Package ‘smoothHR’

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Description Provides flexible hazard ratio curves allowing non-linear relationships between continuous predictors and survival. To better understand the effects that each continuous covariate has on the outcome, results are expressed in terms of hazard ratio curves, taking a specific covariate value as reference. Confidence bands for these curves are also derived.
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Description

Provides flexible hazard ratio curves allowing non-linear relationships between continuous predictors and survival. To better understand the effects that each continuous covariate has on the outcome, results are expressed in terms of hazard ratio curves, taking a specific covariate value as reference. Confidence bands for these curves are also derived.

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Author(s)

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References


**dfmacox**

Degrees of freedom in multivariate additive Cox models

Description

Provides the degrees of freedom for flexible continuous covariates in multivariate additive Cox models.
Usage

dfmacox(time, time2=NULL, status, nl.predictors, other.predictors,
        smoother, method, mindf=NULL, maxdf=NULL, ntimes=NULL, data)

Arguments

time For right censored data, this is the follow up time. For interval data, the first argument is the starting time for the interval.
time2 Ending time of the interval for interval censored or counting process data only. Intervals are assumed to be open on the left and closed on the right, (start, end]. For counting process data, event indicates whether an event occurred at the end of the interval.
status The status indicator, normally 0=alive, 1=dead. Other choices are TRUE/FALSE (TRUE = death) or 1/2 (2=death). For interval censored data, the status indicator is 0=right censored, 1=event at time, 2=left censored, 3=interval censored. Although unusual, the event indicator can be omitted, in which case all subjects are assumed to have an event.

nl.predictors Vector with covariates to be introduced in the additive Cox model with a non-linear effect.
other.predictors Vector with remaining covariates to be introduced in the additive Cox model. This will include qualitative covariates or continuous covariates with a linear effect.
smoother Smoothing method to be used in the additive Cox model. Possible options are 'ns' for natural spline smoothing or 'pspline' for penalized spline smoothing.
method The desired method to obtain the optimal degrees of freedom. If method ="AIC", then the AIC = (loglik -df) is used to choose the "optimal" degrees of freedom. The corrected AIC of Hurvich et. al. (method="AICc") and the BIC criterion (method = "BIC") can also be used.
mindf Vector with minimum degrees of freedom for each nonlinear predictor. By default this value is a vector of of the same length of nl.predictors all with value 1, if smoother is 'ns'; a vector with the same length of nl.predictors all with value 1.5, if smoother is 'pspline'.
maxdf Vector with maximum degrees of freedom for each nonlinear predictor. By default, when penalized spline is used (smoother='pspline'), the corrected AIC from Hurvich obtained in the corresponding univariate additive Cox model is used. When penalized spline is used (smoother='ns') a vector with the same length of nl.predictors all with values 1.5.
ntimes Internel procedure which involves repetition of some convergence steps to attain the optimal degrees of freedom. By default is 5.
data A data.frame in which to interpret the variables named in the arguments time, time2, and status.

Value

An object of class list, basically a list including the elements:
df  
Degrees of freedom of the 'nl.predictors'.

AIC  
Akaike’s Information Criterion score of the fitted model.

AICC  
Corrected Akaike’s Information Criterion score of the fitted model.

BIC  
Bayesian Information Criterion score of the fitted model.

myfit  
Fitted (additive Cox) model based on the chosen degrees of freedom.

method  
The method used for obtaining the degrees of freedom.

nl.predictors  
Vector with the nonlinear predictors.

Author(s)

Artur Araújo and Luís Meira-Machado

References


Examples

```r
# Example 1
library(survival)
data(whas500)
mydf_ns <- dfmacox(time="lenfol", status="fstat", nl.predictors=c("los", "bmi"),
other.predictors=c("age", "hr", "gender", "diasbp"), smoother="ns", data=whas500)
print(mydf_ns)

# Example 2
mydf_ps <- dfmacox(time="lenfol", status="fstat", nl.predictors=c("los", "bmi"),
other.predictors=c("age", "hr", "gender", "diasbp"), smoother="pspline", data=whas500)
print(mydf_ps)
```

Description

Flexible hazard ratio curves taking a specific covariate value as reference

Plots flexible hazard ratio curves allowing non-linear relationships between continuous predictors and survival. To better understand the effects that each continuous covariate has on the outcome, results are expressed in terms of hazard ratio curves, taking a specific covariate value as reference. Confidence bands for these curves are also derived.
Usage

```r
## S3 method for class 'HR'
plot(x, predictor, prob=NULL, pred.value=NULL, conf.level=0.95, round.x=NULL,
     ref.label=NULL, col, main, xlab, ylab, lty, xlim, ylim, xx, ...)
```

Arguments

- `x`: An object of class HR
- `predictor`: Variable named in the formula or included as a predictor in the coxfit. Usually a continuous predictor of survival for which the results are expressed in terms of hazard ratio curves, taking a specific covariate value as reference.
- `prob`: Value between 0 and 1. If `prob=0` the reference value will be the minimum of the hazard ratio curve. If `prob=1` the reference value will be the maximum of the hazard ratio curve. For values between 0 and 1 the reference value will be the corresponding quantile of the variable `predictor`.
- `pred.value`: Value from the variable `predictor` to be taken as the reference value.
- `conf.level`: Level of confidence. Defaults to 0.95 (corresponding to 95%).
- `round.x`: Rounding of numbers in the plot.
- `ref.label`: Label for the reference covariate. By default is the name of the covariate.
- `col`: Vector of dimension 3 for the colors to plot.
- `main`: These arguments to title have useful defaults here.
- `xlab`: The range of x and y values with sensible defaults.
- `ylab`: The range of x and y values with sensible defaults.
- `lty`: Vector of dimension 2 for the line type.
- `xlim`: The range of x and y values with sensible defaults.
- `ylim`: The range of x and y values with sensible defaults.
- `xx`: Vector of variables (from the variable `predictor`) to be shown in the x axis.
- `...`: Other arguments.

Value

No value is returned.

Author(s)

Artur Araújo and Luís Meira-Machado

References

predict.HR

See Also

smoothHR.

Examples

# Example 1
library(survival)
data(whas500)
fit <- coxph(Surv(lenfol, fstat)-age+hr+gender+diasbp+pspline(bmi)+pspline(los),
data=whas500, x=TRUE)
hrl <- smoothHR(data=whas500, coxfit=fit)
plot(hrl, predictor="bmi", prob=0, conf.level=0.95)

# Example 2
hr2 <- smoothHR(data=whas500, time="lenfol", status="fstat", formula=~age+hr+gender+diasbp+
pspline(bmi)+pspline(los))
plot(hr2, predictor="los", pred.value=7, conf.level=0.95, xlim=c(0,30), round.x=1,
ref.label="Ref.", xaxt="n")
xx <- c(0, 5, 10, 15, 20, 25, 30)
axis(1, xx)

predict.hr

predict method for an object of class 'HR'.

Description

predict method for an object of class 'HR'.

Usage

## S3 method for class 'HR'
predict(object, predictor, prob=NULL, pred.value=NULL, conf.level=0.95,
prediction.values=NULL, round.x=NULL, ref.label=NULL, ...)

Arguments

object

An object of class HR.

predictor

Variable named in the formula or included as a predictor in the coxfit. Usually
a continuous predictor of survival for which the results are expressed in terms of
hazard ratio curves, taking a specific covariate value as reference.

prob

Value between 0 and 1. If prob=0 the reference value will be the minimum of
the hazard ratio curve. If prob=1 the reference value will be the maximum of
the hazard ratio curve. For values between 0 and 1 the reference value will be
the corresponding quantile of the variable predictor.

pred.value

Value from the variable predictor to be taken as the reference value.

conf.level

Level of confidence. Defaults to 0.95 (corresponding to 95%).
**print.HR**

`prediction.values`  
Vector of values ranging between minimum and maximum of the variable `predictor`.

`round.x`  
Rounding of numbers in the predict.

`ref.label`  
Label for the reference covariate. By default is the name of the covariate.

`...`  
Other arguments.

**Value**

Returns a matrix with the prediction values.

**Author(s)**

Artur Araújo and Luís Meira-Machado

**References**


**See Also**

`smoothHR`.

**Examples**

```r
# Example 1
library(survival)
data(whas500)
fit <- coxph(Surv(lenfol, fstat)~age+hr+gender+diasbp+pspline(bmi)+pspline(los),
data=whas500, x=TRUE)
hr1 <- smoothHR(data=whas500, coxfit=fit)
predict(hr1, predictor="bmi", prob=0, conf.level=0.95)

# Example 2
hr2 <- smoothHR( data=whas500, time="lenfol", status="fstat", formula=~age+hr+gender+diasbp+
pspline(bmi)+pspline(los))
pdval <- c(1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 15, 18, 22, 25)
predict(hr2, predictor="los", pred.value=7, conf.level=0.95, prediction.values=pdval,
ref.label="Ref.")
```

**print.HR**

`print method for a Smooth Hazard Ratio Object`

**Description**

This class of objects is returned by the HR class of functions to represent smooth hazard ratio curve. Objects of this class have methods for `print`, `predict` and `plot`. 
Usage

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

Arguments

- `x` An object of class HR.
- `...` Other arguments.

Value

No value is returned.

Author(s)

Artur Araújo and Luís Meira-Machado

See Also

- `smoothHR`.

Examples

```r
# Example 1
library(survival)
data(whas500)
fit <- coxph(Surv(lenfol, fstat) ~ age + hr + gender + diasbp + pspline(bmi) + pspline(los),
data=whas500, x=TRUE)
hr1 <- smoothHR(data=whas500, coxfit=fit)
print(hr1)

# Example 2
hr2 <- smoothHR(data=whas500, time="lenfol", status="fstat", formula=~age+hr+gender+diasbp+
ppline(bmi)+pspline(los))
print(hr2)
```

---

Description

Provides flexible hazard ratio curves allowing non-linear relationships between continuous predictors and survival. To better understand the effects that each continuous covariate has on the outcome, results are expressed in terms of hazard ratio curves, taking a specific covariate value as reference. Confidence bands for these curves are also derived.
smoothHR

Usage

smoothHR(data, time=NULL, time2=NULL, status=NULL, formula=NULL, coxfit, status.event=NULL)

Arguments

data A data.frame in which to interpret the variables named in the formula or in the arguments time, time2, status and coxfit.
time For right censored data, this is the follow up time. For interval data, the first argument is the starting time for the interval.
time2 Ending time of the interval for interval censored or counting process data only. Intervals are assumed to be open on the left and closed on the right, (start, end]. For counting process data, event indicates whether an event occurred at the end of the interval.
status The status indicator, normally 0=alive, 1=dead. Other choices are TRUE/FALSE (TRUE = death) or 1/2 (2=death). For interval censored data, the status indicator is 0=right censored, 1=event at time, 2=left censored, 3=interval censored. Although unusual, the event indicator can be omitted, in which case all subjects are assumed to have an event.
formula A formula object, with the terms on the right after the ~ operator.
coxfit An object of class coxph. This argument is optional, being an alternative to the arguments time, time2, status and formula.
status.event The status indicator is a qualitative variable where usually the highest value is left for the event of interest (usually 0=alive, 1=dead). If that is not the case the status.event indicates which value denotes the event of interest.

Value

An object of class HR. There are methods for print, predict and plot. HR objects are implemented as a list with elements:
dataset Dataset used.
coxfit The object of class `coxph` used.
ptest Result from testing the proportional hazards assumption.

Author(s)

Artur Araújo and Luís Meira-Machado

References

whas500

Examples

# Example 1
library(survival)
data(whas500)
fit <- coxph(Surv(lenfol, fstat)~age+hr+gender+diasbp+pspline(bmi)+pspline(los), data=whas500, 
x=TRUE)
h1 <- smoothHR(data=whas500, coxfit=fit)
print(h1)

# Example 2
hr2 <- smoothHR( data=whas500, time="lenfol", status="fstat", formula=~age+hr+gender+diasbp+ 
pspline(bmi)+pspline(los) )
print(hr2)

whas500  Worcester Heart Attack Study WHAS500 Data

Description

Data from the Worcester Heart Attack Study

Usage

data(whas500)

Format

A data frame with 500 observations with 22 variables.

Details

Data from the Worcester Heart Attack Study whose main goal was to describe factors associated 
with trends over time in the incidence and survival rates following hospital admission for acute 
myocardial infarction.

Source

Worcester Heart Attack Study data from Dr. Robert J. Goldberg of the Department of Cardiology at 
the University of Massachusetts Medical School. This data is also available at the following Wiley’s 

References


Examples

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