Package 'SurvEval'

Type Package

Title Methods for the Evaluation of Survival Models

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Description Provides predictive accuracy tools to evaluate time-to-event survival models. This includes calculating the concordance probability estimate that incorporates the follow-up time for a particular study developed by Devlin, Gonen, Heller (2020)<doi:10.1007/s10985-020-09503-3>. It also evaluates the concordance probability estimate for nested Cox proportional hazards models using a projection-based approach by Heller and Devlin (under review).

License GPL (>= 2)

Depends R (>= 3.6), survival, stats

Imports Rcpp (>= 1.0.11)

LinkingTo Rcpp

NeedsCompilation yes

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R topics documented:

SurvEval-package   *Methods for the Evaluation of Survival Models.*

Description

This implements various tools to evaluate Cox proportional hazards regression models.

Details

Currently, this implements the methodology outlined in the following two papers. The first is Devlin, Gonen, and Heller (2020) that evaluates the discriminatory power of a baseline-derived risk score over time. This same method is used to evaluate the concordance probability estimate (CPE) up until the follow-up duration of a given study.

The second is Heller and Devlin (under review) that develops a projection-based approach to estimate the CPE from nested survival models.

Author(s)

Sean Devlin and Glenn Heller.

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References

Devlin, Sean M., Mithat Gonen, and Glenn Heller. Measuring the temporal prognostic utility of a baseline risk score. Lifetime data analysis 26.4 (2020): 856-871.

Heller, Glenn, and Sean M. Devlin. Measuring the Impact of New Risk Factors Within Survival Models. Under Review.

ProjectionCPE   *Projecton-based Approach to Estimate the CPE from Nested Survival Models.*

Description

Using a projection-based approach, the concordance probability estimate (CPE) for nested Cox proportional hazards regression models is computed. Under this approach, the proportional hazards assumption is satisfied for the model containing both the standard covariates and the new covariates under investigation.

Usage

```
ProjectionCPE(Time, Event,StandardMarkers,NewMarkers, tau, Block=TRUE)
```

Arguments

`Time`	Survival Time
`Event`	Event Status
`StandardMarkers`	
	A vector or matrix of standard covariates. Unique column names should be assigned to the matrix before running this function.
`NewMarkers`	A vector or matrix of new covariates.Unique column names should be assigned to the matrix before running this function.
`tau`	The follow-up duration for a given study. This should be no larger than the maximum observed failure time (uncensored).
`Block`	Due to the complexity of the calculation, this is an approximation that calculates the CPE using random blocks of 50 patients. Recommended for data sets larger than 150 individuals.

Details

This function implements the method described in Heller and Devlin (under review).

Value

an object with the following elements

`projCPE`	Projected CPE statistic using the standard markers.

References

Heller, Glenn, and Sean M. Devlin. Measuring the Impact of New Risk Factors Within Survival Models. *Under Review*.

Examples

```
SM0 = rnorm(300, 0,1)
SM1 = rnorm(300, 0,1)
NM0 = rnorm(300, 0,1)
NM1 = rnorm(300, 0,1)

S1 = exp(-1*(0.408*SM0 +0.15*SM1 + 0.684*NM0+0.15*NM1))*rweibull(300,scale = 1 , shape=1)
C1 = runif(300, 0,1.58)

Time = pmin(S1, C1)
Event = 1*(S1 < C1)

StandardMarkers = cbind(SM0,SM1)
NewMarkers = cbind(NM0 ,NM1 )
tau = max(Time[Event==1])

ProjectionCPE(Time, Event,StandardMarkers,NewMarkers,  tau)
```

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stCPE   *Estimate the Durability of a Baseline Risk Score or the CPE for a*
                                   Fixed Follow-up Duration.

Description

This implements the methodology developed by Devlin, Gonen, and Heller (2020) to estimate the durability of a baseline risk score estimated under a Cox proportional hazards model. The same methodology can be used to estimate the concordance probability estimate (CPE) up to a fixed follow-up duration in a study.

Usage

```
stCPE(Time, Event, Markers, starttime, tau)
```

Arguments

Time	Survival Time.
Event	Event Status.
Markers	A vector or matrix of covariates.
starttime	The start time when evaluating the durability of a risk score. This should be set to 0 when evaluating the CPE up to a study's follow-up duration.
tau	The end time under evaluation.

Details

This function implements the method described in Devlin, Gonen, and Heller (2020).

Value

an object with the following element

stCPE.estimate   which is the concordance probability estimate.

References

Devlin, Sean M., Mithat Gonen, and Glenn Heller. Measuring the temporal prognostic utility of a baseline risk score. Lifetime data analysis (2020).

Examples

```
SM0 = rnorm(300, 0,1)
SM1 = rnorm(300, 0,1)
NM0 = rnorm(300, 0,1)
NM1 = rnorm(300, 0,1)
```

```
S1 <- exp(-1*(0.408*SM0 +0.15*SM1 + 0.684*NM0+0.15*NM1))*rweibull(300,scale = 1 , shape=1)
C1 <- runif(300, 0,1.58)

Time <- pmin(S1, C1)
Event <- 1*(S1 < C1)

Markers <- cbind(SM0,SM1,NM0 ,NM1 )
tau <- max(Time[Event==1])

stCPE(Time, Event, Markers, 0, tau)
```

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