Package 'multiRDPG'

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Version 1.0.1

Type Package

Title Multiple Random Dot Product Graphs

Description Fits the Multiple Random Dot Product Graph Model and performs a test
for whether two networks come from the same distribution. Both methods are
proposed in Nielsen, A.M., Witten, D., (2018) ``The Multiple Random Dot Product Graph
Model'', arXiv preprint <arXiv:1811.12172> (Submitted to Journal of Computational
and Graphical Statistics).

License GPL-2

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R topics documented:

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multiRDPG   *Fitting Multiple Random Dot Product Graphs*

Description

`multiRDPG` is used to fit Multiple Random Dot Product Graphs from a set of adjacency matrices.

Usage

```
multiRDPG(A, d, maxiter = 100, tol = 1e-06)
```

Arguments

A	List of adjacency matrices representing graphs. Each matrix must be symmetric. All matrices of the same size n x n.
d	Dimension of latent space. d<= n.
maxiter	Maximal number of iterations. Default is 100.
tol	Tolerance for update of the objective function. Default is 1e-6.

Value

Returns a list of the following:

U	Matrix of the joint vectors. n x d.
Lambda	List of diagonal matrices. One for each graph. d x d.
Converged	Represent of the algorithm converged. 1 if converged, 0 if not.
iter	Number of iterations
maxiter	Maximal number of iterations.Default is 100.
objfun	Value of the objective function. sum_k ||A^k - U Lambda U^T||_F^2

Author(s)

Agnes Martine Nielsen (agni@dtu.dk)

See Also

[multiRDPG_test](#)

Examples

```
#simulate data
U <- matrix(0, nrow=20, ncol=3)
U[,1] <- 1/sqrt(20)
U[,2] <- rep(c(1,-1), 10)/sqrt(20)
U[,3] <- rep(c(1,1,-1,-1), 5)/sqrt(20)
```

```
L<-list(diag(c(11,6,2)),diag(c(15,4,1)))
A <- list()
for(i in 1:2){
  P <- U%*%L[[i]]%*%t(U)
  A[[i]] <-apply(P,c(1,2),function(x){rbinom(1,1,x)})
  A[[i]][lower.tri(A[[i]])]<-t(A[[i]])[lower.tri(A[[i]])]
}

#fit model
multiRDPG(A,3)
```

---

multiRDPG_test   *Performs test based on Multiple Random Dot Product Graph*

Description

multiRDPG_test calculates the likelihood ratio test for whether a set of graphs comes from the same disribution.

Usage

```
multiRDPG_test(A, d, maxiter = 100, tol = 1e-06, B = 1000)
```

Arguments

A	List of symmetric A matrices
d	Dimension of the latent space
maxiter	Maximum number of iterations in the fit of multiRDPG. Default is 100.
tol	Tolerance for the step in the objective function in multiRDPG. Default is 1e-6.
B	Number of permutation iterations. Default is 1000.

Value

Returns a list of the following elements:

pvalue	Estimated p-values
Tval	Value of the test statistic
Tstar	Vector of the test statistic for each permutation iteration
nullmodel	Model fit under the null
altmodel	Modelfit under the alternative

Author(s)

Agnes Martine Nielsen (agni@dtu.dk)

See Also

multiRDPG

Examples

```
#simulate data
U <- matrix(0, nrow=20, ncol=3)
U[,1] <- 1/sqrt(20)
U[,2] <- rep(c(1,-1), 10)/sqrt(20)
U[,3] <- rep(c(1,1,-1,-1), 5)/sqrt(20)

L<-list(diag(c(11,6,2)),diag(c(15,4,1)))
A <- list()
for(i in 1:2){
  P <- U%*%L[[i]]%*%t(U)
  A[[i]] <-apply(P,c(1,2),function(x){rbinom(1,1,x)})
  A[[i]][lower.tri(A[[i]])]<-t(A[[i]])[lower.tri(A[[i]])]
}

#perform test
multiRDPG_test(A,3,B=100)
```

---

nullestimation	nullestimation *calculates the estimation under the null hypothesis*

Description

`nullestimation` calculates the estimation under the null hypothesis

Usage

```
nullestimation(A, d)
```

Arguments

A	List of symmetric A matrices
d	Dimension of the latent space

Value

Returns a list of the following

U	The common latent space vectors. U in R^n x d
Lambda	List of Lambdas. Each is a positive diagonal matrix of size d x d.

Author(s)

Agnes Martine Nielsen (agni@dtu.dk)

See Also

multiRDPG

Examples

```
#simulate data
U <- matrix(0, nrow=20, ncol=3)
U[,1] <- 1/sqrt(20)
U[,2] <- rep(c(1,-1), 10)/sqrt(20)
U[,3] <- rep(c(1,1,-1,-1), 5)/sqrt(20)

L<-list(diag(c(11,6,2)),diag(c(15,4,1)))
A <- list()
for(i in 1:2){
  P <- U%*%L[[i]]%*%t(U)
  A[[i]] <-apply(P,c(1,2),function(x){rbinom(1,1,x)})
  A[[i]][lower.tri(A[[i]])]<-t(A[[i]])[lower.tri(A[[i]])]
}

#fit model
nullestimation(A,3)
```

---

plot.multiRDPGfit   *Plots object from* multiRDPG

Description

Plots object from multiRDPG

Usage

```
## S3 method for class 'multiRDPGfit'
plot(x, ...)
```

Arguments

x	multiRDPGfit object from function multiRDPG
...	further arguments passed to or from other methods

Author(s)

Agnes Martine Nielsen (agni@dtu.dk)

See Also

multiRDPG

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plot.multiRDPGtest   *Plots object from* multiRDPG_test

Description

Plots histogram of permutation test statistics and indicates test statistic value with red line.

Usage

```
## S3 method for class 'multiRDPGtest'
plot(x, ...)
```

Arguments

x   multiRDPGtest object from function multiRDPG_test

...   further arguments passed to or from other methods

Details

Red line indicates the value of the test statistics with a red line.

Author(s)

Agnes Martine Nielsen (agni@dtu.dk)

See Also

multiRDPG_test

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print.multiRDPGfit   *Print object from* multiRDPG

Description

Print object from multiRDPG

Usage

```
## S3 method for class 'multiRDPGfit'
print(x, ...)
```

Arguments

x	multiRDPGfit object from function `multiRDPG`
...	further arguments passed to or from other methods

Author(s)

Agnes Martine Nielsen (agni@dtu.dk)

See Also

[multiRDPG](#)

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print.multiRDPGtest   *Print object from* `multiRDPG_test`

Description

Print object from `multiRDPG_test`

Usage

```
## S3 method for class 'multiRDPGtest'
print(x, ...)
```

Arguments

x	multiRDPGtest object from function `multiRDPG_test`
...	further arguments passed to or from other methods

Author(s)

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See Also

[multiRDPG_test](#)

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