Package ‘MultiGlarmaVarSel’

October 12, 2022

Type Package

Title Variable Selection in Sparse Multivariate GLARMA Models

Version 1.0

Date 2022-09-01

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Description Performs variable selection in high-dimensional sparse GLARMA models. For further details we refer the reader to the paper Gomtsyan et al. (2022), <arXiv:2208.14721>.

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

VignetteBuilder knitr

Suggests knitr, markdown, formatR

NeedsCompilation no

Repository CRAN

Date/Publication 2022-09-02 07:50:11 UTC

R topics documented:

MultiGlarmaVarSel-package *Variable Selection in Sparse Multivariate GLARMA Models*

Description

MultiGlarmaVarSel consists of four functions: "variable_selection.R", "grad_hess_L_gamma.R", "grad_hess_L_eta.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_L_gamma.R", "grad_hess_L_eta.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 et al. "Variable selection in sparse multivariate GLARMA models: Application to germination control by environment", arXiv:2208.14721

Examples

```
data(Y)
I=3
J=100
T=dim(Y)[2]
q=1
X=matrix(0,nrow=(I*J),ncol=I)
for (i in 1:I)
{
  X[((i-1)*J+1):(i*J),i]=rep(1,J)
}
gamma_0 = matrix(0, nrow = 1, ncol = q)
result=variable_selection(Y, X, gamma_0, k_max=1,
n_iter=100, method="min", nb_rep_ss=1000, threshold=0.6)
estim_active = result$estim_active
eta_est = result$eta_est
gamma_est = result$gamma_est
```

`grad_hess_L_eta` *Gradient and Hessian of the log-likelihood with respect to eta*

Description

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

Usage

```
grad_hess_L_eta(Y, X, eta_vect, gamma, I, J)
```

Arguments

`Y`	Observation matrix
`X`	Design matrix
`eta_vect`	Initial eta vector
`gamma`	Initial gamma vector
`I`	Number of conditions
`J`	Number of replications

Value

`grad_L_eta`	Vector of the gradient of L with respect to eta
`hess_L_eta`	Matrix of the Hessian of L with respect to eta

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Examples

```
data(Y)
I=3
J=100
T=dim(Y)[2]
q=1
X=matrix(0,nrow=(I*J),ncol=I)
for (i in 1:I)
{
  X[((i-1)*J+1):(i*J),i]=rep(1,J)
```

```
}
gamma_0 = matrix(0, nrow = 1, ncol = q)
eta_glm_mat_0 = matrix(0,ncol=T,nrow=I)
for (t in 1:T)
{
  result_glm_0 = glm(Y[,t]~X-1,family=poisson(link='log'))
  eta_glm_mat_0[,t]=as.numeric(result_glm_0$coefficients)
}
eta_0 = round(as.numeric(t(eta_glm_mat_0)),digits=6)
result = grad_hess_L_eta(Y, X, eta_0, gamma_0, I, J)
grad = result$grad_L_eta
Hessian = result$hess_L_eta
```

`grad_hess_L_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_L_gamma(Y, X, eta, gamma, I, J)
```

Arguments

Y	Observation matrix
X	Design matrix
eta	Initial eta vector
gamma	Initial gamma vector
I	Number of conditions
J	Number of replications

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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References

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Examples

```
data(Y)
I=3
J=100
T=dim(Y)[2]
q=1
X=matrix(0,nrow=(I*J),ncol=I)
for (i in 1:I)
{
  X[((i-1)*J+1):(i*J),i]=rep(1,J)
}
gamma_0 = matrix(0, nrow = 1, ncol = q)
eta_glm_mat_0 = matrix(0,ncol=T,nrow=I)
for (t in 1:T)
{
  result_glm_0 = glm(Y[,t]~X-1,family=poisson(link='log'))
  eta_glm_mat_0[,t]=as.numeric(result_glm_0$coefficients)
}
eta_0 = round(as.numeric(t(eta_glm_mat_0)),digits=6)
result = grad_hess_L_gamma(Y, X, eta_0, gamma_0, I, J)
grad = result$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, eta, gamma, I, J, n_iter = 100)
```

Arguments

`Y`	Observation matrix
`X`	Design matrix
`eta`	Initial eta vector
`gamma`	Initial gamma vector
`I`	Number of conditions
`J`	Number of replications
`n_iter`	Number of iterations of the algorithm. Default=100

Value

Estimated gamma vector

Author(s)

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References

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Examples

```
data(Y)
I=3
J=100
T=dim(Y)[2]
q=1
X=matrix(0,nrow=(I*J),ncol=I)
for (i in 1:I)
{
  X[((i-1)*J+1):(i*J),i]=rep(1,J)
}
gamma_0 = matrix(0, nrow = 1, ncol = q)
eta_glm_mat_0 = matrix(0,ncol=T,nrow=I)
for (t in 1:T)
{
  result_glm_0 = glm(Y[,t]~X-1,family=poisson(link='log'))
  eta_glm_mat_0[,t]=as.numeric(result_glm_0$coefficients)
}
eta_0 = round(as.numeric(t(eta_glm_mat_0)),digits=6)
gamma_est=NR_gamma(Y, X, eta_0, gamma_0, I, J, n_iter = 100)
```

---

variable_selection *Variable selection*

Description

This function performs variable selection, estimates a new vector eta and a new vector gamma

Usage

```
variable_selection(Y, X, gamma, k_max = 1, n_iter = 100,
method = "min", nb_rep_ss = 1000, threshold = 0.6)
```

Arguments

Y	Observation matrix
X	Design matrix
gamma	Initial gamma vector

k_max	Number of iteration to repeat the whole algorithm
n_iter	Number of iteration for Newton-Raphson 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 "min"
nb_rep_ss	Number of replications in stability selection step. The default is 1000
threshold	Threshold for stability selection. The default is 0.9

Value

estim_active	Vector of stimated active coefficients
eta_est	Vector of estimated eta values
gamma_est	Vector of estimated gamma values

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Examples

```
data(Y)
I=3
J=100
T=dim(Y)[2]
q=1
X=matrix(0,nrow=(I*J),ncol=I)
for (i in 1:I)
{
  X[((i-1)*J+1):(i*J),i]=rep(1,J)
}
gamma_0 = matrix(0, nrow = 1, ncol = q)
result=variable_selection(Y, X, gamma_0, k_max=1,
n_iter=100, method="min", nb_rep_ss=1000, threshold=0.6)
estim_active = result$estim_active
eta_est = result$eta_est
gamma_est = result$gamma_est
```

`Y` *Observation matrix Y*

Description

An example of observation matrix

Usage

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

Format

The format is: num [1:300, 1:15] 3 1 1 0 0 3 2 0 3 2 ...

References

M. Gomtsyan et al. "Variable selection in sparse multivariate GLARMA models: Application to germination control by environment", arXiv:2208.14721

Examples

```
data(Y)
```

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