Package 'intdag'

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Type Package

Title Reconstruction of a Directed Acyclic Graph with Interventions

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Author Si Peng, Xiaotong Shen, Wei Pan

Maintainer Si Peng <pengx179@umn.edu>

Depends R (>= 3.4.0)

Description Provides intdag() for a constrained maximum likelihood estimate of a directed acyclic graph with intervention data. Also available is obsdag() for an estimate with observation data only, based on the method in the paper by Yuan, Shen and Pan (2018) <doi:10.1093/biomet/asy057>.

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LazyData true

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intDAG *A DAG function for interventional data*

Description

This function allows you to learn the DAG structure from interventional data

Usage

```
intDAG(X, p, lambda, lambda2, tau = 0.05, rho = 1, A_NZ0 = NULL,
  A0 = NULL, sigma = NULL, Sig = NULL, variance.constraint = TRUE,
  opts.tol = 0.001, maxIter = 1000)
```

Arguments

X	The n by M data matrix
p	The dimension of the adjacency matrix
lambda	tuning parameter for the first penalty of the adjacency matrix
lambda2	tuning parameter for the sparsity penalty of the intervention matrix
tau	tuning parameter of the TLP function, default is 0.05
rho	the ADMM penalty parameter, default is 1
A_NZ0	An p by M matrix indicating nonzero elements as initial values
A0	An p by M matrix as initial values for (A, B)
sigma	the parameter in the variance constraint, not needed when variance.constraint is set to FALSE
Sig	vector of length p, the error variances of each node, not needed when variance.constraint is set to FALSE
variance.constraint	a flag indicating if the variance constraint is included, default is TRUE
opts.tol	Tolerance for convergence
maxIter	maximum number of iterations in ADMM loop

Value

A list with components

A	Estimated adjacency matrix
B	Estimated intervention matrix
Sig	Estimated vector of error variances of each node
sigma	Estimated paramter in the variance constraint

Examples

```
p <- w <- 10
s0 <- p # number of edges
lower <- rep(0, (p*(p-1)/2)) # num of possible edges
nz_set <- sample(1:(p*(p-1)/2), s0) # sample a non-zero edge set
lower[nz_set] <- 0.5
amat <- matrix(0, p, p)
amat[lower.tri(amat)] <- lower
bmat <- diag(sqrt(seq(1, 1.5, length=p)))
Sig <- seq(1.5, 1, length = p)
X <- rmvDAG_int(100, amat, bmat, Sig)
Sig0 <- rep(1, p)
sigma0 <- 3
out <- intDAG(X, p, 2, 2, 0.05, rho=10, sigma=sigma0, Sig=Sig0)
```

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obsDAG *A DAG function for observational data*

Description

This function allows you to learn the DAG structure from observational data

Usage

```
obsDAG(X, lambda, tau, rho = 1, A_NZ0 = NULL, A0 = NULL,
  opts.tol = 1e-04, maxIter = 1000)
```

Arguments

X	The n by p data matrix
lambda	tuning parameter for the first penalty of the adjacency matrix
tau	tuning parameter of the TLP function
rho	the ADMM penalty parameter, default is 1
A_NZ0	An p by p matrix indicating nonzero elements as initial values
A0	An p by p matrix as initial values for A
opts.tol	Tolerance for convergence
maxIter	maximum number of iterations in ADMM loop

Value

Estimated adjacency matrix

Examples

```
p <- 10
amat <- matrix(0, p, p)
amat[2:p, 1] <- 1
Sig <- seq(1, 0.5, length.out=p)
X <- rmvDAG_obs(100, amat, Sig)
out <- obsDAG(X, 5, 0.01)
```

`rmvDAG_int` *A random graph data generation function*

Description

This function generates random observations from a DAG graph

Usage

```
rmvDAG_int(n, amat, bmat, Sig = NULL)
```

Arguments

`n`	The sample size
`amat`	The adjacency matrix of a DAG
`bmat`	The intervention matrix
`Sig`	The error variance of each node

Value

Gaussian data with the given sample size

Examples

```
amat <- matrix(c(0,1,0,0),2,2)
bmat <- matrix(c(1,1,0,1),2,2)
rmvDAG_int(50, amat, bmat)
```

rmvDAG_obs *A random graph data generation function*

Description

This function generates random observations from a DAG graph

Usage

```
rmvDAG_obs(n, amat, Sig = NULL)
```

Arguments

n	The sample size
amat	The adjacency matrix of a DAG
Sig	The error variance of each node

Value

Gaussian data with the given sample size

Examples

```
amat=matrix(c(0,1,0,0),2,2)
rmvDAG_obs(50,amat)
```

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