Package ‘survC1’

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R topics documented:

  survC1-package .................................................. 2
  CompCase .................................................. 3
  conc .................................................. 4
  cvC .................................................. 4
  Est.Cval .................................................. 5
  Est.PH .................................................. 6
  Inf.Cval .................................................. 7
  Inf.Cval.Delta .................................................. 8
  kmcens .................................................. 9
  unoCW .................................................. 9
  unoU2P .................................................. 10
  VEC2MAT .................................................. 10

Index

11
survC1-package

C-Statistics for Risk Prediction Models with Censored Survival Data

Description

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

Details

Package: survC1
Type: Package
Version: 1.0-3
Date: 2021-02-10
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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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)

# Inference of C
tau=365.25*8
C=Inf.Cval(D, tau, itr=200)
round(c(C$Dhat, C$se, C$low95, C$upp95), digits=3)
```
# Inference of Delta C between 2 models

```r
model0<-D[,c(1:2,4:5)]
model1<-D
covs1<-as.matrix(model1[,c(-1,-2)])
covs0<-as.matrix(model0[,c(-1,-2)])

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

# Point estimation via cross-validation

```r
model1=D[,c(1,2,4)]
cvC(model1,tau,cvK=2,Rep=10)
```

---

**CompCase**  
*Creates complete case data*

**Description**

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

**Usage**

```r
CompCase(mydata)
```

**Arguments**

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

**Examples**

```r
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

X  time
D  event indicator (1: event, 0: censor)
W  weight
R  risk score

cvC

Cross-validation estimate for C

Description

Provides a cross-validation estimate for C

Usage

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

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.
cvK  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.
Rep  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.
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)

---

Est.Cval

**Estimation of C**

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
Examples

D=CompCase(pbc[1:200,c(2:4,10:14)])
D[,2]=as.numeric(D[,2]==2)
tau=365.25*8
model=D[,c(1,2,4,5)]

Est.Cval(model, tau)$Dhat

---

**Est.PH**  
*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**

```r
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**

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

---

**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
unoU2P

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
unoU2P(A, B)

Arguments
A  A nxp matrix
B  A nx1 vector

VEC2MAT
Vector to Matrix

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

Usage
VEC2MAT(vc, dm)

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

* 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