Package ‘simexaft’

October 14, 2022

Type Package
Title simexaft
Version 1.0.7.1
Date 2014-01-19
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Description Implement of the Simulation-Extrapolation (SIMEX) algorithm for the accelerated failure time (AFT) with covariates subject to measurement error.
License GPL
Imports mvtnorm, survival
LazyLoad yes
NeedsCompilation no
Repository CRAN
Date/Publication 2019-01-07 12:21:27 UTC
Depends R (>= 2.10)

R topics documented:

simexaft-package ................................................. 2
BHS ......................................................... 2
linearextrapolation ........................................ 4
plotsimexaft ............................................... 5
print.simexaft ................................................. 6
quadraticextrapolation ..................................... 7
rhDNase ....................................................... 8
simexaft ...................................................... 9
summary.simexaft ......................................... 12

Index 14
**Description**

Implementation of Simulation-Extrapolation (SIMEX) algorithm for the accelerated failure time (AFT) model with mismeasured covariates.

**Details**

<table>
<thead>
<tr>
<th>Package:</th>
<th>simexaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>Package</td>
</tr>
<tr>
<td>Version:</td>
<td>1.0.7</td>
</tr>
<tr>
<td>Date:</td>
<td>2014-01-19</td>
</tr>
<tr>
<td>License:</td>
<td>GPL</td>
</tr>
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</tr>
<tr>
<td>LazyLoad:</td>
<td>yes</td>
</tr>
</tbody>
</table>

**Author(s)**

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**References**


**BHS**

**Busselton Health Study**

**Description**

This dataset is a subset of the Busselton Health study. The Busselton Health study was a repeated cross-sectional survey that was conducted to the community of Busselton in Western Australian.
Usage
data(BHS)

Format
A data frame with 100 observations on the following 18 variables.

- PAIR: spouse pair id number
- AGE: age at survey
- SEX: sex
- SBP: systolic blood pressure
- DBP: diastolic blood pressure
- BMI: body mass index
- CHOL: cholesterol level
- DIABETES: history of diabetes
- RXHYPER: on blood pressure treatment
- CHID: history of coronary heart disease
- SMOKE: smoking status
- DRINKING: alcohol consumption level
- SURVTIME: survival time from survey data to date last known alive
- DTHCENS: censoring indicator
- CHDCENS: indicator of the death from coronary heart disease
- CVDCENS: indicator of the death from cardiovascular disease
- SMOKE1: indicator of ex-smoker
- SMOKE2: indicator of current smoker

Details
This dataset is a subset of the Busselton Health study. The Busselton Health study was a repeated cross-sectional survey that was conducted to the community of Busselton in Western Australian.

Source


See Also
simexaft
Description

Linear extrapolation step of SIMEX algorithm.

Usage

```r
linearextrapolation(A1, A2, A3, lambda)
```

Arguments

- `A1`: estimates obtained from each level of `lambda`.
- `A2`: variances estimates obtained from each level of `lambda`.
- `A3`: scale estimates obtained from each level of `lambda`.
- `lambda`: vector of `lambda`s, the grids for the extrapolation step.

Value

- `reg1`: extrapolation back to `lambda=-1` yield the SIMEX estimates
- `reg2`: extrapolation back to `lambda=-1` yield the SIMEX estimates of variances
- `scalereg`: extrapolation back to `lambda=-1` yield the SIMEX estimates of scale

Author(s)

Juan Xiong, Wenqing He and Grace Y. Yi

References


See Also

- `quadraticextrapolation`
Description

A function to give the plot of the extrapolation curve for any covariables of the AFT model.

Usage

```r
plotsimexaft(obj, var, extrapolation=c("linear","quadratic","both"), ylimit)
```

Arguments

- `obj`: an object returned by the function "simexaft".
- `var`: a character string of any covariate used in the AFT model.
- `extrapolation`: a character string giving the type of the extrapolation method, the default is set to be linear extrapolation.
- `ylimit`: the y limits of the plot.

Details

The green points are the average of estimates of B iteration for each lambda.

The linear extrapolation curve is in blue, the corresponding SIMEX estimate is the solid red circle.

The quadratic extrapolation curve is in red, the corresponding SIMEX estimate is the solid blue circle.

The "both" option of the extrapolation method gives both linear and quadratic extrapolation curves.

Author(s)

Juan Xiong, Wenqing He and Grace Y. Yi

See Also

`survreg`

Examples

```r
###########example for the dataset with known variance.################
library("simexaft")
library("survival")
data("BHS")
dataset <- BHS
dataset$SBP <- log(dataset$SBP-50)
set.seed(120)
formula <- Surv(SURVTIME,DTHCENS)~SBP+CHOL+AGE+BMI+SMOKE1+SMOKE2
```
```r

ind <- c("SBP", "CHOL")
err.mat <- diag(rep(0.5625, 2))

### fit an AFT model with quadratic extrapolation
out2 <- simexaft(formula = formula, data = dataset, SIMEXvariable = ind,
                  repeated = FALSE, repind = list(), err.mat = err.mat, B = 50,
                  lambda=seq(0, 2, 0.1), extrapolation="quadratic", dist="weibull")

summary(out2)

plotsimexaft(out2,"SBP","both",ylim=c(-3,1))
```

---

**print.simexaft**  
*Print Method for the SIMEXAFT Class*

**Description**

Printing the most important values in a clear way.

**Usage**

```r
## S3 method for class 'simexaft'
print(x, digits = max(3, getOption("digits") - 3), ...)
```

**Arguments**

- `x`: object of class SIMEXAFT.
- `digits`: number of digits to be printed.
- `...`: arguments passed to other functions.

**Author(s)**

Juan Xiong, Wenqing He and Grace Y. Yi

**References**


Quadratic extrapolation step of SIMEX algorithm.

Usage

quadraticextrapolation(A1, A2, A3, lambda)

Arguments

A1        estimates obtained from each level of lambda.
A2        variances estimates obtained from each level of lambda.
A3        scale estimates obtained from each level of lambda.
lambda    vector of lambdas, the grids for the extrapolation step.

Value

reg1      extrapolation back to lambda=-1 yield the SIMEX estimates
reg2      extrapolation back to lambda=-1 yield the SIMEX estimates of variances
scalereg  extrapolation back to lambda=-1 yield the SIMEX estimates of scale

Author(s)

Juan Xiong, Wenqing He and Grace Y. Yi

References

norm: Multivariate Normal and t Distributions. R package version 0.9-9991, URL http://CRAN.  
R-project.org/package=mvtnorm.

He, W., Yi, G. Y. and Xiong, J. (2007). Accelerated Failure Time Models with Covariates Subject 
to Measurement Error. Statistics in Medicine, 26, 4817-4832.

R package version 2.36-10, URL http://CRAN.R-project.org/package=survival.

See Also

linearextrapolation
rhDNase  rhDNase Data Set

Description

This is a dataset reported by Fuchs et al. (1994) for a double-blind randomized multicenter clinical trial designed to evaluate the effect of rhDNase, a recombinant deoxyribonuclease I enzyme, versus placebo on the occurrence of respiratory exacerbations among patients with cystic fibrosis. Data on the occurrence and resolution of all exacerbations were recorded for 645 patients in this trial. For more details about the dataset feature, see Cook and Lawless (2007). Here we only include the first record of the patients that have etype=1.

Usage

data(rhDNase)

Format

A data frame with 641 observations on the following 11 variables.

id  patient identifier
trt  the treatment assignment, trt=1 if patient receive rhDNase and 0 if patient receive placebo
fev  baseline measurement of forced expiratory volume
fev2 baseline measurement of forced expiratory volume
time1 the start of a period indicating when subjects become "at risk" for a transition
time2 if etype=1 then time2 corresponds the onset of an exacerbation (or censoring) and if etype=2 then time2 corresponds to the time of a resolution of an exacerbation (or censoring)
status status equals 1 if time2 is a transition time and equals 0 if it is a censoring time
etype  the indicator of the nature of the event time recorded in time2
enum  the cumulative number of lines in the data frame for each individual
enum1  the cumulative number of exacerbation-free periods
enum2  a numeric vector

Source


See Also

simexaft
simexaft

**SIMEX Algorithm for Accelerated Failure Time Model with Covariates Subject to Measurement Error**

**Description**

Implementation of the SIMEX algorithm for Accelerated Failure Time model with covariates subject to measurement error.

**Usage**

```r
simexaft(formula = formula(data), data = parent.frame(),
           SIMEXvariable, repeated = FALSE, repind = list(),
           err.mat = err.mat, B = 50, lambda = seq(0, 2, 0.1),
           extrapolation = "quadratic", dist = "weibull")
```

**Arguments**

- `formula` specifies the model to be fitted, with the variables coming with data. This argument has the same format as the formula argument in the existing R function "survreg".
- `data` optional data frame in which to interpret the variables occurring in the formula.
- `SIMEXvariable` the index of the covariate variables that are subject to measurement error.
- `repeated` set to TRUE or FALSE to indicate if there are repeated measurements for the mis-measured variables.
- `repind` the index of the repeated measurement variables for each mis-measured variable. It has an R list form. If repeated = TRUE, repind must be specify.
- `err.mat` specifies the variables with measurement error, If repeated = FALSE, err.mat must be specify.
- `B` the number of simulated samples for the simulation step. The default is set to be 50.
- `lambda` the vector of lambdas, the grids for the extrapolation step.
- `extrapolation` specifies the function form for the extrapolation step. The options are linear, quadratic and both. The default is set to be quadratic.(first 4 letters are enough)
- `dist` specifies a parametric distribution that is assumed in AFT model. This argument is the same as the dist option in the existing R function "survreg". These include "weibull", "exponential", "gaussian", "logistic", "lognormal", and "loglogistic".

**Details**

If the SIMEXvariable is repeated measured then you only need to use arguments repeated and repind without mention err.mat. The summary.simex will contain repind.
Value

- **coefficient**: the corrected coefficients of the AFT model
- **se**: the standard deviation of each coefficient
- **pvalue**: the p-value for the hypothesis of that coefficient equal zero
- **scalreg**: the estimate of the scale
- **theta**: the estimates for every B and lambda
- **lambda**: the vector of lambdas for which the simulation step should be done
- **B**: the number of simulated samples for the simulation step.
- **formula**: the model to be fitted in the survreg function
- **err.mat**: the covariance matrix of the variables with measurement error
- **repind**: the list contains the names of the repeat measurement variables
- **extrapolation**: the extrapolation method: linear, quadratic are implemented (first 4 letters are enough)
- **SIMEXvariable**: the vector contains the names of the variables with measurement error

Author(s)

Juan Xiong, Wenqing He and Grace Y. Yi

References


See Also

`survreg`, `plotsimexaft`

Examples

```r
library("simexaft")
library("survival")
data("BHS")

dataset <- BHS

dataset$SBP <- log(dataset$SBP - 50)

###Naive AFT approach

formula <- Surv(SURVTIME,DTHCENS) ~ SBP + CHOL + AGE + BMI + SMOKE1 + SMOKE2
```
out1 <- survreg(formula = formula, data = dataset, dist = "weibull")
summary(out1)

### fit a AFT model with quadratic extrapolation
set.seed(120)
ind <- c("SBP", "CHOL")
err.mat <- diag(rep(0.5625, 2))
out2 <- simexaft(formula = formula, data = dataset, SIMEXvariable = ind,
repeated = FALSE, repind = list(), err.mat = err.mat, B = 50,
lambda = seq(0, 2, 0.1), extrapolation = "quadratic", dist = "weibull")
summary(out2)

############################### repeated measurements ################################
data("rhDNase")

### true model
rhDNase$fev.ave <- (rhDNase$fev + rhDNase$fev2)/2
output1 <- survreg(Surv(time2, status) ~ trt + fev.ave, data = rhDNase,
dist = "weibull")
summary(output1)

### sensitive analysis####
set.seed(120)
fev.error <- rhDNase$fev + rnorm(length(rhDNase$fev), mean = 0,
sd = 0.15 * sd(rhDNase$fev))
fev.error2 <- rhDNase$fev2 + rnorm(length(rhDNase$fev2),mean = 0,
sd = 0.15 * sd(rhDNase$fev2))
dataset2 <- cbind(rhDNase[, c("time2", "status", "trt")], fev.error, fev.error2)
formula <- Surv(time2, status) ~ trt + fev.error
ind <- "fev.error"

########naive model using the average FEV value

naive_model <- survreg(formula, data = dataset, dist = "weibull")
summary(naive_model)
fev.error.c <- (fev.error + fev.error2)/2

output2 <- survreg(Surv(time2, status) ~ trt + fev.error.c, data = rhDNase, 
     dist = "weibull")

summary(output2)

##### use simexaft and apply the quadratic extrapolation#####
formula <- Surv(time2, status) ~ trt + fev.error

output3 <- simexaft(formula = formula, data = dataset2, SIMEXvariable = ind, 
     repeated=TRUE, repind=list(c("fev.error", "fev.error2")), err.mat=NULL, 
     B=50, lambda=seq(0.2, 0.1), extrapolation="quadratic", dist="weibull")

summary(output3)

summary.simexaft

Summarizing Model fits for the AFT model by SIMEX method

Description
Summary method for the class SIMEXAFF.

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

Arguments
object object of class SIMEXAFF.
...

Value
coefficients a p x 3 matrix with columns for the estimated coefficient its standard error, 
     corresponding(two-sided) p-value
scalereg estimate of the scale
extrapolation the extrapolation method
SIMEXvariable character vector of the SIMEXvariable

Author(s)
Juan Xiong, Wenqing He and Grace Y. Yi
References


See Also

simexaft
Index

* datasets
  BHS, 2
  rhDNase, 8
* package
  simexaft-package, 2

BHS, 2
linearextrapolation, 4, 7
plotsimexaft, 5, 10
print.simexaft, 6
quadraticextrapolation, 4, 7
rhDNase, 8
simexaft, 3, 8, 9, 13
simexaft-package, 2
summary.simexaft, 12
survreg, 5, 10