Package 'saeHB.hnb'

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Type Package

Title Small Area Estimation under Hurdle Negative Binomial Distribution using Hierarchical Bayesian Method

Version 0.1.2

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Description

We design this package to provide a function for area level of small area estimation using Hierarchical Bayesian (HB) method under Hurdle Negative Binomial Distribution. This package provides model using Univariate Hurdle Negative Binomial Distribution for variable of 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 Hierarchical Bayes estimators which include the mean and the variation of mean. For references, see Hilbe (2011) <doi:10.1017/CBO9780511973420> and Rao (2015) <doi:10.1002/9781118735855>.

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.1.2

URL https://github.com/rakaikmana/saeHB.hnb

BugReports https://github.com/rakaikmana/saeHB.hnb/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:

`dataHNB` *Synthetics Data for Small Area Estimation using Hierarchical Bayesian Method under Hurdle Negative Binomial Distribution*

Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Hurdle Negative Binomial Distribution

This data is generated by these following steps:

1. Generate sampling random area effect for non-zero count `u` with `u ~ N(0,1)`. The auxiliary variables are generated by `x1 ~ U(0,1)` and `x2 ~ N(0,1)`. The coefficient parameters for non-zero count variable of interest $\beta_0, \beta_1, and \beta_2$ are set with a certain values, we set them equals to 1. Meanwhile, the coefficient parameters for zero count of variable of interest $\gamma_0, \gamma_1, and \gamma_2$ are set with values = 0,5.
   Set the dispersion parameter α with a certain value, we set $\alpha = 1$.
   Calculate the probability of hurdle crossing π = $exp(\gamma_0 + x_1\gamma_1 + x_2\gamma_2)$ / $1 + exp(\gamma_0 + x_1\gamma_1 + x_2\gamma_2)$
   Calculate μ = $exp(\beta_0 + x_1\beta_1 + x_2\beta_2 + u)$
   Generate direct estimate `y ~ Hurdle Negative Binomial`, with the following parameters : μ, α, π
   Calculate the variance of `y`. Variance of `y` is obtained using MGF Method.
2. Auxiliary variables x1, x2, direct estimation (y) and variance (vardir) are combined in a dataframe called dataHNB.

Usage

```
data(dataHNB)
```

Format

A data frame with 50 rows and 2 variables:

y Direct Estimation of y

x1 Auxiliary variable of x1

x2 Auxiliary variable of x2

vardir Sampling Variance of y

dataHNBNs — *Synthetics Data for Small Area Estimation using Hierarchical Bayesian Method under Hurdle Negative Binomial Distribution with non-sampled areas*

Description

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Hurdle Negative Binomial Distribution with non-sampled areas

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

Usage

```
data(dataHNBNs)
```

Format

A data frame with 50 rows and 5 variables:

y Direct Estimation of y

x1 Auxiliary variable of x1

x2 Auxiliary variable of x2

vardir Sampling Variance of y

HurdleNB — *Small Area Estimation using Hierarchical Bayesian under Hurdle Negative Binomial Distribution*

Description

This function is implemented to variable of interest (y) that assumed to be a Hurdle Negative Binomial Distribution. The value of variable of interest must be a non-negative data count. This model can be used to handle overdispersion and excess zero in data.

Usage

```
HurdleNB(
  formula,
  iter.update = 3,
  iter.mcmc = 2000,
  coef.nonzero,
  var.coef.nonzero,
  coef.zero,
```

```
  var.coef.zero,
  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.nonzero	Optional vector for the mean of the prior distribution of the model coefficients (β) for variable of interest (y) which value is zero count
var.coef.nonzero	Optional vector of variance of coefficient non-zero count
coef.zero	Optional vector for the mean of the prior distribution of the model coefficients (γ) for variable of interest (y) which value is zero count
var.coef.zero	Optional vector for variance of coefficient zero count
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 with the estimated model coefficient
alpha	Dispersion parameter
plot	Trace, Density, Autocorrelation Function Plot of MCMC samples

Examples

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

result <- HurdleNB(y ~ x1 + x2, data = dataHNB)

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

```
result$alpha        # Estimated dispersion parameter

# 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 dataHNBNs
```

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saeHB.hnb *saeHB.hnb : Small Area Estimation under Hurdle Negative Binomial Model using Hierarchical Bayesian Method*

Description

Provides function and datasets for area level of Small Area Estimation under Hurdle Negative Binomial Model using Hierarchical Bayesian (HB) Method. For the reference, see Rao and Molina (2015), Hilbe (2011), and Andika, et al. (2019)

Author(s)

Raka Ikmana, Azka Ubaidillah

Maintainer: Raka Ikmana <221810548@stis.ac.id>

Functions

HurdleNB This function gives small area estimator under Hurdle Negative Binomial Model and is implemented to variable of interest (y) that assumed to be a HNB Distribution. The value of variable of interest must be a non-negative data count. This model can be used to handle overdispersion and excess zero in data.

Reference

- Rao, J.N.K & Molina. (2015). Small Area Estimation 2nd Edition. New Jersey: John Wiley and Sons, Inc. <doi:10.1002/9781118735855>.
- Hilbe, J. M. (2011). Negative Binomial Regression 2nd Edition. New York : Cambridge University Press. <doi:10.1017/CBO9780511973420>.
- Ntzoufras, I. (2009). Bayesian Modelling Using WinBUGS. New Jersey : John Wiley & Sons, Inc.

Index