Package 'clrdag'

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Type Package

Title Likelihood Ratio Tests of a Large Directed Acyclic Graph

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Depends R (>= 3.5.0)

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))
```

Index