Package 'survParamSim'

Type Package

Title Parametric Survival Simulation with Parameter Uncertainty

Version 0.1.2

Description Perform survival simulation with parametric survival model generated from 'survreg' function in 'survival' package.
In each simulation coefficients are resampled from variance-covariance matrix of parameter estimates to
capture uncertainty in model parameters.
Prediction intervals of Kaplan-Meier estimates and hazard ratio of treatment effect can be further calculated using simulated survival data.

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Encoding UTF-8

LazyData true

Depends R (>= 3.4.0),

Imports magrittr (>= 1.5), mvtnorm, rlang, purrr, forcats, dplyr,
tidyr, tibble, ggplot2, survival (>= 2.43), methods

Suggests testthat (>= 2.1.0), vdiffr, knitr, rmarkdown, survminer

RoxygenNote 7.1.0

Language en-US

URL https://github.com/yoshidk6/survParamSim

BugReports https://github.com/yoshidk6/survParamSim/issues

VignetteBuilder knitr

NeedsCompilation no

Author Kenta Yoshida [aut, cre] (<https://orcid.org/0000-0003-4967-3831>),
Laurent Claret [aut]

Maintainer Kenta Yoshida <6.kurabupasu@gmail.com>

Repository CRAN

Date/Publication 2020-06-18 06:00:03 UTC

R topics documented:

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calc_hr_pi	*Generate hazard ratio with prediction intervals from parametric boot-strap simulation*

Description

Generate hazard ratio with prediction intervals from parametric bootstrap simulation

Usage

```
calc_hr_pi(
  sim,
  trt,
  group = NULL,
  pi.range = 0.95,
  calc.obs = TRUE,
  trt.assign = c("default", "reverse")
)
```

Arguments

sim	A survparamsim class object generated by surv_param_sim function.
trt	A string to specify which column define treatment status to calculate HR. The specified column should have only two levels.
group	Optional string(s) to specify grouping variable(s). You will have faceted histograms for these variables in plot_hr_pi function.
pi.range	Prediction interval for simulated HR.
calc.obs	A logical to specify whether to calculate HR for the observed data. Need be set as FALSE if survival information in the newdata is dummy.
trt.assign	Specify which of the categories of trt need to be considered as control group.

| calc_km_pi | *Generate Kaplan-Meier curves with prediction intervals from parametric bootstrap simulation* |

Description

Generate Kaplan-Meier curves with prediction intervals from parametric bootstrap simulation

Usage

```
calc_km_pi(
  sim,
  trt = NULL,
  group = NULL,
  pi.range = 0.95,
  calc.obs = TRUE,
  simtimelast = NULL
)
```

Arguments

sim	A survparamsim class object generated by [surv_param_sim](#) function.
trt	An optional string to specify which column define treatment status. You will have survival curves with different colors in [plot_km_pi](#) function.
group	Optional string(s) to specify grouping variable(s). You will have faceted survival curves for these variables in [plot_km_pi](#) function.
pi.range	Prediction interval for simulated survival curves.
calc.obs	A logical to specify whether KM estimates will be performed for the observed data. Need be set as FALSE if survival information in the newdata is dummy.
simtimelast	An optional numeric to specify last simulation time for survival curve. If NULL (default), the last observation time in the newdata will be used.

| extract_km_pi | *Functions to extract prediction intervals and observed data* |

Description

Functions to extract prediction intervals and observed data

Usage

```
extract_km_pi(km.pi, trunc.sim.censor = TRUE)

extract_median_surv(km.pi, outtype = c("long", "wide"))

extract_hr_pi(hr.pi, outtype = c("long", "wide"))
```

Arguments

km.pi	A return object from [calc_km_pi](#) function.
trunc.sim.censor	
	A logical specifying whether to truncate the simulated curve at the last time of 'censor.dur" specified in [surv_param_sim](#).
outtype	Specifies whether output will be in long or wide format.
hr.pi	a return object from [calc_hr_pi](#) function.

Details

[extract_km_pi](#) extracts prediction intervals of simulated Kaplan-Meier curves.

[extract_median_surv](#) extracts prediction intervals of median survival times and and the corresponding observed values.

[extract_hr_pi](#) extracts prediction intervals of simulated hazard ratios and the corresponding observed values.

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extract_sim   *Functions to extract raw simulated samples*

Description

Functions to extract raw simulated samples

Usage

```
extract_sim(sim)

extract_hr(hr.pi)

extract_km_obs(km.pi)
```

Arguments

sim	A survparamsim class object generated by [surv_param_sim](#) function.
hr.pi	a return object from [calc_hr_pi](#) function.
km.pi	A return object from [calc_km_pi](#) function.

Details

[extract_sim](#) extracts raw survival time & event status for all simulated subjects.

[extract_hr](#) extracts simulated HRs for all repeated simulations

[extract_km_obs](#) extracts observed Kaplan-Meier curves.

plot_hr_pi	*Plot HR*

Description

Plot HR

Usage

```
plot_hr_pi(hr.pi, show.obs = TRUE)
```

Arguments

hr.pi	a return object from calc_hr_pi function.
show.obs	A logical specifying whether to show observed HR on the plot. This will have no effect if calc.obs was set to FALSE in calc_hr_pi.

plot_km_pi	*Plot Kaplan-Meier curves with prediction intervals from parametric bootstrap simulation*

Description

Need to think about how to apply this for subgroups

Usage

```
plot_km_pi(km.pi, show.obs = TRUE, trunc.sim.censor = TRUE)
```

Arguments

km.pi	an output from calc_km_pi function.
show.obs	A logical specifying whether to show observed K-M curve on the plot. This will have no effect if calc.obs was set to FALSE in calc_km_pi.
trunc.sim.censor	
	A logical specifying whether to truncate the simulated curve at the last time of censor.dur specified in surv_param_sim.

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print.survparamsim.hrpi
Methods for S3 objects in the package

Description

Methods for S3 objects in the package

Usage

```
## S3 method for class 'survparamsim.hrpi'
print(x, ...)

## S3 method for class 'survparamsim.hrpi'
summary(object, ...)

## S3 method for class 'survparamsim.kmpi'
print(x, ...)

## S3 method for class 'survparamsim.kmpi'
summary(object, ...)

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

Arguments

x	An object of the corresponding class
...	Additional arguments passed to methods.
object	An object of the corresponding class

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surv_param_sim   *Simulation of parametric survival model*

Description

The main function to generate predicted survival using a model object generated with [survreg](#) function.

Usage

```
surv_param_sim(
  object,
  newdata,
  n.rep = 1000,
  censor.dur = NULL,
  coef.var = TRUE,
  na.warning = TRUE
)

surv_param_sim_resample(
  object,
  newdata,
  n.rep = 1000,
  censor.dur = NULL,
  n.resample,
  strat.resample = NULL
)
```

Arguments

object	A survreg class object. Currently accept exponential, lognormal, weibull, loglogistic, and gaussian distributions.
newdata	A required data frame for simulation that contain covariates in the survival model. It is required even if this is the same as the one used for survreg function.
	It also has to contain columns for survival information. These can be used in plot_km_pi and plot_hr_pi function as observed data. Survival information can be dummy data, but time need to be long enough so that simulated KM plot will be long enough for plot_km_pi to draw simulated survival curves.
	Subjects with NA for covariates in survreg model will be removed from the simulation and subsequent plotting of observed data.
n.rep	An integer defining numbers of parametric bootstrap runs
censor.dur	A two elements vector specifying duration of events censoring. Censoring time will be calculated with uniform distribution between two numbers. No censoring will be applied if NULL is provided.
coef.var	Boolean specifying whether parametric bootstrap are performed on survival model coefficients, based on variance-covariance matrix. If FALSE, prediction interval only reflects inherent variability from survival events.
na.warning	Boolean specifying whether warning will be shown if newdata contain subjects with missing model variables.
n.resample	Number of subjects for resampled simulations. If strat.resample is provided, this needs to be a vector of the length equal to the number of categories in the stratification variable.
strat.resample	String specifying stratification variable for resampling.

Details

surv_param_sim returns simulation using the provided subject in newdata as it is, while surv_param_sim_resample perform simulation based on resampled subjects from the dataset. The latter allows more flexibility in terms of simulating future trials with different number of subjects.

Currently we have not tested whether this function work for a survreg model with stratification variables.

Value

A survparamsim object that contains the original survreg class object, newdata, and a data frame for predicted survival profiles with the following columns:

- **time**: predicted event or censor time
- **event**: event status, 0=censored, 1=event
- **rep**: ID for parametric bootstrap runs
- **subj**: ID for subjects in newdata (currently original ID is not retained and subj is sequentially assigned as 1:nrow(newdata))

Examples

```
library(survival)

fit.lung <- survreg(Surv(time, status) ~ sex + ph.ecog, data = lung)

object <- fit.lung
n.rep  <-  30
newdata <-
  tibble::as_tibble(dplyr::select(lung, time, status, sex, ph.ecog)) %>%
  tidyr::drop_na()
censor.dur <- c(200, 1100)

sim <- surv_param_sim(object, newdata, n.rep, censor.dur)
```

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