

# Package ‘cslogistic’

January 16, 2012

**Version** 0.1-2

**Date** 2012-01-16

**Title** Conditionally Specified Logistic Regression

**Author@R** c(person(“Alejandro”, “Jara”, email = “atjara@uc.cl”), person(“Maria Jose”, “Garcia-Zattera”, role = “ctb”, email = “mjgarcia@uc.cl”))

**Author** Alejandro Jara <atjara@uc.cl> and Maria Jose Garcia-Zattera <mjgarcia@muc.cl>

**Maintainer** Alejandro Jara <atjara@uc.cl>

**Depends** R (>= 2.10), mvtnorm

**Description** This package contains functions for likelihood and posterior analysis of conditionally specified logistic regression models. All calculus and simulation is done in compiled FORTRAN.

**License** GPL (>= 2)

**URL** <http://www.mat.puc.cl/~ajara>

**Repository** CRAN

**Date/Publication** 2012-01-16 21:00:40

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|-----------------|---|
| BayesCslogistic | <i>Perform a Bayesian Analysis of a conditionally specified logistic regression model</i> |
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### Description

This function generates a posterior density sample from a conditionally specified logistic regression model for multivariate binary data using a random walk Metropolis algorithm. The user supplies data and priors, and a sample from the posterior density is returned as a object, which can be subsequently analyzed with functions provided in the coda package.

### Usage

```
BayesCslogistic(formula, type = TRUE, intercept = TRUE,
                burnin = 1000, mcmc = 10000, thin=1,
                tune=1.1, beta.start = NA, b0 = 0, B0 = 0, ...)
```

### Arguments

|            |   |
|------------|---|
| formula    | Model formula.  |
| type       | logical variable indicating if covariates have the same effect 'TRUE' or different effect 'FALSE' for each variable.  |
| intercept  | logical variable indicating if only the intercept 'TRUE' or all the covariates have different effect 'FALSE' for each variable. The option 'type' must be 'FALSE'.  |
| burnin     | The number of burn-in iterations for the sampler.   |
| mcmc       | The number of Metropolis iterations for the sampler.  |
| thin       | The thinning interval used in the simulation. The number of mcmc iterations must be divisible by this value.  |
| tune       | Metropolis tuning parameter. Make sure that the acceptance rate is satisfactory (typically between 0.20 and 0.5) before using the posterior density sample for inference.   |
| beta.start | The starting value for the $\beta$ vector. This can either be a scalar or a column vector with dimension equal to the number of betas. If this takes a scalar value, then that value will serve as the starting value for all of the betas. The default value of NA will use the maximum likelihood estimate of $\beta$ as the starting value. Those are obtained using the function Cslogistic |
| b0         | The prior mean of $\beta$ . This can either be a scalar or a column vector with dimension equal to the number of betas. If this takes a scalar value, then that value will serve as the prior mean for all of the betas.  |
| B0         | The prior precision of $\beta$ . This can either be a scalar or a square matrix with dimensions equal to the number of betas. If this takes a scalar value, then that value times an identity matrix serves as the prior precision of $\beta$ . Default value of 0 is equivalent to an improper uniform prior for beta.   |
| ...        | further arguments to be passed.   |

**Value**

An mcmc object that contains the posterior density sample. This object can be summarized by functions provided by the coda package.

**Author(s)**

Alejandro Jara <atjara@uc.cl>

Maria Jose Garcia-Zattera <mjgarcia@uc.cl>

**References**

Garcia-Zattera, M. J., Jara, A., Lesaffre, E. and Declerck, D. (2007). Conditional independence of multivariate binary data with an application in caries research. *Computational Statistics and Data Analysis*, 51(6): 3223-3232.

Joe, H. and Liu, Y. (1996). A model for multivariate response with covariates based on compatible conditionally specified logistic regressions. *Statistics & Probability Letters* 31: 113-120.

**See Also**

[cslogistic](#), [MleCslogistic](#).

**Examples**

```
# simulated data set

library(mvtnorm)

n <- 400
mu1 <- c(-1.5,-0.5)
Sigma1 <- matrix(c(1, -0.175,-0.175,1),ncol=2)
agev <- as.vector(sample(seq(5,6,0.1),n,replace=TRUE))
beta1 <- 0.2

z <- rmvnorm(n,mu1,Sigma1)
zz <- cbind(z[,1]+beta1*agev,z[,2]+beta1*agev)
dat <- cbind(zz[,1]>0,zz[,2]>0,agev)
colnames(dat) <- c("y1","y2","age")
data0 <- data.frame(dat)
attach(data0)

# equal effect of age for all the covariates

y <- cbind(y1,y2)

fit0 <- BayesCslogistic(y~age)
fit0
summary(fit0)
plot(fit0)

# different effects: only intercept
```

```

fit1 <- BayesCslogistic(y~age,type=FALSE)
fit1
summary(fit1)
plot(fit1)

# different effects: all the covariates

fit2 <- BayesCslogistic(y~age,type=FALSE,intercept=FALSE)
fit2
summary(fit2)
plot(fit2)

```

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|            |   |
|------------|---|
| cslogistic | <i>Perform an Analysis of a conditionally specified logistic regression model</i> |
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## Description

This package contains functions for likelihood and posterior analysis of conditionally specified logistic regression models.

## Details

Assume that for each of  $n$  experimental units the values of  $m$  binary variables

$$Y_{i1}, \dots, Y_{im}$$

are recorded. The 'MleCslogistic' and 'BayesCslogistic' functions fit a conditional specified logistic regression model, such that for  $i = 1, \dots, n$  and  $j = 1, \dots, m$ ,

$$\text{logit}P(Y_{ij} = 1 | Y_{ik} = y_k, k \neq j) = X_{ij}\beta_j + \sum_{k=1, k \neq j}^m \alpha_{jk}y_k$$

where, the parameters  $\alpha_{jk}$  have interpretation as conditional log-odds ratios and the parameters  $\beta_j$  correspond to the regression coefficients associated to the vector of covariates  $X_{ij}$ . For compatibility of conditional distributions it is assumed that  $\alpha_{jk} = \alpha_{kj}$ ,  $j \neq k$ .

## Author(s)

Alejandro Jara Vallejos <Alejandro.JaraVallejos@med.kuleuven.be>

Maria Jose Garcia-Zattera <MariaJose.GarciaZattera@med.kuleuven.be>

## References

Garcia-Zattera, M. J., Jara, A., Lesaffre, E. and Declerck, D. (2005). On conditional independence for multivariate binary data in caries research. In preparation.

Joe, H. and Liu, Y. (1996). A model for multivariate response with covariates based on compatible conditionally specified logistic regressions. *Statistics & Probability Letters* 31: 113-120.

**See Also**

[MleCslogistic](#), [BayesCslogistic](#).

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|---------------|---|
| MleCslogistic | <i>Perform a Maximum Likelihood Analysis of a conditionally specified logistic regression model</i> |
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**Description**

Fit a conditional specified logistic regression model for multivariate binary responses.

**Usage**

```
MleCslogistic(formula,type = TRUE, intercept = TRUE, method = "BFGS",
               maxiter=1000 , data, ...)
```

**Arguments**

|           |  |
|-----------|--|
| formula   | a symbolic description of the model to be fit.   |
| type      | logical variable indicating if covariates have the same effect 'TRUE' or different effect 'FALSE' for each variable.   |
| intercept | logical variable indicating if only the intercept 'TRUE' or all the covariates have different effect 'FALSE' for each variable. The option 'type' must be 'FALSE'.                                       |
| method    | the optimization method to be used; the default method is "BFGS".  |
| maxiter   | maximum number of iterations used by the optimization method.  |
| data      | an optional data frame containing the variables in the model. If not found in 'data', the variables are taken from 'environment(formula)', typically the environment from which 'cslogistic' is called.. |
| ...       | further arguments to be passed.  |

**Author(s)**

Alejandro Jara <atjara@uc.cl>

Maria Jose Garcia-Zattera <mjgarcia@uc.cl>

**References**

Garcia-Zattera, M. J., Jara, A., Lesaffre, E. and Declerck, D. (2007). Conditional independence of multivariate binary data with an application in caries research. *Computational Statistics and Data Analysis*, 51(6): 3223-3232.

Joe, H. and Liu, Y. (1996). A model for multivariate response with covariates based on compatible conditionally specified logistic regressions. *Statistics & Probability Letters* 31: 113-120.

**See Also**

[cslogistic](#), [BayesCslogistic](#).

**Examples**

```
# simulated data set

library(mvtnorm)

n <- 400
mu1 <- c(-1.5,-0.5)
Sigma1 <- matrix(c(1, -0.175,-0.175,1),ncol=2)
agev <- as.vector(sample(seq(5,6,0.1),n,replace=TRUE))
beta1 <- 0.2

z <- rmvnorm(n,mu1,Sigma1)
zz <- cbind(z[,1]+beta1*agev,z[,2]+beta1*agev)
dat <- cbind(zz[,1]>0,zz[,2]>0,agev)
colnames(dat) <- c("y1","y2","age")
data0 <- data.frame(dat)
attach(data0)

# equal effect of age for all the covariates

y <- cbind(y1,y2)

fit0 <- MleCslogistic(y~age)
fit0
summary(fit0)

# different effects: only intercept

fit1 <- MleCslogistic(y~age,type=FALSE)
fit1
summary(fit1)

# different effects: all the covariates

fit2 <- MleCslogistic(y~age,type=FALSE,intercept=FALSE)
fit2
summary(fit2)
```

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