

Package: FLAG (via r-universe)

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Title Flexible and Accurate Methods for Estimation and Inference of
Gaussian Graphical Models with Applications

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Description Flexible and Accurate Methods for Estimation and Inference
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 FLAG

FLAG is the main function to fulfill the whole process.

Description

FLAG is the main function to fulfill the whole process.

Usage

```
FLAG(
  data,
  scale.var = T,
  low.rank = NULL,
  infer = "llr",
  eps = 1e-07,
  crit.loglik = 1e-04
)
```

Arguments

<code>data</code>	Matrix, with size $n \times p$.
<code>scale.var</code>	Logical, whether to scale the variance of X to $1/p$, default to be T(RUE).
<code>low.rank</code>	Logical, whether to use low rank update to shrink the time of eigen-decomposition of XX^T , default to be TRUE when sample size larger than 1000.
<code>infer</code>	Character, option of different tests of inference where 'llr' for likelihood ratio test and 'wald' for Wald test based on Fisher Information Matrix.
<code>eps</code>	Numeric, a small term to avoid numerical problems, default to be $1e-7$.
<code>crit.loglik</code>	Numeric, the criteria of the change ratio of log likelihood to stop.

Value

List, the estimated precision matrix, the p-value of precision matrix estimation, the edge existence using Bonferroni correction, the edge existence using false discovery rate, the matrix of estimated η , the standard error or estimated η , the matrix of estimated partial correlation ρ , the standard error or estimated partial correlation ρ , the p-value of partial correlation matrix estimation, the matrix of estimated σ_a^2 , the standard error or estimated σ_b^2 , the execution time.

Examples

```
FLAG(matrix)
```

FlagOneEdge	<i>Use FLAG to infer one edge. Given n*p data matrix, when we only interest in the conditional dependence between i-th and j-th variables.</i>
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Description

Use FLAG to infer one edge. Given n*p data matrix, when we only interest in the conditional dependence between i-th and j-th variables.

Usage

```
FlagOneEdge(data, i, j, scale.var = T, infer = "llr", eps = 1e-07)
```

Arguments

data	Matrix, with size n*p.
i	integer, the index of one element.
j	integer, the index of another element.
scale.var	Logical, whether to scale the variance of X to 1/p, default to be T(RUE).
infer	Character, option of different tests of inference where 'llr' for likelihood ratio test and 'wald' for Wald test based on Fisher Information Matrix.
eps	Numeric, a small term to avoid numerical problems, default to be 1e-7.

Value

List, the list of log likelihood during iterations, the estimated precision value, the p-value of precision value estimation, the estimated Gamma_beta matrix with size 22, *in the random effects model*, the estimated Gamma_epsilon matrix with size 22, *in the random effects model*, the estimated off-diagonal element eta in the matrix Gamma_epsilon, the standard error of eta, the estimated partial correlation rho, the standard error of rho, the p-value of rho, the execution time.

Examples

```
FlagOneEdge(matrix, i, j)
```

FlagOnePair	<i>FLAG for one pair of random variables, using random effects model. This is a repeated function for FLAG.</i>
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Description

FLAG for one pair of random variables, using random effects model. This is a repeated function for FLAG.

Usage

```
FlagOnePair(
  Y,
  X,
  Gamma_beta = NULL,
  Gamma_e = NULL,
  infer = "llr",
  fix.eta = FALSE,
  eps = 1e-07,
  max.iter = 5000,
  crit.loglik = 1e-04
)
```

Arguments

Y	Matrix, with size $n \times 2$.
X	Matrix, with size $n \times (p-2)$.
Gamma_beta	Matrix, with size 2×2 .
Gamma_e	Matrix, with size 2×2 .
infer	Character, option of different tests of inference where 'llr' for likelihood ratio test and 'wald' for Wald test based on Fisher Information Matrix.
fix.eta	Logical, whether to fix eta, default to be FALSE.
eps	Numeric, a small term to avoid numerical problems, default to be $1e-7$.
max.iter	Integer, the maximum number of iterations, default to be 5000.
crit.loglik	Numeric, the criteria of the change ratio of log likelihood to stop.

Value

List, the list of log likelihood during iterations, the estimated Gamma_beta matrix with size 22, in the random effects model, the estimated Gamma_epsilon matrix with size 22, in the random effects model, the estimated 2×2 submatrix of the precision matrix, the covariance matrix, which is the inverse of the Fisher information matrix, inferred by the Wald test, the estimated off-diagonal element eta in the matrix Gamma_epsilon, the standard error of eta, the p-value of eta, the estimated partial correlation rho, the standard error of rho, the p-value of rho.

Examples

```
FlagOnePair(Y, X)
```

FlagOnePairEta0	<i>FLAG for one pair of random variables fixing eta as zero, using likelihood-ratio test.</i>
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Description

FLAG for one pair of random variables fixing eta as zero, using likelihood-ratio test.

Usage

```
FlagOnePairEta0(
  Y,
  X,
  Gamma_beta,
  Gamma_e,
  eps = 1e-07,
  max.iter = 5000,
  crit.loglik = 1e-04
)
```

Arguments

Y	Matrix, with size n*2.
X	Matrix, with size n*(p-2).
Gamma_beta	Matrix, with size 2*2.
Gamma_e	Matrix, with size 2*2.
eps	Numeric, a small term to avoid numerical problems, default to be 1e-4.
max.iter	Integer, the maximum number of iterations, default to be 5000.
crit.loglik	Numeric, the criteria of the change ratio of log likelihood to stop.

Value

List, the list of log likelihood during iterations, Numeric, the log likelihood of the last iterations, the estimated Gamma_beta matrix with size 22, *in the random effects model, the estimated Gamma_epsilon matrix with size 22, in the random effects model, the estimated 2*2 submatrix of the precision matrix.*

Examples

```
FlagOnePairEta0(Y, X, Gamma_beta, Gamma_e)
```

GetSeRho	<i>Get the standard error of rho.</i>
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Description

Get the standard error of rho.

Usage

```
GetSeRho(Gamma_e, Gamma_e_cov)
```

Arguments

Gamma_e	Matrix, with size 2*2.
Gamma_e_cov	Matrix, with size 2*2.

Value

Numeric.

Examples

```
GetSeRho(Gamma_e, Gamma_e_cov)
```

InferWald	<i>Infer by the Wald test.</i>
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Description

Infer by the Wald test.

Usage

```
InferWald(Omega.inv, n, K, Y.vec, Gamma_e)
```

Arguments

Omega.inv	Matrix, with size (2n)*(2n).
n	Integer.
K	Matrix, with size n*n.
Y.vec	Matrix, with size (2*n)*1, the vectorized Y.
Gamma_e	Matrix, with size 2*2.

Value

List, the covariance matrix, which is the inverse of the Fisher information matrix, inferred by the Wald test, the estimated off-diagonal element eta in the matrix Gamma_epsilon, the standard error of eta, the p-value of eta, the estimated partial correlation rho, the standard error of rho, the p-value of rho.

Examples

```
InferWald(Omega.inv, n, K, Y.vec, Gamma_e)
```

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