Package 'NBtsVarSel'

July 17, 2023

Type Package

Title Variable Selection in a Specific Regression Time Series of Counts

Version 1.0

Date 2023-07-17

Description Performs variable selection in sparse negative binomial GLARMA (Generalised Linear Autoregressive Moving Average) models. For further details we refer the reader to the paper Gomtsyan (2023), <arXiv:2307.00929>.

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Depends R (>= 3.5.0), Matrix, glmnet, stats, MASS, mpath, ggplot2

VignetteBuilder knitr

Suggests knitr, markdown, formatR

NeedsCompilation no

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R topics documented:

NBtsVarSel-package *Variable Selection in a Specific Regression Time Series of Counts*

Description

NBtsVarSel consists of four functions: "variable_selection.R", "grad_hess_beta.R", "grad_hess_gamma.R" and "NR_gamma.R" For further information on how to use these functions, we refer the reader to the vignette of the package.

Details

This package consists of four functions: "variable_selection.R", "grad_hess_beta.R", "grad_hess_gamma.R" and "NR_gamma.R" For further information on how to use these functions, we refer the reader to the vignette of the package.

Author(s)

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References

M. Gomtsyan "Variable selection in a specific regression time series of counts.", arXiv:2307.00929

Examples

```
n = 50
p = 30
X = matrix(NA,(p+1),n)
f = 1/0.7
for(t in 1:n){X[,t] = c(1,cos(2*pi*(1:(p/2))*t*f/n),sin(2*pi*(1:(p/2))*t*f/n))}
gamma0 = c(0)
data(Y)
result = variable_selection(Y, X, gamma.init=gamma0, alpha.init=NULL, k.max=1, method="cv",
tr=0.3, n.iter=100, n.rep=1000)
beta_est = result$beta_est
Estim_active = result$estim_active
gamma_est = result$gamma_est
alpha_est = result$alpha_est
```

grad_hess_beta *Gradient and Hessian of the log-likelihood with respect to beta*

Description

This function calculates the gradient and Hessian of the log-likelihood with respect to beta.

Usage

```
grad_hess_beta(Y, X, beta, gamma, alpha)
```

Arguments

Y	Observation matrix
X	Design matrix
beta	Initial beta vector
gamma	Initial gamma vector
alpha	Initial overdispertion parameter

Value

grad_L_beta	Vector of the gradient of L with respect to beta
hess_L_beta	Matrix of the Hessian of L with respect to beta

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gamma0 = c(0)
data(Y)
glm_nb = glm.nb(Y~t(X)[,2:(p+1)])
beta0 = as.numeric(glm_nb$coefficients)
alpha0 = glm_nb$theta
result = grad_hess_beta(Y, X, beta0, gamma0, alpha0)
grad = result$grad_L_beta
Hessian = result$hess_L_beta
```

grad_hess_gamma *Gradient and Hessian of the log-likelihood with respect to gamma*

Description

This function calculates the gradient and Hessian of the log-likelihood with respect to gamma

Usage

```
grad_hess_gamma(Y, X, beta, gamma, alpha)
```

Arguments

Y	Observation matrix
X	Design matrix
beta	Initial beta vector
gamma	Initial gamma vector
alpha	Initial overdispertion parameter

Value

grad_L_gamma	Vector of the gradient of L with respect to gamma
hess_L_gamma	Matrix of the Hessian of L with respect to gamma

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for(t in 1:n){X[,t] = c(1,cos(2*pi*(1:(p/2))*t*f/n),sin(2*pi*(1:(p/2))*t*f/n))}
gamma0 = c(0)
data(Y)
glm_nb = glm.nb(Y~t(X)[,2:(p+1)])
beta0 = as.numeric(glm_nb$coefficients)
alpha0 = glm_nb$theta
result = grad_hess_gamma(Y, X, beta0, gamma0, alpha0)
grad = result$grad_L_gamma
Hessian = result$hess_L_gamma
```

NR_gamma *Newton-Raphson method for estimation of gamma*

Description

This function estimates gamma with Newton-Raphson method

Usage

```
NR_gamma(Y, X, beta, gamma, alpha, n.iter)
```

Arguments

Y	Observation matrix
X	Design matrix
beta	Initial beta vector
gamma	Initial gamma vector
alpha	Initial overdispertion parameter
n.iter	Number of iterations of the algorithm. Default=100

Value

gamma	Estimated gamma vector

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for(t in 1:n){X[,t] = c(1,cos(2*pi*(1:(p/2))*t*f/n),sin(2*pi*(1:(p/2))*t*f/n))}
gamma0 = c(0)
data(Y)
glm_nb = glm.nb(Y~t(X)[,2:(p+1)])
beta0 = as.numeric(glm_nb$coefficients)
alpha0 = glm_nb$theta
gamma_est = NR_gamma(Y, X, beta0, gamma0, alpha0, n.iter=100)
```

`variable_selection` *Variable selection*

Description

This function performs variable selection, estimates new vectors of beta and gamma and a new alpha

Usage

```
variable_selection(Y, X, gamma.init, alpha.init = NULL, k.max = 1, method = "cv",
tr = 0.3, n.iter = 100, n.rep = 1000)
```

Arguments

`Y`	Observation matrix
`X`	Design matrix
`gamma.init`	Initial gamma vector
`alpha.init`	Optional initial alpha value. The default is NULL
`k.max`	Number of iteration to repeat the whole algorithm
`method`	Stability selection method: "min" or "cv". In "min" the smallest lambda is chosen, in "cv" cross-validation lambda is chosen for stability selection. The default is "cv"
`tr`	Threshold for stability selection. The default is 0.3
`n.iter`	Number of iteration for Newton-Raphson algorithm. The default is 100
`n.rep`	Number of replications in stability selection step. The default is 1000

Value

`estim_active`	Estimated active coefficients
`beta_est`	Vector of estimated beta values
`gamma_est`	Vector of estimated gamma values
`alpha_est`	Estimation of alpha

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gamma0 = c(0)
data(Y)
result = variable_selection(Y, X, gamma.init=gamma0, alpha.init=NULL, k.max=1, method="cv",
tr=0.3, n.iter=100, n.rep=1000)
beta_est = result$beta_est
Estim_active = result$estim_active
gamma_est = result$gamma_est
alpha_est = result$alpha_est
```

Y *Observation matrix Y*

Description

An example of observation matrix

Usage

```
data("Y")
```

Format

The format is: num [1:50] 9 2 11 14 18 17 1 0 1 0 ...

References

M. Gomtsyan "Variable selection in a specific regression time series of counts.", arXiv:2307.00929

Examples

```
data(Y)
```

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