Package ‘rpsftm’

October 27, 2023

Type Package

Title Rank Preserving Structural Failure Time Models

Version 1.2.8

Date 2023-10-26

Description Implements methods described by the paper Robins and Tsiatis (1991) <DOI:10.1080/03610929108830654>. These use g-estimation to estimate the causal effect of a treatment in a two-armed randomised control trial where non-compliance exists and is measured, under an assumption of an accelerated failure time model and no unmeasured confounders.

Depends R (>= 2.10)

License GPL-2

Imports survival, ggplot2, stats

LazyData true

RoxygenNote 7.2.3

Suggests testthat, knitr, rmarkdown, tableone

VignetteBuilder knitr

Language en-GB

Encoding UTF-8

NeedsCompilation no

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Repository CRAN

Date/Publication 2023-10-27 11:40:06 UTC
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rpsftm-package  

rpsftm: a package to fit Rank Preserving Structural Failure Time Model

Description

This implements the method of Robins JM, Tsiatis AA. The key function is \texttt{rpsftm}, which provides estimates of the causal parameter of interest.

Details

\texttt{rpsftm}: a package to fit Rank Preserving Structural Failure Time Model

References


See Also

- \texttt{survdiff}
- \texttt{coxph}
- \texttt{survreg}
**Description**

If the fit inherits both rpsftm and coxph then this pulls out the genuine survival::coxph object that is deeply nested in the object, and then runs survival::cox.zph on it. Or it avoids overwriting the function from survival by calling survival::cox.zph directly if the object does not inherit rpsftm. Or it fails.

**Usage**

```r
cox.zph(fit, ...)
```

**Arguments**

- `fit` the result of fitting a rpsftm model using coxph as the inner estimation tool.
- `...` any other arguments to pass to `cox.zph`.

**Note**

This does rely on the order of loading packages. The rpsftm package must be loaded after survival, if both are required, to avoid the masking of synonymous functions causing errors.

**See Also**

- `cox.zph`

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**immdef**

**Description**

Simulated data to use with the rpsftm function.

**Usage**

```r
immdef
```
Plot Method

Description

Function used to plot the KM curves of the treatment-free transformed times

Usage

```r
## S3 method for class 'rpsftm'
plot(x, ...)
```

Arguments

- `x`: an object returned from the `rpsftm` function.
- `...`: further arguments passed to or from other methods.

Value

a ggplot plot of the fitted KM curves. The underlying data.frame has variables

- `time`: failure time
- `survival`: estimated treatment-free survival probability
- `upper`: upper confidence interval at level defined by alpha in the call to `rpsftm`
- `lower`: lower confidence interval at level defined by alpha in the call to `rpsftm`
- `group`: randomised treatment arm
Author(s)
Simon Bond

Examples

```r
fit <- rpsftm(Surv(progyrs, prog)~rand(imm,1-xoyrs/progyrs),immdef, censyrs)
plot(fit)
library(ggplot2)
plot(fit)+
  scale_linetype_discrete(labels=c("Control","Experimental"))+
  ylim(0.5,1)+
  geom_ribbon(aes(ymin=lower, ymax=upper, fill=group), alpha=0.3)+
  labs(x="Time (years)", title=NULL, lty="Arm", fill="Arm")
```

print.rand

### Print method

**Description**

print method for rand() objects - to display the summary of rx, by arm

**Usage**

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

**Arguments**

- `x` a rand() object
- `...` further arguments passed to or from other methods.

**Value**

a summary of rx values broken down by arm for a rand() object

**Author(s)**

Simon Bond

**See Also**

`rand`, `rpsftm`
print.rpsftm  

**Print Method**

**Description**

Function used to print of the underlying test object at the point estimate of a rpsftm object

**Usage**

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

**Arguments**

- `x`:
  - an object returned from the `rpsftm` function.
- `...`:
  - further arguments passed to or from other methods.

**Value**

A print of the underlying test object at the point estimate.

**Author(s)**

Simon Bond

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**rand**

**rand functions to use in the rpsftm() formula**

**Description**

A function that is defined to be used in the formula argument, and identified as specials in the terms() object.

**Usage**

```r
rand(arm, rx)
```

**Arguments**

- `arm`:
  - the randomised treatment arm. a factor with 2 levels, or numeric variable with values 0/1.
- `rx`:
  - the proportion of time on active treatment (arm=1 or the non-reference level of the factor)
Value

matrix with two columns named arm and rx. These can be used in the formula argument to rpsftm()

Author(s)

Simon Bond

See Also

print.rand, rpsftm

Examples

x <- with(immdef, rand(imm, 1 - xoyrs / progyrs ) )
x
class(x)
y <- as.data.frame(x)
head(y)

residuals.rpsftm  residual() method for rpsftm objects

Description

Function to apply residual method to rpsftm objects

Usage

## S3 method for class 'rpsftm'
residuals(object, ...)

Arguments

object an object returned from the rpsftm() function.
...
further arguments passed to or from other methods.

Value

a residuals object.

Author(s)

Simon Bond

See Also

residuals residuals.coxph residuals.survreg
Description

Main Function used for estimating causal parameters under the Rank Preserving Structural Failure Time Model

Usage

rpsftm(
  formula,
  data,
  censor_time,
  subset,
  na.action,
  test = survdiff,
  low_psi = -1,
  hi_psi = 1,
  alpha = 0.05,
  treat_modifier = 1,
  autoswitch = TRUE,
  n_eval_z = 100,
  ...
)

Arguments

formula a formula with a minimal structure of Surv(time, status)~rand(arm,rx). Further terms can be added to the right hand side to adjust for covariates and use strata or cluster arguments.
data an optional data frame that contains variables
censor_time variable or constant giving the time at which censoring would, or has occurred. This should be provided for all observations unlike standard Kaplan-Meier or Cox regression where it is only given for censored observations. If no value is given then re-censoring is not applied.
subset expression indicating which subset of the rows of data should be used in the fit. This can be a logical vector (which is replicated to have length equal to the number of observations), a numeric vector indicating which observation numbers are to be included (or excluded if negative), or a character vector of row names to be included. All observations are included by default.
na.action a missing-data filter function. This is applied to the model.frame after any subset argument has been used. Default is options()$na.action.
test the survival regression function to calculate the z-statistic: survdiff, coxph, survreg
`rpsftm`

- **low_psi**: the lower limit of the range to search for the causal parameter
- **hi_psi**: the upper limit of the range to search for the causal parameter
- **alpha**: the significance level used to calculate confidence intervals
- **treat_modifier**: an optional variable that psi is multiplied by on an individual observation level to give differing impact to treatment.
- **autoswitch**: a logical to autodetect cases of no switching. If TRUE, then if all observations in an arm have perfect compliance then recensoring is not applied in that arm. If FALSE the recensoring is applied regardless of perfect compliance.
- **n_eval_z**: The number of points between hi_psi and low_psi at which to evaluate the Z-statistics in the estimating equation. Default is 100.

... arguments to supply to the test function.

**Details**

the formula object `Surv(time, status)~rand(arm,rx)`. `rand()` stands for randomisation, both the randomly assigned and actual observed treatment.

- **arm**: the randomised treatment arm. a factor with 2 levels, or numeric variable with values 0/1.
- **rx**: the proportion of time on active treatment (arm=1 or the non-reference level of the factor)

Further adjustment terms can be added on the right hand side of the formula if desired, included `strata()` or `cluster()` terms.

**Value**

a `rpsftm` method object that is a list of the following:

- **psi**: the estimated parameter
- **fit**: a `survdiff` object to produce Kaplan-Meier curves of the estimated counterfactual untreated failure times for each treatment arm
- **CI**: a vector of the confidence interval around psi
- **Sstar**: the recensored `Surv()` data using the estimate value of psi to give counterfactual untreated failure times.
- **rand**: the `rand()` object used to specify the allocated and observed amount of treatment.
- **ans**: the values from `uniroot_all` used to solve the estimating equation, but embedded within a list as per `uniroot`, with an extra element `root_all`, a vector of all roots found in the case of multiple solutions. The first element of `root_all` is subsequently used.
- **eval_z**: a data frame with the Z-statistics from the estimating equation evaluated at a sequence of values of psi. Used to plot and check if the range of values to search for solution and limits of confidence intervals need to be modified.
- **Further elements corresponding to either a `survdiff`, `coxph`, or `survreg` object. This will always include:**
  - **call**: the R call object
  - **formula**: a formula representing any adjustments, strata or clusters- used for the `update()` function
  - **terms**: a more detailed representation of the model formula
Author(s)
Simon Bond

See Also
survdiff, coxph.object, survreg.object

Examples
?immdef
fit <- rpsftm(Surv(progyrs, prog)~rand(imm,1-xoyrs/progyrs),immdef, censyrs)
print(fit)
summary(fit)
plot(fit)

Description
Function used to summarise the fitted model to an rpsftm object

Usage
## S3 method for class 'rpsftm'
summary(object, ...)

Arguments

object
an object returned from the rpsftm() function.

... further arguments passed to or from other methods.

Value
a summary of the fitted regression model.

Author(s)
Simon Bond
**survfit.rpsftm**  

**survfit() method for rpsftm objects**

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### Description

Function to apply survfit method to rpsftm objects

### Usage

```r
survfit.rpsftm(object, ...)
```

### Arguments

- **object**: an object returned from the `rpsftm()` function.
- **...**: further arguments passed to or from other methods.

### Value

A `survfit` object.

### Author(s)

Simon Bond

### See Also

- `survfit`
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