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 estima-
tion using hierarchical Bayesian (HB) method. This package provides model us-
ing panel data for variable interest.This package also provides a dataset produced by a data gen-
eration. The 'rjags' package is employed to obtain parameter estimates. Model-based estima-
tors involves the HB estimators which include the mean and the variation of mean. For the refer-
ence, 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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R **topics documented:**

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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 $\mu_{ij} = \beta_0 + \beta_1 x di1_{ij} + \beta_2 x di2_{ij} + v_i + \epsilon_{ij} + e_{ij}$
- 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	*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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