

Package ‘saeHB.panel’

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Type Package

Title Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model

Version 0.1.1

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Description We designed this package to provide several functions for area level of small area estimation using hierarchical Bayesian (HB) method. This package provides model using panel data for variable interest. This package also provides a dataset produced by a data generation. The 'rjags' package is employed to obtain parameter estimates. Model-based estimators involves the HB estimators which include the mean and the variation of mean. For the reference, see Rao and Molina (2015).

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.1.2

URL <https://github.com/Veliatrimarliana/saeHB.panel>

BugReports <https://github.com/Veliatrimarliana/saeHB.panel/issues>

Suggests knitr, rmarkdown

VignetteBuilder knitr

Imports stringr, coda, rjags, stats, grDevices, graphics

SystemRequirements JAGS (<http://mcmc-jags.sourceforge.net>)

Depends R (>= 2.10)

NeedsCompilation no

Repository CRAN

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dataAr1	<i>Sample Data for Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model</i>
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Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model
This data is generated by these following steps:

1. Generate random effect area v , random effect for area i at time point j u , epsilon ϵ , variance of y_{di} var_{dir} , sampling error e , auxiliary x_{di1} and x_{di2}
 - Set coefficient $\beta_0 = \beta_1 = \beta_2 = 2$ and $\rho = -0,5$
 - Generate random effect area $v_{\{i\}} \sim N(0,1)$
 - Generate auxiliary variable $x_{di1}_{\{ij\}} \sim U(1,2)$
 - Generate auxiliary variable $x_{di2}_{\{ij\}} \sim U(1,3)$
 - Generate epsilon $\epsilon_{ij} \sim N(0,1)$
 - Calculate variance of y_{di} with $var_{dir}_{\{ij\}} \sim IG(10,6)$
 - Generate sampling error $e_{\{ij\}} \sim N(0, var_{dir}_{\{ij\}})$
 - Calculate random effect for area i at time point j $u_{ij} = \rho * u_{ij-1} + \epsilon_{ij}$
 - Calculate $\mu_{ij} = \beta_0 + \beta_1 x_{di1}_{ij} + \beta_2 x_{di2}_{ij} + v_i + u_{ij} + e_{ij}$
 - Set area=50 and period=10
2. Auxiliary variables x_{di1} , x_{di2} , direct estimation y , area, period, and var_{dir} are combined in a dataframe called dataAr1

Usage

dataAr1

Format

A data frame with 100 rows and 6 variables::

ydi Direct Estimation of y

area Area (domain) of the data

period Period (subdomain) of the data

vardir Sampling Variance of y
xdi1 Auxiliary variable of xdi1
xdi2 Auxiliary variable of xdi2

dataAr1Ns	<i>Sample Data for Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model with Non Sampled Area</i>
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Description

1. A dataset to simulate Small Area Estimation using Hierarchical Bayesian method for Rao-Yu Model with Non-sampled Area
2. This data contains NA values that indicates no sampled in at least one area.

Usage

dataAr1Ns

Format

A data frame with 100 row and 6 column:

ydi Direct Estimation of y
area Area (domain) of the data
period Period (subdomain) of the data
vardir Sampling Variance of y
xdi1 Auxiliary variable of xdi1
xdi2 Auxiliary variable of xdi2

dataPanel	<i>Sample Data for Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model when rho = 0</i>
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Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method for Rao-Yu Model with rho = 0 This data is generated by these following steps:

1. Generate random effect area v , random effect for area i at time point j u , epsilon ϵ , variance of y_{di} $vardir$, sampling error e , auxiliary x_{di1} and x_{di2}
 - Set coefficient $\beta_0 = \beta_1 = \beta_2 = 2$ and $\rho = -0,5$
 - Generate random effect area $v_{\{i\}} \sim N(0,1)$
 - Generate auxiliary variable $x_{di1}_{\{ij\}} \sim U(1,2)$

- Generate auxiliary variable $x_{di2_{ij}} \sim U(1, 3)$
 - Generate epsilon $\epsilon_{ij} \sim N(0, 1)$
 - Calculate variance of ydi with $var_{dir}_{ij} \sim IG(10, 6)$
 - Generate sampling error $e_{ij} \sim N(0, var_{dir}_{ij})$
 - Calculate $\mu_{ij} = \beta_0 + \beta_1 x_{di1_{ij}} + \beta_2 x_{di2_{ij}} + v_i + \epsilon_{ij} + e_{ij}$
 - Set area=50 and period=10
2. Auxiliary variables xdi1, xdi2, direct estimation y, area, period, and vardir are combined in a dataframe called dataPanel

Usage

dataPanel

Format

A data frame with 100 rows and 6 variables::

- ydi** Direct Estimation of y
- area** Area (domain) of the data
- period** Period (subdomain) of the data
- vardir** Sampling Variance of y
- xdi1** Auxiliary variable of xdi1
- xdi2** Auxiliary variable of xdi2

dataPanelNs	<i>Sample Data for Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model when rho = 0 with Non Sampled Area</i>
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Description

1. A dataset to simulate Small Area Estimation using Hierarchical Bayesian method for Rao-Yu Model with Non-sampled area
2. This data contains NA values that indicates no sampled in at least one area.

Usage

dataPanelNs

Format

A data frame with 100 row and 6 column:

ydi Direct Estimation of y

area Area (domain) of the data

period Period (subdomain) of the data

vardir Sampling Variance of y

xdi1 Auxiliary variable of xdi1

xdi2 Auxiliary variable of xdi2

Panel	<i>Small Area Estimation using Hierarchical Bayesian under Rao-Yu Model with $\rho=0$</i>
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Description

This function is implemented to variable of interest ydi

Usage

```
Panel(
  formula,
  area,
  period,
  vardir,
  iter.update = 3,
  iter.mcmc = 2000,
  thin = 2,
  burn.in = 1000,
  tau.e = 1,
  tau.v = 1,
  data
)
```

Arguments

formula	Formula that describe the fitted model
area	Number of areas (domain) of the data
period	Number of periods (subdomains) for each area of the data
vardir	Sampling variances of direct estimations
iter.update	Number of updates with default 3
iter.mcmc	Number of total iterations per chain with default 2000
thin	Thinning rate, must be a positive integer with default 1

burn.in	Number of iterations to discard at the beginning with default 1000
tau.e	Variance of area-by-time effect of variable interest with default 1
tau.v	Variance of random area effect of variable interest with default 1
data	The data frame

Value

This function returns a list of the following objects:

Est	A vector with the values of Small Area mean Estimates using Hierarchical bayesian method
refVar	Estimated random effect variances
coef	A dataframe with the estimated model coefficient
plot	Trace, Density, Autocorrelation Function Plot of MCMC samples

Examples

```
##For data without any non-sampled area
data(dataPanel)      # Load dataset
formula = ydi ~ xdi1 + xdi2
area = max(dataPanel[, "area"])
period = max(dataPanel[, "period"])
vardir = dataPanel[, "vardir"]

result <- Panel(formula, area, period, vardir, data = dataPanel)

result$Est
result$refVar
result$coef
result$plot

## For data with non-sampled area use dataPanelNs
```

Description

This function is implemented to variable of interest ydi

Usage

```
RaoYuAr1(
  formula,
  area,
  period,
  vardir,
  iter.update = 3,
  iter.mcmc = 2000,
  thin = 2,
  burn.in = 1000,
  tau.e = 1,
  tau.v = 1,
  data
)
```

Arguments

formula	Formula that describe the fitted model
area	Number of areas (domain) of the data
period	Number of periods (subdomains) for each area of the data
vardir	Sampling variances of direct estimations
iter.update	Number of updates with default 3
iter.mcmc	Number of total iterations per chain with default 2000
thin	Thinning rate, must be a positive integer with default 1
burn.in	Number of iterations to discard at the beginning with default 1000
tau.e	Variance of area-by-time effect of variable interest with default 1
tau.v	Variance of random area effect of variable interest with default 1
data	The data frame

Value

This function returns a list of the following objects:

Est	A vector with the values of Small Area mean Estimates using Hierarchical bayesian method
refVar	Estimated random effect variances
coefficient	A dataframe with the estimated model coefficient
alpha	Parameter dispersion of Generalized Poisson distribution
plot	Trace, Density, Autocorrelation Function Plot of MCMC samples

Examples

```
##For data without any non-sampled area
data(dataAr1)      # Load dataset
formula = ydi ~ xdi1 + xdi2
area = max(dataAr1[, "area"])
period = max(dataAr1[, "period"])
varDir = dataAr1[, "varDir"]

result <- RaoYuAr1(formula, area, period, varDir, data = dataAr1)
result$Est
result$refVar
result$coefficient
result$plot
## For data with non-sampled area use dataAr1Ns
```

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