Package ‘clrdag’

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Type Package

Title Likelihood Ratio Tests of a Large Directed Acyclic Graph

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Depends R (>= 3.6.0)

Imports Rcpp (>= 1.0.1)

LinkingTo Rcpp, RcppArmadillo

Description
The 'clrdag' package provides R functions for constrained maximum likelihood estimate and likelihood ratio test of a large directed acyclic graph. Documentation about 'clrdag' is provided by the vignette included in this package and via the paper by Li, Shen, and Pan (2019).

License GPL (>= 2)

URL https://github.umn.edu/li000007/clrdag

BugReports https://github.umn.edu/li000007/clrdag/issues

NeedsCompilation yes

R topics documented:

clrdag *MLEdag*

Description

A function computes the MLE/LRT of a Gaussian directed acyclic graph with specified constraints.

Usage

```
MLEdag(X, A = NULL, Lambda = NULL, D = NULL, tau, mu, rho,
        tol_abs = 1e-04, tol_rel = 1e-04,
        dc_max_iter = 20, admm_max_iter = 1000, trace_obj = TRUE)
```

Arguments

`X`	An n by p data matrix, where n is the number of observations and p is the dimension.
`A, Lambda`	Initial estimate. `A` is a p by p adjacency matrix, `Lambda` is a p by p dual matrix in acyclicity condition. `A` must be a DAG! If `A` is NULL (default), the initial estimate is provided automatically (Be careful!).
`D`	A p by p matrix indicating hypothesized edges. For the entries equal to 1, no sparse penalty is imposed.
`tau`	A positive real number. `tau` is the threshold parameter in TLP.
`mu`	A positive real number. `mu` is the sparsity parameter.
`rho`	A positive real number. `rho` is the ADMM dual parameter.
`tol_abs, tol_rel`	Positive real. The absolute and relative tolerance.
`dc_max_iter, admm_max_iter`	Positive integer. The maximum iteration number of DC and ADMM.
`trace_obj`	Logical. If TRUE, the objective values are printed after each iteration.

Value

The function returns a LIST containing the following components.

`X`	The input data matrix.
`A`	The final estimate of adjacency matrix.
`Lambda`	The final estimate of dual variables in the acyclicity condition.
`mu`	The input sparsity parameter.
`tau`	The input threshold parameter in TLP.

Author(s)

Chunlin Li

References

Li, C., Shen, X., and Pan, W. (2019). Likelihood ratio tests of a large directed acyclic graph. Submitted.

Examples

```
## library(mvtnorm)
##
## Example 1: random graph
##
set.seed(2019)
p<-10
n<-1000
## random graph: randomly generate adjacency matrix A, A lower triangular
sparsity <- 2/p
A <- matrix(rbinom(p*p,1,sparsity)*sign(runif(p*p,min=-1,max=1)),p,p)
A[upper.tri(A, diag = TRUE)] <- 0
#Sigma <- solve(diag(p) - A)
#Sigma <- Sigma %*% t(Sigma)
#X <- rmvnorm(n,mean=rep(0,p), sigma=Sigma, method="chol")
X <- matrix(rnorm(n*p), n, p) %*% t(solve(diag(p) - A))
out <- MLEdag(X=X,tau=0.3,mu=1,rho=1.2,trace_obj=FALSE) # compute the MLE
B <- out$A
B <- ifelse(abs(B)>0.3,1,0)
all(B == abs(A))
##
## Example 2: hub graph
##
set.seed(2019)
p<-10
n<-1000
## hub graph: randomly generate adjacency matrix A, A lower triangular
A <- matrix(0,p,p)
A[,1] <- sign(runif(p,min=-1,max=1))
A[1,1] <- 0
#Sigma <- solve(diag(p) - A)
#Sigma <- Sigma %*% t(Sigma)
#X <- rmvnorm(n,mean=rep(0,p), sigma=Sigma, method="chol")
X <- matrix(rnorm(n*p), n, p) %*% t(solve(diag(p) - A))
out <- MLEdag(X=X,tau=0.3,mu=1,rho=1.2,trace_obj=FALSE) # compute the MLE
B <- out$A
B <- ifelse(abs(B)>0.3,1,0)
all(B == abs(A))
```

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