Package ‘survC1’

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survC1-package .................................................. 2
CompCase .................................................. 3
cnc .................................................. 4
cvC .................................................. 4
Est.Cval .................................................. 5
Est.PH .................................................. 6
Inf.Cval .................................................. 7
Inf.Cval.Delta .................................................. 8
kmccns .................................................. 9
unoCW .................................................. 9
unoU2P .................................................. 10
VEC2MAT .................................................. 10
C-statistics for risk prediction models with censored survival data

Description

Performs inference of overall adequacy of risk prediction models with censored survival data.

Details

Package: survC1
Type: Package
Version: 1.0-2
Date: 2012-02-14
License: GPL-2
LazyLoad: yes

Performs inference for C of risk prediction models with censored survival data, using the method proposed by Uno et al. (2011). Inference for the difference in C between two competing prediction models is also implemented.

Author(s)

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Maintainer: Hajime Uno <huno@jimmy.harvard.edu>

References


Examples

```r
# read sample data (PBC in survival package)
D=CompCase(pbc[1:200,c(2:4,10:14)])
D[,2]=as.numeric(D[,2]==2)

tau=365.25*8
C=Inf.Cval(D, tau, itr=200)
```
CompCase

Create complete case data

Description

Creates a complete-case data set, removing subjects with any missing value in the outcome or predictors

Usage

CompCase(mydata)

Arguments

mydata A data matrix that consists of numeric data. No character data is allowed.

Examples

D=CompCase(pbc[,c(2:4,10:14)])
conc  

*A child function to calculate concordance*

**Description**

This is a child function (R-wrapper) called in the main functions in this package.

**Usage**

conc(X, D, W, R)

**Arguments**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>time</td>
</tr>
<tr>
<td>D</td>
<td>event indicator (1: event, 0: censor)</td>
</tr>
<tr>
<td>W</td>
<td>weight</td>
</tr>
<tr>
<td>R</td>
<td>risk score</td>
</tr>
</tbody>
</table>

---

cvC  

*Cross-validation estimate for C*

**Description**

Provides a cross-validation estimate for C

**Usage**

cvC(mydata, tau, cvK = 10, Rep = 10)

**Arguments**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mydata</td>
<td>Input data. The 1st column should be time-to-event, and the 2nd column is event indicator (1=event, 0=censor). The rest of the columns are covariates/predictors used in the model. No character variable or missing is allowed.</td>
</tr>
<tr>
<td>tau</td>
<td>Truncation time. The resulting C tells how well the given prediction model works in predicting events that occur in the time range from 0 to tau. Note that the survival function for the underlying censoring time distribution needs to be positive at tau.</td>
</tr>
<tr>
<td>cvK</td>
<td>The number of fold. A K-fold cross-validation is performed, according to the number given for cvK. Generally, a value from 2 to 10 will be specified.</td>
</tr>
<tr>
<td>Rep</td>
<td>The number of iteration of the random splits for the K-fold cross-validation. The average of the Rep times of cvK-fold cross-validation estimates is provided as a resulting estimate for C.</td>
</tr>
</tbody>
</table>
Est.Cval

Examples

D=CompCase(pbc[,c(2:4,10:14))]
D[,2]=as.numeric(D[,2]==2)

tau=365.25*8

model1=D[1:200,c(1,2,4)]
cvC(model1,tau,cvk=2,Rep=10)

<table>
<thead>
<tr>
<th>Est.Cval</th>
<th>Estimation of C</th>
</tr>
</thead>
</table>

Description

Performs a point estimation of C

Usage

Est.Cval(mydata, tau, nofit=FALSE)

Arguments

mydata | Input data. The 1st column should be time-to-event, and the 2nd column is event indicator (1=event, 0=censor). The rest of the columns are covariates/predictors used in the model. No character variable or missing is allowed.

tau | Truncation time. The resulting C tells how well the given prediction model works in predicting events that occur in the time range from 0 to tau. Note that the survival function for the underlying censoring time distribution needs to be positive at tau.

nofit | If TRUE, the 3rd column of mydata is used as the risk score directly in calculation of C. The default is FALSE.

Value

Dhat | Estimate of C
beta | Estimates for regression coefficient in the Cox model
beta.var | Variance-Covariance matrix for beta above
rs | Risk score of each individual
ft | coxph object with the fitted model
Derivation of a risk score by a Cox proportional hazards model

Description

Provides risk score by fitting data to a Cox’s proportional hazards model with a given set of predictors.

Usage

Est.PH(mydata)

Arguments

mydata Input data. The 1st column should be time-to-event, and the 2nd column is event indicator (1=event, 0=censor). The rest of the columns are covariates/predictors used in the model. No character variable or missing is allowed.

Value

beta Estimates for regression coefficient in the Cox model
var Variance-Covariance matrix for the beta above
rs Risk score of each individual
ft coxph object with the fitted model

Examples

D=CompCase(pbc[1:200,c(2:4,10:14)])
D[,2]=as.numeric(D[,2]==2)
tau=365.25x8
model=D[,c(1,2,4,5)]

Est.Cval(model, tau)$Dhat

D=CompCase(pbc[1:200,c(2:4,10:14)])
D[,2]=as.numeric(D[,2]==2)

ft=Est.PH(D)
Inf.Cval

Inference of C

Description

Performes the inference for C

Usage

Inf.Cval(mydata, tau, itr = 1000, seed = NULL)

Arguments

mydata Input data. The 1st column should be time-to-event, and the 2nd column is event indicator (1=event, 0=censor). The rest of the columns are covariates/predictors used in the model. No character variable or missing is allowed.
tau Truncation time. The resulting C tells how well the given prediction model works in predicting events that occur in the time range from 0 to tau. Note that the survival function for the underlying censoring time distribution needs to be positive at tau.
itr Iteration of perturbation-resampling.
seed A seed for generating random numbers for the resampling. The default is NULL.

Value

Dhat Estimate for C
se Standard error estiamte
low95 Lower limit of a 0.95 two-sided confidence interval for C
upp95 Upper limit of a 0.95 two-sided confidence interval for C
ft coxph object with the fitted model

Examples

D=CompCase(pbc[1:200,c(2:4,10:14)])
D[,2]=as.numeric(D[,2]==2)

tau=365.25*8

C=Inf.Cval(D, tau, itr=200)
round(c(C$Dhat, C$se, C$low95, C$upp95), digits=3)
Inf.Cval.Delta  Inference of Delta C

Description
Performes the inference for the difference in C between two competing risk prediction models

Usage
Inf.Cval.Delta(mydata, covs0, covs1, tau, itr = 1000, seed = NULL)

Arguments
mydata Input data. The 1st column should be time-to-event, and the 2nd column is event indicator (1=event, 0=censor).
covs0 A matrix that consists of a set of predictors for a base model (Model 0)
covs1 A matrix that consists of a set of predictors for a new model (Model 1)
tau Truncation time. The resulting C tells how well the given prediction model works in predicting events that occur in the time range from 0 to tau. Note that the survival function for the underlying censoring time distribution needs to be positive at tau.
itr Iteration of perturbation-resampling.
seed A seed for generating random numbers for the resampling. The default is NULL.

Value
A 4x3 matrix that consists of point estimates, standard error estimates, and lower and upper limits of 0.95 two-sided intervals for C of Model 1, Model 0 and that for the difference of C

Examples
D=CompCase(pbc[1:200, c(2:4,10:14)])
D[,2]=as.numeric(D[,2]==2)

model0<-D[,c(1:2,4:5)]
model1<-D
covs1<-as.matrix(model1[,c(-1,-2)])
covs0<-as.matrix(model0[,c(-1,-2)])
tau=365.25*8

Delta=Inf.Cval.Delta(model0[,1:2], covs0, covs1, tau, itr=200)
round(Delta, digits=3)
**kmcens**

*Kaplan-Meier for Censoring*

**Description**

This is a child function called in the main functions in this package. Specifically, this obtains the survival function for censoring time and gives quantities used in the perturbation-resampling method for C.

**Usage**

`kmcens(time, status, tau)`

**Arguments**

- `time`: time to event variable
- `status`: indicator of event (1: event, 0: censor)
- `tau`: see `cvK`

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**unoCW**

*A child function used in Inf.Cval and Inf.Cval.Delta*

**Description**

This is a child function (R-wrapper) used in the main functions of this package.

**Usage**

`unoCW(X, D, W, Wstar, RS, RSstar, REX, Chat)`

**Arguments**

- `X`: time
- `D`: event indicator (1: event, 0: censor)
- `W`: Weight used in calculating C
- `Wstar`: Weight used in calculating C (perturbed version)
- `RS`: risk score
- `RSstar`: risk score (perturbed version)
- `REX`: Random numbers assigned to each individual for the perturbation-resampling method
- `Chat`: C-statistic estimated with the present dataset
**unouRp**

*A child function used in Inf.Cval and Inf.Cval.Delta*

**Description**

This is a child function (R-wrapper) used in the main functions of this package.

**Usage**

unouRp(A, B)

**Arguments**

- **A**
  - A nxp matrix
- **B**
  - A nx1 vector

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**VEC2MAT**

*Vector to Matrix*

**Description**

Making a (PxM) matrix (x’, x’, x’,..., x’) from a (Px1) vector, x

**Usage**

VEC2MAT(vc, dm)

**Arguments**

- **vc**
  - A vector
- **dm**
  - The number of row of the matrix returned
Index

*Topic \textasciitilde\textasciitilde kwd1
  conc, 4
  kmcens, 9
  unoCW, 9
  unoU2P, 10

*Topic \textasciitilde\textasciitilde kwd2
  conc, 4
  kmcens, 9
  unoCW, 9
  unoU2P, 10

*Topic package
  survC1-package, 2

CompCase, 3
conc, 4
cvC, 4

Est.Cval, 5
Est.PH, 6

Inf.Cval, 7
Inf.Cval.Delta, 8

kmcens, 9

survC1(survC1-package), 2
survC1-package, 2

unoCW, 9
unoU2P, 10

VEC2MAT, 10