

Package ‘latentSNA’

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Type Package

Title LatentSNA

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Description Neuroimaging connectivity analysis needs network science for brain-behavior linking (Wang et al. (2023) <arXiv:2309.11349>).

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Encoding UTF-8

LazyData true

Depends R (>= 4.3.2),
MASS,
base

Imports dplyr,
plyr

RoxygenNote 7.3.1

Suggests knitr,
rmarkdown

VignetteBuilder knitr

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latentSNA	<i>Attribute informed brain connectivity</i>
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Description

An MCMC algorithm for fitting the latentSNA model

Usage

```
latnetSNA(X, Y, W, H, seed = 1, nscan =
10000, burn = 500, odens = 25,
prior=list())
```

Arguments

X	a list of V x V brain connectivity data.
Y	a matrix of N x P individual outcome data.
W	a matrix of N x Q covariates for the connectivity data.
H	a matrix of N x Q1 covariates for the attribute data.
seed	random seed
nscan	number of iterations of the Markov chain (beyond burn-in)
burn	burn in for the Markov chain
odens	output density for the Markov chain, chain thinning every odens iterations
prior	list: A list of hyperparameters for the prior distribution

Value

COV	posterior mean of the covariance parameters between brain and behaviors
BETAPM	posterior mean of the regression coefficient parameters for the connectivity data
GAMMAPM	posterior mean of the regression coefficient parameters for the attribute data
THETAPM	posterior mean of the latent person variable
APM	posterior mean of connectivity intercepts
BPM	posterior mean of attribute intercepts
U	last iteration of latent connectivity for all regions
UPM	posterior mean of U
UVPM.1	list of posterior mean of connectivity
Theta	the last iteration of the Theta estimate
X	observed X
Y	observed Y

EF1PM	posterior mean estimates of X
ETPM	posterior mean estimates of Y
TMPM	posterior mean estimates of latent behavior component
FLPM	posterior mean estimates of latent connectivity component
input	input values

Author(s)

Selena Wang

Examples

```
attach(X)
attach(Y)

## More MCMC burn-in iterations and iterations are needed than specified here.
model1=latentSNA(X, Y,W=NULL, H=NULL,
seed = 1, nscan = 1, burn = 1, odens = 1,
prior=list())
```

rbeta_a

Conditional simulation of intercept and regression coefficients

Description

Simulates from the joint full conditional distribution of (beta) in a brain connectivity model

Usage

```
rbeta_a(F1, W = NULL, s2 = 1, U = U, ivA = NULL, beta0 = NULL, S0 = NULL)
```

Arguments

F1	a list of V X V normal connectivity matrix
W	N x Q covariate matrix
s2	variance
U	a V by V by N array
ivA	prior inverse variance for the intercept parameters
beta0	prior mean vector for regression parameters
S0	prior precision matrix for regression parameters

Value

beta	regression coefficients
a	subject-specific intercept

Author(s)

Selena Wang

rFl_nrm	<i>Simulate missing values in a normal connectivity model</i>
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Description

Simulates missing values of a sociomatrix under a normal connectivity model

Usage

```
rFl_nrm(Z, EZ, s2, X)
```

Arguments

Z	a square matrix, the current value of Z
EZ	expected value of Z
s2	dyadic variance
X	square relational matrix

Value

a square matrix, equal to at non-missing values

Author(s)

Selena Wang

rH_bin	<i>Simulate H</i>
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Description

Simulates a random latent matrix H given its expectation and a behavior matrix Y

Usage

```
rH_bin(H, EH, Y)
```

Arguments

H	a n X m matrix, the current value of H
EH	expected value of H
Y	n X m binary item response matrix
s1	item response variance

Value

a n X m matrix, the new value of H

Author(s)

Selena Wang

`rH_nrm`*Simulate missing values in a normal behavior model*

Description

Simulates missing values under a behavior model

Usage

```
rH_nrm(H, EH, s1, Y)
```

Arguments

H	a matrix, the current value of H
EH	expected value of H
s1	behavior variance
Y	behavior matrix

Value

a behavior matrix, equal to at non-missing values

Author(s)

Selena Wang

`rs1_b`*Gibbs update for behavior variance*

Description

Gibbs update for behavior variance

Usage

```
rs1(Tm, offset=0, nu1=NULL, s10=NULL)
```

Arguments

Tm	a list of V X P normal behavior matrix
nu1	prior degrees of freedom
s10	prior estimate of s1

Value

a new value of s1

Author(s)

Selena Wang

rs2	<i>Gibbs update for connectivity variance</i>
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Description

Gibbs update for connectivity variance

Usage

rs2(F1, offset=0, nu2=NULL, s20=NULL)

Arguments

- F1 a list of V X V normal connectivity matrix
- nu2 prior degrees of freedom
- s20 prior estimate of s2

Value

a new value of s2

Author(s)

Selena Wang

rSu	<i>Gibbs update for latent effects covariance</i>
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Description

Gibbs update for latent effects covariance

Usage

rSu(U, Su0=NULL, etau=NULL)

Arguments

- U latent connectivity and behavior
- Su0 prior (inverse) scale matrix for the prior distribution
- etau prior degrees of freedom for the prior distribution

Author(s)

Selena Wang

rTheta_b

*Gibbs sampling of Theta***Description**

A Gibbs sampler for updating the Person latent effect Theta.

Usage

```
rTheta(H, beta, Alpha, Theta ,U, Stheta, Sutheta, Su, s1)
```

Arguments

H	N X P normal behavior matrix
beta	P X 1 behavior intercept vector
Alpha	1 X 1 intercept vector
Theta	current value of Theta
U	matrix containing current value of U
Stheta	covariance of Theta
Sutheta	covariance between U and Theta
Su	matrix containing covariance of U
s1	behavior variance

Value

Theta	a new value of Theta
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Author(s)

Selena Wang

rU

*Gibbs sampling of U***Description**

A Gibbs sampler for updating U.

Usage

```
rU(F1,U,Theta, Stheta, Sutheta, Su, s2=1, offset=offset)
```

Arguments

F1	a list of V X V normal relational matrix
EF1	a list of the same dimension as F1. It is assumed that F1-offset follows a SRRM, so the offset should contain any multiplicative effects (such as U%% t(U))
U	V X K matrix containing current value of U
Theta	D X V current value of Theta
Stheta	D X D covariance of Theta
Sutheta	D X K covariance between U and Theta
Su	K X K matrix containing covariance of U
s2	dyadic variance

Value

U	a new value of U
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Author(s)

Selena Wang

<i>rXi</i>	<i>Gibbs sampling of behaivor parameters Xi</i>
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Description

A Gibbs sampler for updating the behavior parameters.

Usage

`rXi(H, beta, Alpha, Theta, mxi, Sigmaxi, s1 = 1)`

Arguments

H	normal behavior matrix
beta	behavior intercept vector
Alpha	behavior intercept vector
Theta	current value of Theta
mxi	vector of prior for the mean of Xi
Sigmaxi	matrix of prior for the variance of Xi
s1	behavior variance

Value

beta	a new value of beta
Alpha	a new value of Alpha

Author(s)

Selena Wang

`simH`*Simulate H given its expectation and covariance*

Description

Simulate H given its expectation and covariance

Usage

```
simH(EH, s1 = 1)
```

Arguments

EH	expected value of H
s1	attribute variance

Value

a simulated value of H

Author(s)

Selena Wang

`simX_nrm`*Simulate a normal connectivity matrix*

Description

Simulates a normal connectivity matrix

Usage

```
simX_nrm(EX, s2)
```

Arguments

EX	square matrix giving the expected value of the connectivity matrix
s2	dyadic variance

Value

a square matrix

Author(s)

Selena Wang

simY_nrm	<i>Simulate a normal behavior matrix</i>
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Description

Simulates a normal behavior matrix

Usage

```
simY_nrm(EY, s1)
```

Arguments

EY	matrix giving the expected value of the behavior matrix
s1	variance

Value

a N by P matrix

Author(s)

Selena Wang

simZ	<i>Simulate Z given its expectation and covariance</i>
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Description

Simulate Z given its expectation and covariance

Usage

```
simZ(EZ, rho, s2 = 1)
```

Arguments

EZ	expected value of Z
s2	dyadic variance

Value

a simulated value of Z

Author(s)

Selena Wang

X	<i>Simulated a list of V by V connectivity data</i>
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Description

The dataset contains a list of V by V connectivity data

Usage

X

Format

List including a list of weighted adjacency matrices of length N.

Details

a list of V by V connectivity data

Y	<i>Simulated a matrix of N by P individual outcomes data</i>
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Description

The dataset contains a matrix of N by P individual outcomes data

Usage

Y

Format

List including a matrix of N by P individual outcomes data about N individuals and P variables measuring a latent construct

Details

a matrix of N by P individual outcomes data

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