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

Author Velia Tri Marliana [aut, cre], Azka Ubaidillah [aut]

Maintainer Velia Tri Marliana <221810642@stis.ac.id>

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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Contents

`dataAr1` *Sample Data for Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model*

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 ydi `vardir`, sampling error `e`, auxiliary `xdi1` and `xdi2`
   - Set coefficient $\beta_0 = \beta_1 = \beta_2 = 2$ and $\rho = -0,5$
   - Generate random effect area `v_{i}~N(0,1)`
   - Generate auxiliary variable `xdi1_{ij}~U(1,2)`
   - Generate auxiliary variable `xdi2_{ij}~U(1,3)`
   - Generate epsilon ϵ_{ij}`~N(0,1)`
   - Calculate variance of ydi with `vardir_{ij}~IG(10,6)`
   - Generate sampling error `e_{ij}~N(0,vardir_{ij})`
   - Calculate random effect for area i at time point j $u_{ij} = \rho * u_{ij-1} + \epsilon_{ij}$
   - Calculate $\mu_{ij} = \beta_0 + \beta_1 xdi1_{ij} + \beta_2 xdi2_{ij} + v_i + u_{ij} + e_{ij}$
   - Set `area=50` and `period=10`
2. Auxiliary variables `xdi1,xdi2`, direct estimation `y`, `area`, `period`, and `vardir` are combined in a dataframe called `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` *Sample Data for Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model with Non Sampled Area*

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` *Sample Data for Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model when* `rho = 0`

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 ydi `vardir`, sampling error `e`, auxiliary `xdi1` and `xdi2`
   - Set coefficient $\beta_0 = \beta_1 = \beta_2 = 2$ and $\rho = -0, 5$
   - Generate random effect area `v_{i}~N(0,1)`
   - Generate auxiliary variable `xdi1_{ij}~U(1,2)`

- Generate auxiliary variable `xdi2_{ij}~U(1,3)`
- Generate epsilon ϵ_{ij}`~N(0,1)`
- Calculate variance of ydi with `vardir_{ij}~IG(10,6)`
- Generate sampling error `e_{ij}~N(0,vardir_{ij})`
- Calculate $\mu_{ij} = \beta_0 + \beta_1 xdi1_{ij} + \beta_2 xdi2_{ij} + v_i + \epsilon_{ij} + e_{ij}$
- 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

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dataPanelNs — *Sample Data for Small Area Estimation using Hierarchical Bayesian Method for Rao Yu Model when* `rho = 0` *with Non Sampled Area*

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` *Small Area Estimation using Hierarchical Bayesian under Rao-Yu Model with* `rho=0`

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
```

`RaoYuAr1` *Small Area Estimation using Hierarchical Bayesian under Rao-Yu Model*

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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