Package 'msaeHB'

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Type Package

Title Multivariate Small Area Estimation using Hierarchical Bayesian Method

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Description Implements area level of multivariate small area estimation using Hierarchical Bayesian method under Normal and T distribution. The 'rjags' package is employed to obtain parameter estimates. For the reference, see Rao and Molina (2015) <doi:10.1002/9781118735855>.

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R topics documented:

`datasaeNorm` *Sample Data for Small Area Estimation using Hierarchical Bayesian Method under Multivariate Normal distribution*

Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Multivariate Normal distribution

This data is generated by these following steps:

1. Generate sampling error `e`, random effect `u`, and auxiliary variables `X1` `X2`.
   - For sampling error `e`, we set e_d ~ $N_3(0, V_{ed})$, where $V_{ed} = (\sigma_{dij})_{i,j=1,2,3}$, with σ_{ii} ~ $InvGamma(a, b)$ and ρ_e = 0.5.
   - For random effect `u`, we set u ~ $N_3(0, V_u)$.
   - For auxiliary variables `X1` and `X2`, we set $X1$ ~ $UNIF(1, 2)$ and $X2$ ~ $UNIF(1, 10)$.
2. Calculate direct estimation `Y1` `Y2` and `Y3` , where Y_i = $X * \beta + u_i + e_i$. We take $\beta_1 = 1$ and $\beta_2 = 1$.

Auxiliary variables `X1` `X2`, direct estimation `Y1` `Y2` `Y3`, and sampling variance-covariance `v1` `v2` `v3` `v12` `v13` `v23` are combined into a dataframe called datasaeNorm

Usage

```
datasaeNorm
```

Format

A data frame with 30 rows and 11 variables:

X1 Auxiliary variable of X1

X2 Auxiliary variable of X2

Y1 Direct Estimation of Y1

Y2 Direct Estimation of Y2

Y3 Direct Estimation of Y3

v1 Sampling Variance of Y1

v12 Sampling Covariance of Y1 and Y2

v13 Sampling Covariance of Y1 and Y3

v2 Sampling Variance of Y2

v23 Sampling Covariance of Y2 and Y3

v3 Sampling Variance of Y3

`datasaeT` *Sample Data for Small Area Estimation using Hierarchical Bayesian Method under Multivariate T distribution*

Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Multivariate T distribution

This data is generated by these following steps:

1. Generate sampling error `e`, random effect `u`, and auxiliary variables `X1` `X2`.
   - For sampling error `e`, we set e_d is multivariate T distributed where the vector of noncentrality parameters is zero, scale matrix $V_{ed} = (\sigma_{dij})_{i,j=1,2,3}$, with σ_{ii} ~ $InvGamma(a, b)$ and ρ_e = 0.5, and degree of freedom *df* ~ $InvGamma(a, b)$.
   - For random effect `u`, we set u ~ $N_3(0, V_u)$.
   - For auxiliary variables `X1` and `X2`, we set $X1$ ~ $UNIF(1, 2)$ and $X2$ ~ $UNIF(1, 10)$.
2. Calculate direct estimation `Y1` `Y2` and `Y3` , where $Y_i = X * \beta + u_i + e_i$. We take $\beta_1 = 1$ and $\beta_2 = 1$.

Auxiliary variables `X1` `X2`, direct estimation `Y1` `Y2` `Y3`, and sampling variance-covariance `v1` `v2` `v3` `v12` `v13` `v23` are combined into a dataframe called datasaeT

Usage

```
datasaeT
```

Format

A data frame with 30 rows and 11 variables:

X1 Auxiliary variable of X1

X2 Auxiliary variable of X2

Y1 Direct Estimation of Y1

Y2 Direct Estimation of Y2

Y3 Direct Estimation of Y3

v1 Sampling Variance of Y1

v12 Sampling Covariance of Y1 and Y2

v13 Sampling Covariance of Y1 and Y3

v2 Sampling Variance of Y2

v23 Sampling Covariance of Y2 and Y3

v3 Sampling Variance of Y3

df2R *Transform Dataframe to Matrix R*

Description

This function transforms dataframe contains sampling variance to a diagonal matrix R

Usage

```
df2R(R, r)
```

Arguments

R	dataframe of sampling variances of direct estimators.
r	number of variables

Value

Block diagonal matrix R

Examples

```
NULL
```

mHBNormal *Multivariate Small Area Estimation using Hierarchical Bayesian under Normal Distribution*

Description

This function implements small area estimation using hierarchical bayesian to variable of interest that assumed to be a multivariate normal distribution.

Usage

```
mHBNormal(
  formula,
  vardir,
  iter.update = 3,
  iter.mcmc = 10000,
  thin = 2,
  burn.in = 2000,
  data
)
```

Arguments

formula	an object of class list of formula, describe the model to be fitted
vardir	vector containing name of sampling variances of direct estimators in the following order : var1,var2,. ,var(k) ,cov12,. cov1k,cov23,. ,cov(k-1)(k)
iter.update	number of updates with default 3
iter.mcmc	number of total iterations per chain with default 10000
thin	thinning rate, must be a positive integer with default 2
burn.in	number of iterations to discard at the beginning with default 2000
data	dataframe containing the variables named in formula and vardir

Value

The function returns a list with the following objects:

Est A vector with the values of Small Area mean Estimates using Hierarchical bayesian method

coefficient A dataframe with the estimated model coefficient

plot Trace, Density, Autocorrelation Function Plot of MCMC samples

Examples

```
## Load dataset
data(datasaeNorm)
## Using parameter 'data'
Fo <- list(f1=Y1~X1+X2,
           f2=Y2~X1+X2)
vardir <- c("v1", "v2", "v12")
m1 <- mHBNormal(formula=Fo, vardir=vardir,
iter.update = 1, iter.mcmc = 1000,
thin = 2, burn.in = 200, data=datasaeNorm)
```

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mHBT *Multivariate Small Area Estimation using Hierarchical Bayesian under T Distribution*

Description

This function implements small area estimation using hierarchical bayesian to variable of interest that assumed to be a multivariate T distribution.

Usage

```
mHBT(
  formula,
  vardir,
  iter.update = 3,
  iter.mcmc = 10000,
  thin = 2,
  burn.in = 2000,
  data
)
```

Arguments

formula	an object of class list of formula, describe the model to be fitted
vardir	vector containing name of sampling variances of direct estimators in the following order : var1,var2,. ,var(k) ,cov12,. cov1k,cov23,. ,cov(k-1)(k)
iter.update	number of updates with default 3
iter.mcmc	number of total iterations per chain with default 10000
thin	thinning rate, must be a positive integer with default 2
burn.in	number of iterations to discard at the beginning with default 2000
data	dataframe containing the variables named in formula and vardir

Value

The function returns a list with the following objects:

Est A vector with the values of Small Area mean Estimates using Hierarchical bayesian method

coefficient A dataframe with the estimated model coefficient

plot Trace, Density, Autocorrelation Function Plot of MCMC samples

Examples

```
## Load dataset
data(datasaeT)
## Using parameter 'data'
Fo <- list(f1=Y1~X1+X2,
           f2=Y2~X1+X2)
vardir <- c("v1", "v2", "v12")
m1 <- mHBT(formula=Fo, vardir=vardir,
iter.update = 1, iter.mcmc = 1000,
thin = 2, burn.in = 200, data=datasaeT)
```

msaeHB *msaeHB : Multivariate Small Area Estimation using Hierarchical Bayesian Method*

Description

Implements area level of multivariate small area estimation using hierarchical Bayesian (HB) method under Normal and T distribution. The 'rjags' package is employed to obtain parameter estimates. For the reference, see Rao and Molina (2015) <doi:10.1002/9781118735855>.

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Functions

`mHBNormal` Estimate multivariate small area estimation under normal distribution

`mHBT` Estimate multivariate small area estimation under normal distribution

Reference

- Rao, J.N.K & Molina. (2015). Small Area Estimation 2nd Edition. New York: John Wiley and Sons, Inc. <doi:10.1002/9781118735855>.

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