

Package ‘CoxSubTest’

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Type Package

Title CoxSubTest

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Author Xiao Zhang [aut,cre], Panpan Ren [aut], Xu Liu [aut], Xingjie Shi [aut]

Maintainer Xiao Zhang <zhangxiao1994@cuhk.edu.cn>

Description Maximum likelihood ratio test is proposed for Cox proportional hazard models with a change plane. Different testing methods are provided in this package.

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CoxSubTestLRT	<i>The likelihood ratio test for Cox proportional hazard model with a change plane.</i>
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Usage

```
CoxSubTestLRT(data, Gamma, B = 1000, K = 1000, qlb = 0.1, tol = 1e-8,  
seed = 1, maxs = 20, saveall = FALSE)
```

Arguments

data	A list, including y (time response), x (predictors), z (predictors), u (grouping variables), status (censoring indicator).
Gamma	A matrix for initial gamma values. If not given then it will be automatically generated based on the data.
B	A constant. Number of bootstrap samples. Default is 1000.
K	A constant. The number of the initial gamma values. Default is 1000.
qlb	A constant. The lower quantile specified for $Z\%*\%gamma.initials$. Default is 0.1.
tol	A constant. The precision of the Newton method. Default is $1e-8$.
seed	A constant. The number of seeds for generating the initial gamma values. Default is 1.
maxs	A constant. The maximum number of iterations in Newton method. Default is 20.
saveall	A logical value. Whether to save the results corresponding to all the gamma initial values. Default is FALSE.

Value

A list.

- TestR - The value of test statistic.
- TestB - B values of test statistic obtained from the bootstrap.
- Pval - The p-value of the test.
- TestRVEC - K values of test statistic based on K initial gamma values if saveall is set as TRUE.
- TestBmat - B*K values of test static obtained from the bootstrap based on K initial gamma values if saveall is set as TRUE.
- time - Running time.

Examples

```

n = 100
p1 = 2
p2 = 1
p3 = 3
alpha = rep(1, p1)
beta = rep(1, p2)/2
gamma = c(1, seq(-1,1,length.out = p3-1))
rho = 0.3
cenRate = 0.2
set.seed(100)
data = generate_cox_data(n, alpha, beta, gamma, rho, cenRate = cenRate)
fit <- CoxSubTestLRT(data)

```

CoxSubTestST	<i>The score test for Cox proportional hazard model with a change plane in Kang et al.(2017).</i>
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Usage

```
CoxSubTestST(data, Gamma, B = 1000, K = 1000, qlb = 0.1, tol = 1e-8,
              seed = 1, saveall = FALSE)
```

Arguments

data	A list, including y (time response), x (predictors), z (predictors), u (grouping variables), status (censoring indicator).
Gamma	A matrix for initial gamma values. If not given then it will be automatically generated based on the data.
B	A constant. Number of bootstrap samples. Default is 1000.
K	A constant. The number of the initial gamma values. Default is 1000.
qlb	A constant. The lower quantile specified for $Z\% \gamma$ initial values. Default is 0.1.
tol	A constant. The precision of the Newton method. Default is $1e-8$.
seed	A constant. The number of seeds for generating the initial gamma values. Default is 1.
saveall	A logical value. Whether to save the results corresponding to all the gamma initial values. Default is FALSE.

Value

A list.

- TestR - The value of test statistic.
- TestB - B values of test statistic obtained from the bootstrap.
- Pval - The p-value of the test.
- TestRVEC - K values of test statistic based on K initial gamma values if saveall is set as TRUE.
- TestBmat - B*K values of test static obtained from the bootstrap based on K initial gamma values if saveall is set as TRUE.
- time - Running time.

References

Kang, S., Lu, W., and Song, R. (2017). Subgroup detection and sample size calculation with proportional hazards regression for survival data. *Statistics in medicine*, 36(29), 4646-4659.

Examples

```
n = 100
p1 = 2
p2 = 1
p3 = 3
alpha = rep(1, p1)
beta = rep(1, p2)/2
gamma = c(1, seq(-1,1,length.out = p3-1))
rho = 0.3
cenRate = 0.2
set.seed(100)
data = generate_cox_data(n, alpha, beta, gamma, rho, cenRate = cenRate)
fit <- CoxSubTestST(data)
```

CoxSubTestSUP	<i>The SUP test for Cox proportional hazard model with a change plane in Deng et al.(2022).</i>
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Usage

```
CoxSubTestSUP(data, Gamma, B = 1000, K = 1000, qlb = 0.1, tol = 1e-8, seed = 1)
```

Arguments

data	A list, including y (time response), x (predictors), z (predictors), u (grouping variables), status (censoring indicator).
Gamma	A matrix for initial gamma values. If not given then it will be automatically generated based on the data.
B	A constant. Number of bootstrap samples. Default is 1000.
K	A constant. The number of the initial gamma values. Default is 1000.
qlb	A constant. The lower quantile specified for $Z\% \sim \gamma$. Default is 0.1.
tol	A constant. The precision of the Newton method. Default is 1e-8.
seed	A constant. The number of seeds for generating the initial gamma values. Default is 1.

Value

A list.

- TestR - The value of test statistic.
- TestB - B values of test statistic obtained from the bootstrap.
- Pval - The p-value of the test.
- time - Running time.

References

Deng, Y., Cai, J., and Zeng, D. (2022). Maximum Likelihood Estimation for Cox Proportional Hazards Model with a Change Hyperplane. *Statistica Sinica*, 32(2), 983.

Examples

```

n = 100
p1 = 2
p2 = 1
p3 = 3
alpha = rep(1, p1)
beta = rep(1, p2)/2
gamma = c(1, seq(-1,1,length.out = p3-1))
rho = 0.3
cenRate = 0.2
set.seed(100)
data = generate_cox_data(n, alpha, beta, gamma, rho, cenRate = cenRate)
fit <- CoxSubTestSUP(data)

```

gam.init

*Function to select initial gamma values spanning its space***Usage**

```
gam.init(n.initials, Z, lb.quantile, ub.quantile, ss=1)
```

Arguments

n.initials	Number of gamma values.
Z	The grouping variables.
lb.quantile	The lower quantile specified for $Z\% \gamma$ initial values.
ub.quantile	The upper quantile specified for $Z\% \gamma$ initial values.
ss	A positive integer with n.initials/ss indicating how many sets of gamma are chosen, default to 1.

Value

A matrix. A set of gamma values selected for defining subgroup.

Examples

```

n = 100
p1 = 2
p2 = 1
p3 = 3
alpha = rep(1, p1)
beta = rep(1, p2)/2
gamma = c(1, seq(-1,1,length.out = p3-1))
rho = 0.3
cenRate = 0.2
set.seed(100)
data = generate_cox_data(n, alpha, beta, gamma, rho, cenRate = cenRate)
K = 1000
qlb = 0.1
cols = apply(data$u, 2, var) != 0
Gamma = gam.init(K, data$u[,cols], lb.quantile=qlb, ub.quantile=1-qlb, ss=1)

```

generate_cox_data	<i>Function for generating data from Cox proportional hazard model with a change plane.</i>
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Usage

```
generate_cox_data(n, alpha, beta, gamma, rho,
                  cenRate = 0.1, censortype = c("RightCensor", "RandomCensor"))
```

Arguments

n	A constant. The sample size.
alpha	A vector. The true parameter for baseline covariates.
beta	A vector. The true parameter denoting the heterogeneous effect of the subgroup.
gamma	A vector. The true parameter for grouping variables.
rho	The strength of correlation among covariates.
cenRate	A constant. Censoring rate. Default is 0.1.
censortype	Censroing type, including "RightCensor" and "RandomCensor".

Value

A list.

- y - A length n vector. The survival time.
- x - A matrix. The baseline covariates.
- z - A matrix. The baseline covariates.
- u - A matrix. The grouping variables.
- status - A length n vector. Censoring indicator.

Examples

```
n = 100
p1 = 2
p2 = 1
p3 = 3
alpha = rep(1, p1)
beta = rep(1, p2)/2
gamma = c(1, seq(-1,1,length.out = p3-1))
rho = 0.3
cenRate = 0.2
set.seed(100)
data = generate_cox_data(n, alpha, beta, gamma, rho, cenRate = cenRate)
```

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