Package ‘saeHB.zinb’

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**Type**  Package

**Title**  Small Area Estimation using Hierarchical Bayesian under Zero Inflated Negative Binomial Distribution

**Version**  0.1.1

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**Description**  We designed this package to provide a function for area level of small area estimation using Hierarchical Bayesian (HB) method under Zero Inflated Negative Binomial Distribution. This package provides model using Univariate Zero Inflated 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 HB estimators which include the mean and the variation of mean, and the quantile. For the reference, see Rao,J.N.K & Molina (2015) <doi:10.1002/9781118735855>.

**License**  GPL-3

**Encoding**  UTF-8

**LazyData**  true

**RoxygenNote**  7.2.0

**URL**  https://github.com/hayunbuto/saeHB.zinb

**BugReports**  https://github.com/hayunbuto/saeHB.zinb/issues

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

**Suggests**  saeHB, knitr, rmarkdown

**VignetteBuilder**  knitr

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

**Depends**  R (>= 2.10)

**NeedsCompilation**  no

**Repository**  CRAN

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Description

Datasets to simulate Small Area Estimation using Hierarchical Bayesian Method under Zero Inflated Negative Binomial.

This data is generated by these following steps:

1. Generate sampling random area effect $u$ and $v$ with $u \sim N(0,1)$ and $v \sim N(0,1)$.
2. The auxiliary variables are generated by uniform and bernoulli distribution with $x_1 \sim U(0,1)$ and $x_2 \sim B(1,0.6)$.
3. The coefficient parameters $\beta_0, \beta_1, \beta_2, \gamma_0, \gamma_1$, and $\gamma_2$ are set with a certain values. For the reference, see Desjardins, C.D. (2013).
4. Calculate $\pi = \exp(\gamma_0 + x_1\gamma_1 + x_2\gamma_2 + u) / (1 + \exp(\gamma_0 + x_1\gamma_1 + x_2\gamma_2 + u))$
5. Calculate $\mu = \exp(\beta_0 + x_1\beta_1 + x_2\beta_2 + v)$
6. Generate direct estimate with $y \sim rzinegbin(\mu, \pi, r)$, we set $r = 2$. Using library(VGAM)
7. Calculate the variance of $y$ with $\text{var}(y) = \mu \ast (1 - \pi) \ast (1 + (\mu / r) + (\mu \ast \pi))$
8. Auxiliary variables $x_1, x_2$, direct estimation $y$ and $\text{vardir}$ are combined in a dataframe called dataZINB

Usage

data(dataZINB)

Format

A data frame with 50 rows and 4 variables:

- $y$ Direct Estimation of $y$
- $x_1$ Auxiliary variable of $x_1$
- $x_2$ Auxiliary variable of $x_2$
- $\text{vardir}$ Sampling Variance of $y$
dataZINBNS

**synonyms**

*Synhetics Data for Small Area Estimation using Hierarchical Bayesian Method under Zero Inflated Negative Binomial Distribution with non-sampled areas*

**Description**

Dataset to simulate Small Area Estimation using Hierarchical Bayesian Method under Zero Inflated 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 `dataZINB` with the direct estimates and the related variances in 5 small areas are missing.

**Usage**

```r
data(dataZINBNS)
```

**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

saeHB.zinb

**synonyms**

*saeHB.zinb : Small Area Estimation under Zero Inflated Negative Binomial Model using Hierarchical Bayesian Method*

**Description**

Provides function and datasets for area level of Small Area Estimation under Zero Inflated Negative Binomial Model using Hierarchical Bayesian (HB) Method with Univariate Zero Inflated Negative Binomial Distribution for variable of interest. The `rjags` package is employed to obtain parameter estimates. Model-based estimators involves the HB estimators which include the mean, the variation of mean, and the quantile of mean. For the reference, see Rao, J.N.K & Molina (2015).

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Functions

**ZinbHB** This function gives small area estimator under Zero Inflated Negative Binomial Model and is implemented to variable of interest \((y)\) that assumed to be a Zero Inflated Negative Binomial Distribution. The range of data is \((y \geq 0)\)

Reference


**ZinbHB** 
Small Area Estimation using Hierarchical Bayesian under Zero Inflated Negative Binomial Distribution

Description

This function is implemented to variable of interest \((y)\) that assumed to be a Zero Inflated Negative Binomial Distribution. The range of data is \((y \geq 0)\). This model can be used to handle overdispersion and excess zero in data.

Usage

```r
ZinbHB(
  formula,
  iter.update = 3,
  iter.mcmc = 1100,
)```
coef.nonzero,  
coef.zero,  
var.coef.nonzero,  
var.coef.zero,  
thin = 1,  
burn.in = 600,  
tau.u = 1,  
tau.v = 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 1100
coef.nonzero Optional vector containing initial values mu.b for the mean of the prior distribution of the log model coefficients (β) with default rep(0, nvar)
coef.zero Optional vector containing initial values mu.g for the mean of the prior distribution of the logit model coefficients (γ) with default rep(0, nvar)
var.coef.nonzero Optional vector containing initial values tau.b for the variance of the prior distribution on the log model coefficients (β) with default rep(1, nvar)
var.coef.zero Optional vector containing initial values tau.g for the variance of the prior distribution of the logit model coefficients (γ) with default rep(1, nvar)
thin Thinning rate, must be a positive integer with default 1
burn.in Number of iterations to discard at the beginning with default 600
tau.u Variance of random effect area for non-zero count of variable interest with default 1
tau.v Variance of random effect area for zero count of variable interest with default 1
data The data frame

Value

This function returns a list of the following objects:

Est A dataframe that contains the values, standard deviation, and quantile of Small Area mean Estimates using Hierarchical bayesian method
refVar Estimated random effect variances
coefficient A data frame with the estimated model coefficient consist of beta (coefficient in the log model) and gamma (coefficient in the logit model)
plot.beta Trace, Density, Autocorrelation Function Plot of MCMC samples beta
plot.gamma Trace, Density, Autocorrelation Function Plot of MCMC samples gamma
Examples

## Compute Fitted Model
## y ~ x1 + x2, nvar = 3

## For data without any nonsampled area
## Load Dataset
data(dataZINB)
result <- ZinbHB(formula = y ~ x1 + x2, data = dataZINB)

## Result
result$Est # Small Area mean Estimates
result$refVar # refVar
result$coefficient # coefficient

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

## For data with nonsampled area use dataZINBNs
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