Package 'PHeval'

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Type Package

Title Evaluation of the Proportional Hazards Assumption with a Standardized Score Process

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Author Cecile Chauvel

Maintainer Cecile Chauvel <chauvel.cecile@gmail.com>

Description Provides tools for the evaluation of the goodness of fit and the predictive capacity of the proportional hazards model.

License GPL (>= 2.0)

Depends R (>= 1.8.0), survival, graphics, splines

LazyLoad yes

NeedsCompilation no

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PHeval-package *Evaluation of the proportional hazards assumption with a standardized score process*

Description

This package provides tools for the evaluation of the goodness of fit and the predictive capacity of the proportional hazards model.

Details

Package:	PHeval
Type:	Package
Version:	0.5.1
Date:	2014-04-20
License:	GPL (>=2.0)

This package provides functions to evaluate and plot the standardized score process of OQuigley (2003). The plot of this process over the ranks of the failure times gives an indication of the validity of the proportional hazards assumption. A function to evaluate the R^2 coefficient of OQuigley and Flandre (1994) is provided. This coefficient is a measure of the predictive ability of the proportional hazards model.

Author(s)

Cecile Chauvel <cecile.chauvel@upmc.fr>

References

Chauvel, C. and OQuigley, J. (2014) Tests for comparing estimated survival functions. *Biometrika* **101**, 535-552. https://doi.org/10.1093/biomet/asu015
Chauvel, C. and OQuigley, J. (2017) Survival model construction guided by fit and predictive strength. *Biometrics* **73**, 483-494. https://doi.org/10.1111/biom.12611
OQuigley, J. (2008) *Proportional hazards regression*. Springer New-York.
OQuigley J, Flandre P. (1994) Predictive capability of proportional hazards regression. *PNAS* **91**, 2310-2314.

Examples

```
library(survival)
S=standscore(futime+fustat~resid.ds+rx,data=ovarian)
plotscore(S,printCB = TRUE)
```

```
R2(futime+fustat~resid.ds+rx,data=ovarian)
```

---

plotscore *Plot of the standardized score process*

Description

The function plots the standardized score process. This process is a list resulting of an appeal to the function standscore.

Usage

```
plotscore(s, printCB = FALSE , component.num = 1:dim(s[[1]])[2], main = "" ,
 xlab = "Time", ylab = "Standardized score", ylim)
```

Arguments

s	A list resulting from a call to the function standscore which corresponds to the process and, possibly, its confidence bands.
printCB	Set printCB = TRUE for plotting the confidence bands. Default is printCB = FALSE.
component.num	A vector of length lower than the number of covariates. Indicates which components of the process to plot. For example, set component.num=c(2,3) for plotting the second and third components. By default, all components are plotted.
main,xlab,ylab,ylim	Classical arguments for plotting. See help(plot).

Author(s)

Cecile Chauvel <chauvel.cecile@gmail.com>

See Also

standscore

Examples

```
library(survival)
data(ovarian)

##############################################
# Evaluation and plot of the standardized score process at parameter beta0 = 0
score1=standscore(futime+fustat~age+rx,data=ovarian)
plotscore(score1,printCB=TRUE)


##############################################
# Evaluation of the standardized score process at parameter
```

```
# beta0 = maximum partial likelihood estimator of beta
beta=coxph(Surv(futime,fustat)~age+rx,data=ovarian)$coeff
score2=standscore(futime+fustat~age+rx,data=ovarian,beta0=beta)

# Separated plots for each regression effect
par(mfrow=c(1,2))
plotscore(score2,printCB=TRUE,component.num=1,main="age")
plotscore(score2,printCB=TRUE,component.num=2,main="rx")

##########################################
# Evaluation and plot of the standardized score process at parameter beta0 = 0
# without global standardization
score3=standscore(futime+fustat~age+rx,data=ovarian,globstan=FALSE)
plotscore(score3)
```

R2 *R2 coefficient*

Description

This function calcultates the R^2 coefficient of OQuigley and Flandre (1994) to evaluate the predictive capacity of the proportional hazards model (or Cox model).

Usage

```
R2(formula, data)
```

Arguments

formula	A formula object or character string with the time and censoring status separated by "+" on the left hand side and the covariates separated by "+" on the right. For instance, if the time name is "Time", the censoring status is "Status" and the covariates are called "Cov1" and "Cov2", the formula is "Time+Status~Cov1+Cov2".
data	A data.frame with the data. The censoring status should be 1 for failure and 0 for censoring. No missing data accepted.

Details

The program does not handle ties in the data. We suggest to randomly split the ties before using the program.

Value

- If one covariate Z is present in the model, the R^2 coefficient is

$$R^2 = 1 - \frac{\sum(Zi - E_b(Zi))^2}{\sum(Zi - E_0(Zi))^2},$$

where the sums are over the failures. $E_b(Zi)$ is the expectation of Z at the ith failure time under the model of parameter b = the maximum partial likelihood estimator of the regression coefficient. $E_0(Zi)$ is the expectation of Z under the model of parameter 0 at the ith failure time.

- If several covariates are present in the model, the R^2 coefficient is evaluated as in the previous case except that the covariate Z is replaced by the prognostic index $b'Z$.

Author(s)

Cecile Chauvel

References

OQuigley, J. (2008) *Proportional hazards regression*. Springer New-York. Chapter 12.
OQuigley J, Flandre P. (1994) Predictive capability of proportional hazards regression. *PNAS* **91**, 2310-2314.

Examples

```
library(survival)
data(ovarian)
R2(futime+fustat~age,data=ovarian)
R2(futime+fustat~age+rx,data=ovarian)
```

---

standscore *Standardized Score Process*

Description

This function evaluates the standardized score process of OQuigley (2003). The process helps evaluating the goodness of fit of the proportional hazards model and visualizing the shape of time-dependent effects.

Usage

```
standscore(formula, data, globstan = TRUE, beta0 = 0)
```

Arguments

formula	A formula object or character string with the time and censoring status separated by "+" on the left hand side and the covariates separated by "+" on the right. For instance, if the time name is "Time", the censoring status is "Status" and the covariates are "Cov1" and "Cov2", the formula is "Time+Status~Cov1+Cov2".
data	A data.frame with the data. The censoring status should be 1 for failure and 0 for censoring. No missing data accepted.
globstan	With one covariate in the model, globstan has no effect. With several covariates,

- if globstan = TRUE (default) a global standardization by the matrix Sigma is applied to the process. Sigma is the estimator of the variance-covariance matrix between the covariates to the power of - 1 / 2. With this sandardization, each component of the process represents the cumulative regression effect of each covariates.
- if globstan = FALSE, no standardization is applied. In this case, the components of the process are dependent and do not reflect the shapes of the cumulative effects. The confidence bands are not given. The use of globstan = FALSE is aimed at performing tests of the value of the regression coefficients (null hypothesis : regression parameter = beta0).

`beta0` a vector of parameters to evaluate the process (by default, parameters set to 0). Its length is the number of covariates. Each value corresponds to the regression coefficient for a covariate, in the same order as appearing in formula.

Details

The program does not handle ties in the data. We suggest to randomly split the ties before using the program.

Value

`Score` A vector or matrix with the value of the standardized score process. Each row corresponds to a failure time, each column to a covariate.

`Sigma` The matrix used for the standardization of the process. Sigma is the estimator of the variance-covariance matrix between the coviates to the power of - 1 / 2. This value is present only with multiple covariates and globstan = TRUE.

`confbandCOV` A matrix with the confidence bands of the process for a constant regression effect associated with the covariate named COV. Each row corresponds to a failure time. The first column is the lower band and the second column is the upper band. This value is present with one covariate or with multiple covariates and globstan = TRUE.

Author(s)

Cecile Chauvel <chauvel.cecile@gmail.com>

References

Chauvel, C. and OQuigley, J. (2014) Tests for comparing estimated survival functions. *Biometrika* **101**, 535-552. https://doi.org/10.1093/biomet/asu015
Chauvel, C. and OQuigley, J. (2017) Survival model construction guided by fit and predictive strength. *Biometrics* **73**, 483-494. https://doi.org/10.1111/biom.12611
OQuigley, J. (2008) *Proportional hazards regression*. Springer New-York. Chapter 8.

See Also

plotscore

Examples

```
library(survival)
data(ovarian)

###########################################
# Evaluation and plot of the standardized score process at parameter beta0 = 0

score1=standscore(futime+fustat~age+rx,data=ovarian)
plotscore(score1,printCB=TRUE)


###########################################
# Evaluation of the standardized score process at parameter
# beta0 = maximum partial likelihood estimator of beta

beta=coxph(Surv(futime,fustat)~age+rx,data=ovarian)$coeff
score2=standscore(futime+fustat~age+rx,data=ovarian,beta0=beta)

# Separated plots for each regression effect

par(mfrow=c(1,2))
plotscore(score2,printCB=TRUE,component.num=1,main="age")
plotscore(score2,printCB=TRUE,component.num=2,main="rx")

###########################################
# Evaluation and plot of the standardized score process at parameter beta0 = 0
# without global standardization

fo="futime+fustat~age+rx"
score3=standscore(fo,data=ovarian,globstan=FALSE)
plotscore(score3)
```

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