

# Package ‘clrdag’

April 3, 2019

**Type** Package

**Title** Likelihood ratio tests of a large directed acyclic graph

**Version** 0.19.04

**Date** 2019-04-03

**Author** Chunlin Li, Xiaotong Shen, and Wei Pan

**Maintainer** Chunlin Li <li000007@umn.edu>

**Depends** R (>= 3.5.3)

**Imports** Rcpp (>= 1.0.1)

**LinkingTo** Rcpp, RcppArmadillo

**Suggests** mvtnorm

**Description** The 'clrdag' package provides R functions for constrained likelihood ratio tests 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)

**BugReports** <https://github.umn.edu/li000007/clrdag/issues>

**NeedsCompilation** yes

## R topics documented:

clrdag . . . . .	1
<b>Index</b>	<b>4</b>

---

clrdag	<i>cmleDAG</i>
--------	----------------

---

## Description

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

**Usage**

```
cmleDAG(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, test_path = FALSE, 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.
test_path	Logical. If TRUE, the path test is used.
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<-50
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")
out <- cmleDAG(X=X,tau=0.3,mu=1,rho=1.2,trace_obj=FALSE) # compute the MLE
B <- out$A
B <- ifelse(abs(B)>0.3,1,0)
all(B == abs(A))
##
## Example 2: hub graph
##
set.seed(2019)
p<-50
n<-1000
## hub graph: randomly generate adjacency matrix A, A lower triangular
A <- matrix(0,p,p)
A[,1] <- sign(runif(p,min=-1,max=1))
A[1,1] <- 0
Sigma <- solve(diag(p) - A)
Sigma <- Sigma %*% t(Sigma)
X <- rmvnorm(n,mean=rep(0,p), sigma=Sigma, method="chol")
out <- cmleDAG(X=X,tau=0.3,mu=1,rho=1.2,trace_obj=FALSE) # compute the MLE
B <- out$A
B <- ifelse(abs(B)>0.3,1,0)
all(B == abs(A))
```

# Index

\*Topic **Directed acyclic graph**

clrdag, [1](#)

\*Topic **Likelihood ratio test**

clrdag, [1](#)

\*Topic **MLE**

clrdag, [1](#)

clrdag, [1](#)

cmleDAG (clrdag), [1](#)