

Package ‘ADMMsigma’

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Type Package

Title Penalized Precision Matrix Estimation via ADMM

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Description This R package produces penalized precision matrix estimates via the alternating direction method of multipliers (ADMM) algorithm

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NeedsCompilation yes

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Imports Rcpp (>= 0.12.10),
RcppArmadillo

LinkingTo Rcpp,
RcppArmadillo,
RcppParallel

Suggests testthat

SystemRequirements GNU make

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ADMMsigma

*ADMM penalized precision matrix estimation***Description**

penalized Gaussian likelihood precision matrix estimation using the ADMM algorithm. Likelihood: $\text{Tr}(S)$

Usage

```
ADMMsigma(X = NULL, S = NULL, lam, alpha = 1, eta = 1, rho = 2,
  tol1 = 1e-04, tol2 = 1e-04, tol3 = 1e-04)
```

Arguments

X	data matrix
S	option to specify sample covariance matrix (denominator n)
lam	tuning parameter for penalty
alpha	elasticnet mixing parameter [0, 1]: 0 = ridge, 1 = lasso/bridge
eta	hyperparameter for bridge penalty (0, 2): 1 = lasso
rho	step size for ADMM
tol1	absolute tolerance. Defaults to 1e-4
tol2	relative tolerance. Defaults to 1e-4
tol3	tolerance for proximal gradient. Defaults to 1e-4

Value

iterations, omega, and gradient

Examples

```
ADMM_sigma(X, lam = 0.1, rho = 10)
```

ADMM_sigma

*ADMM penalized precision matrix estimation (using ADMM_sigmac)***Description**

penalized Gaussian likelihood precision matrix estimation using the ADMM algorithm. Likelihood: $\text{Tr}(S)$

Usage

```
ADMM_sigma(X = NULL, S = NULL, lam = 10^seq(-5, 5, 0.5), alpha = 1,
  rho = 2, mu = 10, tau1 = 2, tau2 = 2, crit = "ADMM", tol1 = 1e-04,
  tol2 = 1e-04, maxit = 1000, ind = NULL, K = 3, quiet = TRUE)
```

Arguments

lam	tuning parameter for penalty. Defaults to $10^{\text{seq}(-5, 5, 0.5)}$
alpha	elasticnet mixing parameter [0, 1]: 0 = ridge, 1 = lasso/bridge
rho	initial step size for ADMM
mu	factor for primal and residual norms
tau1	adjustment for rho
tau2	adjustment for rho
crit	criterion for convergence c('ADMM', 'grad', 'lik'). Option crit != 'ADMM' will use tol1 as tolerance. Default is 'ADMM'
tol1	absolute tolerance. Defaults to 1e-4
tol2	relative tolerance. Defaults to 1e-4
maxit	maximum number of iterations
ind	vector of a permutation of 1,...,n for CV
K	specify the number of folds for cross validation
quiet	specify whether the function returns progress of CV or not

Value

iterations, lam, omega, and gradient

Examples

```
ADMM_sigma(X, lam = 0.1, rho = 10)
```

ADMM_sigmac

ADMM penalized precision matrix estimation (c++)

Description

penalized Gaussian likelihood precision matrix estimation using the ADMM algorithm. Likelihood: $\text{Tr}(S)$

Usage

```
ADMM_sigmac(S, lam, alpha = 1, rho = 2, mu = 10, tau1 = 2, tau2 = 2,
  crit = "ADMM", tol1 = 1e-04, tol2 = 1e-04, maxit = 1000L)
```

Arguments

S	option to specify sample covariance matrix (denominator n)
lam	tuning parameter for penalty
alpha	elasticnet mixing parameter [0, 1]: 0 = ridge, 1 = lasso/bridge
rho	initial step size for ADMM
mu	factor for primal and residual norms
tau1	adjustment for rho
tau2	adjustment for rho

<code>crit</code>	criterion for convergence c("ADMM", "grad", "lik"). Option <code>crit != "ADMM"</code> will use <code>tol1</code> as tolerance. Defaults to "ADMM"
<code>tol1</code>	absolute tolerance. Defaults to 1e-4
<code>tol2</code>	relative tolerance. Defaults to 1e-4
<code>maxit</code>	maximum number of iterations
<code>X</code>	data matrix

Value

iterations, lam, omega

Examples

```
ADMM_sigmac(X, lam = 0.1)
```

CV_ADMM_sigma	<i>CV ADMM penalized precision matrix estimation</i>
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Description

Cross validation function for ADMM_sigma.

Usage

```
CV_ADMM_sigma(X, lam, alpha = 1, rho = 2, mu = 10, tau1 = 2, tau2 = 2,
  crit = "ADMM", tol1 = 1e-04, tol2 = 1e-04, maxit = 1000, ind = NULL,
  K = 3, quiet = TRUE)
```

Arguments

<code>X</code>	matrix or data frame. This is the $n \times p$ column matrix where the rows are a realization of n independent copies of a p -variate random vector
<code>lam</code>	tuning parameter for penalty. Defaults to $10^{\text{seq}(-5, 5, 0.5)}$
<code>alpha</code>	elasticnet mixing parameter $[0, 1]$: 0 = ridge, 1 = lasso/bridge
<code>rho</code>	initial step size for ADMM
<code>mu</code>	factor for primal and residual norms
<code>tau1</code>	adjustment for rho
<code>tau2</code>	adjustment for rho
<code>crit</code>	criterion for convergence c('ADMM', 'grad', 'lik'). Option <code>crit != 'ADMM'</code> will use <code>tol1</code> as tolerance. Defaults to 'ADMM'
<code>tol1</code>	absolute tolerance. Defaults to 1e-4
<code>tol2</code>	relative tolerance. Defaults to 1e-4
<code>maxit</code>	maximum number of iterations
<code>ind</code>	vector of a permutation of 1,...,n for CV
<code>K</code>	specify the number of folds for cross validation
<code>quiet</code>	specify whether the function returns progress of CV or not

Value

iterations, lam, S, Omega, and cv.errors

Examples

```
CV_sigma_ridge(X, lam = seq(0.1, 3, 0.1))
```

sigma_ridgec	<i>Ridge-penalized precision matrix estimation (c++)</i>
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Description

Ridge-penalized Gaussian likelihood precision matrix estimation. Augmented from Adam Rothman's STAT 8931 code.

Usage

```
sigma_ridgec(S, lam)
```

Arguments

S	sample covariance matrix (denominator n)
lam	tuning parameter for penalty

Value

matrix of omega hat

Examples

```
n = nrow(X)
sigma_ridgec(S = (n-1)/n*cov(X), lam = 0.1)
```

softc	<i>Soft threshold (elementwise) (c++)</i>
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Description

Elementwise soft thresholding function. Augmented from Adam Rothman's STAT 8931 code.

Usage

```
softc(s, tau)
```

Arguments

s	scalar
tau	scalar

Value

scalar

Examples

```
softc(10, 5)
```

`softmatrixc`*Soft threshold (matrix) (c++)*

Description

Matrix soft thresholding function. Requires ‘softc’. Augmented from Adam Rothman’s STAT 8931 code.

Usage

```
softmatrixc(S, tau)
```

Arguments

tau	scalar
s	matrix

Value

soft threshold s matrix

Examples

```
softmatrixc(10, 5)
```

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