. |
| v | a q times r matrix of ky row blocks v_i ($q_i \times r$) of axes in R^{q_i} relative to y_i ; $v_i' * v_i = \text{Identity}$ |
| s | a kx times ky times r array; with r fixed, each matrix contains $kxky$ values $(u_h' * x_{kh} * v_k)^2$, the partial (squared) singular values relative to x_{kh} . |

Author(s)

Lafosse, R.

References

Lafosse R. & Hanafi M.(1997) Concordance d'un tableau avec K tableaux: Definition de K+1 uples synthetiques. Revue de Statistique Appliquee vol.45,n.4.

Examples

```
x <- matrix(runif(200),10,20)
s <- svdcp(x,c(5,5,10),1)
ss <- svd(x);ss$d[1]^2
sum(ss$s2)
```

Index

concor, [2](#)
concorcano, [3](#)
concoreg, [4](#)
concorgm, [5](#)
concorgmcano, [7](#)
concorgmreg, [8](#)
concors, [9](#)
concorcano, [10](#)
concorsreg, [12](#)

svdbip, [13](#)
svdbip2, [14](#)
svdbips, [15](#)
svdcp, [16](#)