Package: crrSC (via r-universe)

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Title Competing Risks Regression for Stratified and Clustered Data

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Description Extension of 'cmprsk' to Stratified and Clustered data. A goodness of fit test for Fine-Gray model is also provided. Methods are detailed in the following articles: Zhou et al. (2011) <doi:10.1111/j.1541-0420.2010.01493.x>, Zhou et al. (2012) <doi:10.1093/biostatistics/kxr032>, Zhou et al. (2013) <doi:10.1002/sim.5815>.

Depends survival

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Contents

bce *Breast Cancer Data*

Description

Data Randomly Generated According To El178 clinical trial

Usage

```
data(bce)
```

Format

A data frame with 200 observations and the following 6 variables.

`trt` Treatment: 0=Placebo, 1=Tamoxifen

`time` Event time

`type` Event type. 0=censored, 1=Breast Cancer recurrence , 2=Death without recurrence

`nnodes` Number of positive nodes

`tsize` Tumor size

`age` Age

Examples

```
data(bce)
```

cdata *Clustered competing risks simulated data*

Description

sample of 200 observations

Usage

```
data(cdata)
```

Format

A data frame with 200 observations and the following 4 variables. Simulation is detailed on the paper Competing Risk Regression for clustered data. Zhou, Fine, Latouche, Labopin. 2011. In Press. Biostatistics.

`ID` Id of cluster, each cluster is of size 2

`ftime` Event time

`fstatus` Event type. 0=censored, 1 , 2

`z` a binary covariate with P(z=1)=0.5

Examples

```
data(cdata)
```

`center` *Multicenter Bone Marrow transplantation data*

Description

Random sub sample of 400 patients

Usage

```
data(center)
```

Format

A data frame with 400 observations and the following 5 variables.

`id` Id of transplantation center

`ftime` Event time

`fstatus` Event type. 0=censored, 1=Acute or Chronic GvHD , 2=Death free of GvHD

`cells` source of stem cells: peripheral blood vs bone marrow

`fm` female donor to male recipient match

Examples

```
data(center)
```

`crrc` *Competing Risks Regression for Clustered Data*

Description

Regression modeling of subdistribution hazards for clustered right censored data. Failure times within the same cluster are dependent.

Usage

```
crrc(ftime,fstatus,cov1,cov2,tf,cluster,
cengroup,failcode=1,
cencode=0, subset,
na.action=na.omit,
gtol=1e-6,maxiter=10,init)
```

Arguments

cluster	Clustering covariate
ftime	vector of failure/censoring times
fstatus	vector with a unique code for each failure type and a separate code for censored observations
cov1	matrix (nobs x ncovs) of fixed covariates (either cov1, cov2, or both are required)
cov2	matrix of covariates that will be multiplied by functions of time; if used, often these covariates would also appear in cov1 to give a prop hazards effect plus a time interaction
tf	functions of time. A function that takes a vector of times as an argument and returns a matrix whose jth column is the value of the time function corresponding to the jth column of cov2 evaluated at the input time vector. At time tk, the model includes the term cov2[,j]*tf(tk)[,j] as a covariate.
cengroup	vector with different values for each group with a distinct censoring distribution (the censoring distribution is estimated separately within these groups). All data in one group, if missing.
failcode	code of fstatus that denotes the failure type of interest
cencode	code of fstatus that denotes censored observations
subset	a logical vector specifying a subset of cases to include in the analysis
na.action	a function specifying the action to take for any cases missing any of ftime, fstatus, cov1, cov2, cengroup, or subset.
gtol	iteration stops when a function of the gradient is < gtol
maxiter	maximum number of iterations in Newton algorithm (0 computes scores and var at init, but performs no iterations)
init	initial values of regression parameters (default=all 0)

Details

This method extends Fine-Gray proportional hazards model for subdistribution (1999) to accommodate situations where the failure times within a cluster might be correlated since the study subjects from the same cluster share common factors This model directly assesses the effect of covariates on the subdistribution of a particular type of failure in a competing risks setting.

Value

Returns a list of class crr, with components

$coef	the estimated regression coefficients
$loglik	log pseudo-liklihood evaluated at coef
$score	derivitives of the log pseudo-likelihood evaluated at coef
$inf	-second derivatives of the log pseudo-likelihood
$var	estimated variance covariance matrix of coef
$res	matrix of residuals

$uftime	vector of unique failure times
$bfitj	jumps in the Breslow-type estimate of the underlying sub-distribution cumulative hazard (used by predict.crr())
$tfs	the tfs matrix (output of tf(), if used)
$converged	TRUE if the iterative algorithm converged
$call	The call to crr
$n	The number of observations used in fitting the model
$n.missing	The number of observations removed from the input data due to missing values
$loglik.null	The value of the log pseudo-likelihood when all the coefficients are 0

Author(s)

Bingqing Zhou, <bingqing.zhou@yale.edu>

References

Zhou B, Fine J, Latouche A, Labopin M.(2012). Competing Risks Regression for Clustered data. Biostatistics. 13 (3): 371-383.

See Also

cmprsk

Examples

```
#library(cmprsk)
#crr(ftime=cdata$ftime, fstatus=cdata$fstatus, cov1=cdata$z)
# Simulated clustered data set
data(cdata)
crrc(ftime=cdata[,1],fstatus=cdata[,2],
cov1=cdata[,3],
cluster=cdata[,4])
```

---

crrs *Competing Risks Regression for Stratified Data*

Description

Regression modeling of subdistribution hazards for stratified right censored data

Two types of stratification are addressed : Regularly stratified: small number of large groups (strata) of subjects Highly stratified: large number of small groups (strata) of subjects

Usage

```
crrs(ftime, fstatus, cov1, cov2, strata,
tf, failcode=1, cencode=0,
ctype=1,
subsets, na.action=na.omit,
gtol=1e-6, maxiter=10,init)
```

Arguments

strata	stratification covariate
ctype	1 if estimating censoring dist within strata (regular stratification), 2 if estimating censoring dist across strata (highly stratification)
ftime	vector of failure/censoring times
fstatus	vector with a unique code for each failure type and a separate code for censored observations
cov1	matrix (nobs x ncovs) of fixed covariates (either cov1, cov2, or both are required)
cov2	matrix of covariates that will be multiplied by functions of time; if used, often these covariates would also appear in cov1 to give a prop hazards effect plus a time interaction
tf	functions of time. A function that takes a vector of times as an argument and returns a matrix whose jth column is the value of the time function corresponding to the jth column of cov2 evaluated at the input time vector. At time tk, the model includes the term cov2[,j]*tf(tk)[,j] as a covariate.
failcode	code of fstatus that denotes the failure type of interest
cencode	code of fstatus that denotes censored observations
subsets	a logical vector specifying a subset of cases to include in the analysis
na.action	a function specifying the action to take for any cases missing any of ftime, fstatus, cov1, cov2, cengroup, or subset.
gtol	iteration stops when a function of the gradient is < gtol
maxiter	maximum number of iterations in Newton algorithm (0 computes scores and var at init, but performs no iterations)
init	initial values of regression parameters (default=all 0)

Details

Fits the stratified extension of the Fine and Gray model (2011). This model directly assesses the effect of covariates on the subdistribution of a particular type of failure in a competing risks setting.

Value

Returns a list of class crr, with components (see crr for details)

$coef	the estimated regression coefficients
$loglik	log pseudo-liklihood evaluated at coef

$score	derivitives of the log pseudo-likelihood evaluated at coef
$inf	-second derivatives of the log pseudo-likelihood
$var	estimated variance covariance matrix of coef
$res	matrix of residuals
$uftime	vector of unique failure times
$bfitj	jumps in the Breslow-type estimate of the underlying sub-distribution cumulative hazard (used by predict.crr())
$tfs	the tfs matrix (output of tf(), if used)
$converged	TRUE if the iterative algorithm converged
$call	The call to crr
$n	The number of observations used in fitting the model
$n.missing	The number of observations removed from the input data due to missing values
$loglik.null	The value of the log pseudo-likelihood when all the coefficients are 0

Author(s)

Bingqing Zhou, <bingqing.zhou@yale.edu>

References

Zhou B, Latouche A, Rocha V, Fine J. (2011). Competing Risks Regression for Stratified Data. Biometrics. 67(2):661-70.

See Also

cmprsk

Examples

```
##
#using fine and gray model
#crr(ftime=center$ftime, fstatus=center$fstatus,
#cov1=cbind(center$fm,center$cells))
#
# High Stratification: ctype=2
# Random sub-sample
data(center)
cov.test<-cbind(center$fm,center$cells)
crrs(ftime=center[,1],fstatus=center[,2],
cov1=cov.test,
strata=center$id,ctype=2)
```

crrvvs *For internal use*

Description

for internal use

Author(s)

Bingqing Zhou

print.crrs *Print method for crrs output*

Description

Prints call for crrs object

Usage

```
## S3 method for class 'crrs'
print(x, ...)
```

Arguments

x	crr object (output from crrs())
...	additional arguments to print()

Author(s)

B. Zhou

psh.test *Goodness-of-fit test for proportional subdistribution hazards model*

Description

This Goodness-of-fit test proposed a modified weighted Schoenfeld residuals to test the proportionality of subdistribution hazards for the Fine and Gray model

Usage

```
psh.test(time, fstatus, z, D=c(1,1), tf=function(x) cbind(x,x^2), init)
```

Arguments

time	vector of failure times
fstatus	failure status =0 if censored
z	covariates
D	components of z that are tested for time-varying effect
tf	functions of t for z being tested on the same location
init	initial values of regression parameters (default=all 0)

Details

The proposed score test employs Schoenfeld residuals adapted to competing risks data. The form of the test is established assuming that the non-proportionality arises via time-dependent coefficients in the Fine-Gray model, similar to the test of Grambsch and Therneau.

Value

Returns a data.frame with percentage of cens, cause 1, Test Statistic, d.f. ,p-value

Author(s)

Bingqing Zhou, <bingqing.zhou@yale.edu>

References

Zhou B, Fine JP, Laird, G. (2013). Goodness-of-fit test for proportional subdistribution hazards mode. Statistics in Medicine. In Press.

Examples

```
data(bce)
attach(bce)
lognodes <- log(nnodes)
Z1 <- cbind(lognodes, tsize/10, age, trt)
# trt = 0 if placebo, = 0 treatment
# testing for linear time varying effect of trt
psh.test(time=time, fstatus=type, z=Z1, D=c(0,0,0,1), tf=function(x) x)
# testing for quadratic time varying effect of trt
psh.test(time=time, fstatus=type, z=Z1, D=c(0,0,0,1), tf=function(x) x^2)
# testing for log time varying effect of trt
psh.test(time=time, fstatus=type, z=Z1, D=c(0,0,0,1),
tf=function(x) log(x))
# testing for both linear and quadratic time varying effect of trt
psh.test(time=time, fstatus=type, z=Z1,
D=matrix(c(0,0,0,1,0,0,0,1), 4,2),  tf=function(x) cbind(x,x^2))
```

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