Package 'saeHB.gpois'

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Type Package

Title SAE using HB Method under Generalized Poisson Distribution

Version 0.1.1

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Description We designed this package to provide function for area level of Small Area Estimation using Hierarchical Bayesian (HB) method under Generalized Poisson Distribution. This package provides model using Univariate Generalized Poisson Distribution for variable of interest. Some datasets simulated by a data generation are also provided. 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) <doi:10.1002/9781118735855>, Wang (2021) <doi:10.1016/j.ecoinf.2021.101301> and Nzoufras (2009) <doi:10.1002/9780470434567>.

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.1.2

URL https://github.com/joiceevangelista/saeHB.gpois

BugReports https://github.com/joiceevangelista/saeHB.gpois/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

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Repository CRAN

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R topics documented:

`dataGPois` *Synthetic Dataset for SAE HB under Generalized Poisson Distribution*

Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Generalized Poisson Distribution.

This data is generated by these following steps:

1. Generate sampling random area effect `u` with `u ~ N(0,1)`. The auxiliary variables are generated by uniform distribution with `x1 ~ U(0,1)` and `x2 ~ U(0,1)`. The coefficient parameters $\beta_0, \beta_1, and \beta_2$ are set with a certain values. we set the parameter of dispersion, $\alpha = 0.5$.
   Calculate μ = $exp(\beta_0 + x_1\beta_1 + x_2\beta_2 + u)$
   Generate direct estimate `y ~ Generalized Poisson` with parameters: μ and α
   The variance of `y` is obtained with `var(y)` = $\mu/(1-\alpha)^2$
2. Auxiliary variables `x1,x2`, direct estimation `(y)` and vardir are combined in a dataframe called `dataGPois`

Usage

```
dataGPois
```

Format

A data frame with 50 rows and 4 variables:

y Direct Estimation of y

x1 Auxiliary variable of x1

x2 Auxiliary variable of x2

vardir Sampling Variance of y

dataGPoisNs — *Synthetic Dataet for SAE HB under Generalized Poisson Distribution with Non-sampled Areas*

Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Generalized Poisson Distribution with non-sampled areas.

This data contains NA values that indicates no sampled at one or more small areas. It uses `dataGPois` with the direct estimates and the related variances in 5 small areas are missing.

Usage

```
dataGPoisNs
```

Format

A data frame with 50 rows and 4 variables:

y Direct Estimation of y

x1 Auxiliary variable of x1

x2 Auxiliary variable of x2

vardir Sampling Variance of y

GPois — *Small Area Estimation Using Hierarchical Bayesian Method under Generalized Poisson Distribution*

Description

This function is implemented to variable of interest (y) that assumed to be a Generalized Poisson Distribution. The range of data is $0 < y < \infty$. Generalized Distribution model can be used to handle underdispersion and overdispersion in count data.

Usage

```
GPois(
  formula,
  iter.update = 3,
  iter.mcmc = 2000,
  coef,
  var.coef,
  thin = 1,
  burn.in = 1000,
  tau.u = 1,
  data
)
```

Arguments

formula	Formula that describe the fitted model
iter.update	Number of updates with default 3
iter.mcmc	Number of total iterations per chain with default 2000
coef	Regression coefficient for variable of interest (y)
var.coef	Variance of coefficient
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.u	Variance of random effect area for non-zero count 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 contains the estimated model coefficient
plot	Trace, Density, Autocorrelation Function Plot of MCMC samples

Examples

```
##For data without any non-sampled area
data(dataGPois)     # Load dataset

result <- GPois(y ~ x1 + x2, data = dataGPois)

result$Est           # Small Area mean estimates
result$refVar        # Estimated random effect variances
result$coefficient   # Estimated model coefficient

# Load library 'coda' to execute the plot
# autocorr.plot(result$plot[[3]])  # Generate ACF Plot
# plot(result$plot[[3]])           # Generate Density and Trace Plot

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

saeHB.gpois *saeHB.gpois : SAE using HB Method under Generalized Poisson Distribution*

Description

Provides function and datasets for area level of Small Area Estimation using Hierarchical Bayesian Method under Generalized Poisson Distribution.

Author(s)

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Functions

GPois The function produces small area estimator under Generalized Poisson Model Using Hierarchical Bayesian Method with Generalized Poisson distribution based on GP-1 model introduced by Consul (1989).

Reference

- Rao, J.N.K & Molina. (2015). Small Area Estimation 2nd Edition. New Jersey: John Wiley and Sons, Inc. <doi:10.1002/9781118735855>.
- Wang, G. (2021). Bayesian regression models for ecological count data in PyMC3. Ecological Informatics, 63, 101301. <doi:10.1016/j.ecoinf.2021.101301>.
- Ntzoufras, I. (2009). Bayesian Modelling Using WinBUGS. New Jersey : John Wiley & Sons, Inc. <doi:10.1002/9780470434567>.

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