Package ‘bayesZIB’

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bayesZIB-package

Bayesian zero-inflated Bernoulli regression model

Description

This package fits a Bayesian Bernoulli zero-inflated regression model handling different covariates for the zero-inflated and non-zero-inflated parts.

Details

Package: bayesZIB
Type: Package
Version: 0.0.2
Date: 2021-5-12
License: GPL version 2 or newer
LazyLoad: yes

The package implements a new Bayesian Bernoulli zero-inflated. This model is able to distinguish between two sources of zeroes (structural and non-structural) on the basis of a Bayesian framework, using rstan. All the convergence and goodness-of-fit tests from rstan are available.

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See Also

bayesZIB

Examples

```r
set.seed(1234)
x <- rbinom(20, 1, 0.4)  # Structural zeroes
y <- rbinom(20, 1, 0.7*x) # Non-structural zeroes
fit <- bayesZIB(y~1, priors=list(c(0,0.5), c(0.5,1)))
print(fit$fit, pars=c("theta", "beta"))
```
Bayesian Bernoulli zero-inflated regression model.

Description

Fit Bernoulli zero-inflated regression models in a Bayesian framework.

Usage

bayesZIB(formula, data, priors=NULL, chains=3, iter=2000,
  adapt_delta=0.8, max_treedepth=10, verbose=FALSE,
  cores=getOption("mc.cores", 1L))

Arguments

- **formula**: symbolic description of the model, see details.
- **data**: arguments controlling formula processing via `model.frame`.
- **priors**: list with two elements specifying the limits of the uniform priors for \( w \) and \( p \) respectively. It is NULL by default but should be defined if there are no covariates.
- **chains**: a positive integer specifying the number of Markov chains. The default is 3.
- **iter**: a positive integer specifying the number of iterations for each chain (including warmup). The default is 2000.
- **adapt_delta**: for the No-U-Turn Sampler (NUTS), the variant of Hamiltonian Monte Carlo used by `rstan`, `adapt_delta` is the target average proposal acceptance probability for adaptation. double, between 0 and 1, defaults to 0.8.
- **max_treedepth**: maximum depth parameter. Positive integer, defaults to 10. When the maximum allowed tree depth is reached it indicates that NUTS is terminating prematurely to avoid excessively long execution time.
- **verbose**: TRUE or FALSE: flag indicating whether to print intermediate output from Stan on the console, which might be helpful for model debugging.
- **cores**: number of cores to use when executing the chains in parallel, which defaults to 1 but according to the Stan documentation it is recommended to set the `mc.cores` option to be as many processors as the hardware and RAM allow (up to the number of chains).

Details

Zero-inflated models are two-component mixture models combining a point mass at zero with a proper count distribution. Thus, there are two sources of zeros: zeros may come from both the point mass and from the Bernoulli component. For modeling the unobserved state (zero vs. Bernoulli), a binary model is used that captures the probability of zero inflation. in the simplest case only with an intercept but potentially containing regressors. For this zero-inflation model, a binomial model with an appropriate link function is used.

The formula can be used to specify both components of the model: If a formula of type `y ~ x1 + x2` is supplied, then the same regressors are employed in both components. This is equivalent to `y ~ x1`
+ x2 | x1 + x2. Of course, a different set of regressors could be specified for the Bernoulli and zero-inflation component, e.g., y ~ x1 + x2 | z1 + z2 + z3 giving the logistic regression model y ~ x1 + x2 conditional on (|) the zero-inflation model y ~ z1 + z2 + z3. A simple inflation model where all zero counts have the same probability of belonging to the zero component can by specified by the formula y ~ x1 + x2 | 1.

Value

An object of class "bayesZIB", i.e., a list with components including

- **Call**: text string with the original call to the function
- **x**: design matrix for the zero-inflated part
- **z**: design matrix for the non zero-inflated part
- **fit**: an object of S4 class `stanfit` if there are covariates or a named list with **iter** draws from the posterior distribution of **w** and **p**.

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See Also

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Examples

```r
set.seed(1234)
x <- rbinom(20, 1, 0.4)  # Structural zeroes
y <- rbinom(20, 1, 0.7*x) # Non-structural zeroes
fit <- bayesZIB(y~1|1, priors=list(c(0, 0.5), c(0.5, 1)))
print(fit$fit, pars=c("theta", "beta"))
```
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