

Package ‘intercure’

January 12, 2016

Type Package

Title Cure Rate Estimators for Interval Censored Data

Version 0.1.0

Date 2016-01-02

URL <https://github.com/JBrettas/intercure>

BugReports <https://github.com/JBrettas/intercure/issues>

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Description Implementations of semiparametric cure rate estimators for interval censored data in R. The algorithms are based on the promotion time and frailty models, all for interval censoring. For the frailty model, there is also a implementation contemplating clustered data.

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LazyData TRUE

Imports foreach, survival, MASS, stats4, Matrix, iterators, parallel

Suggests testthat, knitr, rmarkdown, doParallel

Depends R (>= 2.10)

RoxygenNote 5.0.1

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

Date/Publication 2016-01-12 08:12:06

R topics documented:

intercure	2
inter_bch	2
inter_frailty	3
inter_frailty_cl	5

sim_bch	6
sim_frailty	7
sim_frailty_cl	8

Index	9
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intercure	<i>intercure: Cure rate regression models for interval censored data.</i>
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Description

The intercure package provides two main functions: `inter_bch` and `inter_frailty`. These are essentially algorithms for estimating the cure fraction with promotion time and frailty model, respectively. The `inter_frailty_cl` function provides support for analysing clustered datasets using the frailty model. For generating datasets based on these two models, the package provides the `sim_bch`, `sim_frailty` and `sim_frailty_cl` functions, the last providing clustered datasets.

intercure functions

`inter_bch`, `inter_frailty`, `inter_frailty_cl`, `sim_bch`, `sim_frailty`, `sim_frailty_cl`

inter_bch	<i>Fits promotion time cure rate model for interval censored data</i>
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Description

`inter_bch` returns a list with the estimated parameters `par` and their asymptotic covariance matrix `mcov`. The list also contains a dummy variable `stop_c` assuming 0 if algorithm converged and 1 if a stop criteria ended the process.

Usage

```
inter_bch(dataset, left, right, cov, sigma = 10, crit_theta = 0.001,
          crit_p = 0.005, max_n = 100, output_files = FALSE)
```

Arguments

<code>dataset</code>	Dataset used to fit the model.
<code>left</code>	Vector containing the last check times before event.
<code>right</code>	Vector containing the first check times after event.
<code>cov</code>	String vector containing the column names to be used on the cure rate predictor.
<code>sigma</code>	Parameter for the primal-dual interior-point algorithm used on the maximization process. Default value set to 10.
<code>crit_theta</code>	The effects minimum error for convergence purposes.
<code>crit_p</code>	Minimum error of the non-parametric cumulative distribution function.
<code>max_n</code>	Maximum number of iterations of the ECM algorithm.
<code>output_files</code>	Boolean indicating if text outputs for the estimates and variances should be generated.

Value

The `inter_bch` function returns an list containing the following outputs:

<code>par</code>	estimates of theta parameters.
<code>mcov</code>	estimates for the asymptotic covariance matrix of theta parameters.
<code>stop_c</code>	stop criteria indicator assuming 1 when process is stopped for a non-convergence criteria. Assumes 0 when convergence is reached.

Examples

```
set.seed(3)
sample_set <- sim_bch(80)

## few iterations just to check how to use the function

inter_bch(sample_set, sample_set$L,
sample_set$R, c("xi1", "xi2"), max_n = 5)

## precise estimate (computationally intensive)
## Not run:

inter_bch(sample_set, sample_set$L, sample_set$R, c("xi1", "xi2"))

## End(Not run)
```

<code>inter_frailty</code>	<i>Fits cure rate frailty model for interval censored data</i>
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Description

`inter_frailty` returns a list with the estimated parameters `par` and their asymptotic covariance matrix `mcov`. The list also contains a dummy variable `stop_c` assuming 0 if algorithm converged and 1 if a stop criteria ended the process.

Usage

```
inter_frailty(dataset, left, right, delta, cov_theta, cov_beta, M, b = 0.001,
  tol = 0.001, max_n = 100, par_cl = NULL, burn_in = 30,
  output_files = FALSE)
```

Arguments

<code>dataset</code>	Dataset used to fit the model.
<code>left</code>	Vector containing the last check times before event.
<code>right</code>	Vector containing the first check times after event.
<code>delta</code>	Flag vector indicating failure inside interval.

cov_theta	String vector containing the column names to be used on the cure rate predictor.
cov_beta	String vector containing the column names to be used on the predictor associated with the hazard function.
M	Number of replicates generated by each iteration on the ANDA (Asymptotic Normal Data Augmentation) algorithm.
b	Parameter for initial theta and beta variances.
tol	Numeric for tolerance of convergence.
max_n	Maximum number of algorithm's iterations without the burn in.
par_cl	Registered SOCK cluster for parallel process. If NULL (default) the program loops are executed sequentially.
burn_in	Number of burn in iterations.
output_files	Boolean indicating if text outputs for the estimates and variances should be generated.

Value

The `inter_frailty` function returns an list containing the following outputs:

par	estimates of theta and beta parameters.
mcov	estimates for the covariance matrix of theta and beta parameters.
stop_c	stop criteria indicator assuming 1 when process is stopped for a non-convergence criteria. Assumes 0 when convergence is reached.

Examples

```
## few iterations just to check how to use the function
set.seed(3)
sample_set <- sim_frailty(80)

inter_frailty(sample_set, sample_set$L, sample_set$R, sample_set$delta,
c("xi1", "xi2"), c("xi1", "xi2"), M = 10, max_n = 3, burn_in = 0)

## precise estimate (computationally intensive)
## Not run:

inter_frailty(sample_set, sample_set$L, sample_set$R, sample_set$delta,
c("xi1"), c("xi2"), M = 50, max_n = 50, burn_in = 10)

## End(Not run)
```

inter_frailty_cl *Cure rate frailty model for interval censored clustered data*

Description

inter_frailty_cl returns a list with the estimated parameters par and their covariance matrix mcov. The list also contains a dummy variable stop_c assuming 0 if algorithm converged and 1 if a stop criteria ended the process.

Usage

```
inter_frailty_cl(dataset, left, right, delta, cov_theta, cov_beta, grp, M,
  b = 0.001, tol = 0.001, max_n = 100, par_cl = NULL, burn_in = 50,
  output_files = FALSE)
```

Arguments

dataset	Dataset used to fit the model.
left	Vector containing the last check times before event.
right	Vector containing the first check times after event.
delta	Flag vector indicating failure inside interval.
cov_theta	String vector containing the column names to be used on the cure rate predictor.
cov_beta	String vector containing the column names to be used on the predictor associated with the hazard function.
grp	Vector containing cluster identifier (numeric or string).
M	Number of replicates generated by each iteration on the ANDA (Asymptotic Normal Data Augmentation) algorithm.
b	Parameter for initial theta and beta variances.
tol	Numeric for tolerance of convergence.
max_n	Maximum number of algorithm's iterations without the burn in.
par_cl	Registered SOCK cluster for parallel process. If NULL (default) the program loops are executed sequentially.
burn_in	Number of burn in iterations.
output_files	Boolean indicating if text outputs for the estimates and variances should be generated.

Value

The inter_frailty_cl function returns an list containing the following outputs:

par	estimates of theta and beta parameters.
mcov	estimates for the covariance matrix of theta and beta parameters.
stop_c	stop criteria indicator assuming 1 when process is stopped for a non-convergence criteria. Assumes 0 when convergence is reached.

Examples

```

set.seed(3)
sample_set <- sim_frailty_cl(80, nclus = 3)

## few iterations just to check how to use the function

inter_frailty_cl(sample_set, sample_set$L, sample_set$R, sample_set$delta,
c("xi1"), c("xi1"), grp = sample_set$clus, M = 20,
max_n = 2, burn_in = 0)

## precise estimate (computationally intensive)
## Not run:

inter_frailty_cl(sample_set, sample_set$L, sample_set$R, sample_set$delta,
c("xi1", "xi2"), c("xi1", "xi2"), grp = sample_set$clus, M = 20,
max_n = 30, burn_in = 10)

## End(Not run)

```

sim_bch	<i>Generates a interval censored dataset using promotion time cure rate model</i>
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Description

sim_frailty_data returns a dataset generated by the cure rate frailty model.

Usage

```

sim_bch(N, theta = c(1, 0.5, 0), lambda = 1, A = 5, B = 15,
prob = 0.5)

```

Arguments

N	Size of the sample to be generated.
theta	Three parameters associated with the cure linear predictor.
lambda	Rate parameter for the exponential distributed latent variables.
A	A positive number representing a fixed right censoring.
B	A positive number which multiplies an uniform random variable, defining another right censoring case.
prob	Probability that individual presents treatment T1 (baseline is T0).

Value

A generated dataset with columns: Z, the actual event time; L, the leftmost limit of the censored interval; R, the rightmost limit of the censored interval; delta, the failure indicator; xi1, the treatment covariate assuming 1 with probability prob and 0 otherwise; xi2, second variable generated by a standard normal distribution.

Examples

```
sim_bch(20)
```

```
sim_frailty
```

Generates a interval censored dataset using frailty cure rate model

Description

sim_frailty returns a dataset generated by the cure rate frailty model.

Usage

```
sim_frailty(N, theta = c(-1, 1, 0), beta = c(0, 0.5), A = 5, B = 15,  
  prob = 0.5)
```

Arguments

N	Size of the sample to be generated.
theta	Three parameters associated with the cure linear predictor.
beta	Two parameters associated with the hazard function.
A	A positive number representing a fixed right censoring.
B	A positive number which multiplies an uniform random variable, defining another right censoring case.
prob	Probability that individual presents treatment T1 (baseline is T0).

Value

A generated dataset with columns: Z, the actual event time; L, the leftmost limit of the censored interval; R, the rightmost limit of the censored interval; delta, the failure indicator; xi1, the treatment covariate assuming 1 with probability prob and 0 otherwise; xi2, second variable generated by a standard normal distribution.

Examples

```
sim_frailty(20)
```

sim_frailty_cl	<i>Generates a interval censored clustered dataset using frailty cure rate model</i>
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Description

sim_frailty returns a dataset generated by the cure rate frailty model.

Usage

```
sim_frailty_cl(N, theta = c(-1, 1, 0), beta = c(0, 0.5), A = 5, B = 15,
  prob = 0.5, nclus = 2, w = exp(-0.5))
```

Arguments

N	Size of the sample to be generated.
theta	Three parameters associated with the cure linear predictor.
beta	Two parameters associated with the hazard function.
A	A positive number representing a fixed right censoring.
B	A positive number which multiplies an uniform random variable, defining another right censoring case.
prob	Probability that individual presents treatment T1 (baseline is T0).
nclus	Number of clusters to generate with balanced sizes.
w	Shape and rate parameters value for the Gamma distribution with mean 1.

Value

A generated dataset with columns: Z, the actual event time; L, the leftmost limit of the censored interval; R, the rightmost limit of the censored interval; delta, the failure indicator; xi1, the treatment covariate assuming 1 with probability prob and 0 otherwise; xi2, second variable generated by a standard normal distribution; clus, representing the cluster id for each observation.

Examples

```
sim_frailty_cl(50)
```


Index

inter_bch, 2
inter_frailty, 3
inter_frailty_cl, 5
intercure, 2
intercure-package (intercure), 2

sim_bch, 6
sim_frailty, 7
sim_frailty_cl, 8