Package 'HazReg'

December 19, 2025

Type Package

Title Parametric hazard-based regression models

Version 0.1.0

Author F. Javier Rubio

Maintainer F. Javier Rubio <fxrubio@gmail.com>

Description The HazReg R package implements the following parametric hazard-based regression models for survival data, in the overall and relative survival frameworks.

License What license is it under?

Encoding UTF-8

LazyData true

RoxygenNote 7.3.3

Imports numDeriv, matrixStats

Contents

`chew` *Power Exponentiated Weibull (EW) cumulative hazard function. https://rpubs.com/FJRubio/EWD*

Description

Power Exponentiated Weibull (EW) cumulative hazard function. https://rpubs.com/FJRubio/EWD

Usage

```
chew(t, sigma, nu, gamma)
```

Arguments

`t`	: positive argument
`sigma`	: scale parameter
`nu`	: shape parameter
`gamma`	: shape parameter

Value

the value of the EW cumulative hazard function

chgamma *Gamma (G) cumulative hazard function.*

Description

Gamma (G) cumulative hazard function.

Usage

```
chgamma(t, shape, scale)
```

Arguments

t	: positive argument
shape	: shape parameter
scale	: scale parameter
log:	log scale (TRUE or FALSE)

Value

the value of the Weibull hazard function

chggamma *Generalised Gamma (GG) cumulative hazard function. https://rpubs.com/FJRubio/GG*

Description

Generalised Gamma (GG) cumulative hazard function. https://rpubs.com/FJRubio/GG

Usage

```
chggamma(t, sigma, nu, gamma)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter

Value

the value of the GG cumulative hazard function

chllogis *Log-logistic (LL) cumulative hazard function.*

Description

Log-logistic (LL) cumulative hazard function.

Usage

```
chllogis(t, mu, sigma)
```

Arguments

t	: positive argument
mu	: mean parameter in the log scale
sigma	: scale parameter in the log scale

Value

the value of the LL cumulative hazard function

chlnorm *Lognormal (LN) cumulative hazard function.*

Description

Lognormal (LN) cumulative hazard function.

Usage

```
chlnorm(t, mu, sigma)
```

Arguments

t	: positive argument
mu	: mean parameter in the log scale
sigma	: scale parameter in the log scale

Value

the value of the LN cumulative hazard function

chpgw *Power Generalised Weibull (PGW) cumulative hazard function. http://rpubs.com/FJRubio/PGW*

Description

Power Generalised Weibull (PGW) cumulative hazard function. http://rpubs.com/FJRubio/PGW

Usage

```
chpgw(t, sigma, nu, gamma)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter

Value

the value of the PGW cumulative hazard function

chweibull *Weibull (W) cumulative hazard function.*

Description

Weibull (W) cumulative hazard function.

Usage

```
chweibull(t, sigma, nu)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter

Value

the value of the Weibull cumulative hazard function

CH_TVC *Compute the Cumulative Hazard for a Proportional Hazards or Accelerated Failure Model (2- and 3-parameter baseline)*

Description

Computes the cumulative hazard $H(t \mid x(t))$ at multiple time points for each individual under a proportional hazards (PH) model or Accelerated Failure Time (AFT) model with a two-parameter or three-parameter parametric baseline hazard.

Usage

```
CH_TVC(df, beta, theta, chfun, hstr)
```

Arguments

df	A data frame containing: • 'time': numeric vector of time points. • Covariate columns named with prefix '"des"' (e.g., 'des1', 'des2', ...), representing $x(t)$.
beta	Numeric vector of regression coefficients.
theta	Numeric baseline parameters of the cumulative hazard.
chfun	A function computing the baseline cumulative hazard: 'chfun(time, theta[1], theta[2])' or 'chfun(time, theta[1], theta[2], theta[3])'.
hstr	Hazard structure ("PH" or "AFT")

Details

The PH model assumes

$$H(t \mid x(t)) = H_0(t; a_0, b_0, c_0) \exp(x(t)^\top \beta).$$

In the AFT model, event time is rescaled as

$$H(t \mid x(t)) = H_0(t \exp(x(t)^\top \beta); a_0, b_0, c_0).$$

Value

A numeric vector with the cumulative hazard evaluated at each time point in 'df'.

`Conf_Int` *Function to calculate the normal confidence intervals. The parameters indicated with "index" are transformed to the real line using log().*

Description

Function to calculate the normal confidence intervals. The parameters indicated with "index" are transformed to the real line using log().

Usage

```
Conf_Int(FUN, MLE, level = 0.95, index = NULL)
```

Arguments

`FUN`	: minus log-likelihood function to be used to calculate the confidence intervals
`MLE`	: maximum likelihood estimator of the parameters of interest
`level`	: confidence level
`index`	: position of the positive parameters under the original parameterisation

Value

a list containing the upper and lower conf.int limits, the transformed MLE, and std errors

`dggamma` *Generalised Gamma (GG) probability density function. https://rpubs.com/FJRubio/GG*

Description

Generalised Gamma (GG) probability density function. https://rpubs.com/FJRubio/GG

Usage

```
dggamma(t, sigma, nu, gamma, log = FALSE)
```

Arguments

`t`	: positive argument
`sigma`	: scale parameter
`nu`	: shape parameter
`gamma`	: shape parameter
`log:`	log scale (TRUE or FALSE)

Value

the value of the GG probability density function

dpgw *Power Generalised Weibull (PGW) probability density function. http://rpubs.com/FJRubio/PGW*

Description

Power Generalised Weibull (PGW) probability density function. http://rpubs.com/FJRubio/PGW

Usage

```
dpgw(t, sigma, nu, gamma, log = FALSE)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter
log:	log scale (TRUE or FALSE)

Value

the value of the PGW probability density function

GEHMLE *Relative (Net) Survival models Log likelihood and MLE for the GH excess hazards model. Baseline hazards: Lognormal, Log-logistic, Gamma, PGW, EW, GG*

Description

Relative (Net) Survival models Log likelihood and MLE for the GH excess hazards model. Baseline hazards: Lognormal, Log-logistic, Gamma, PGW, EW, GG

Usage

```
GEHMLE(
  init,
  times,
  status,
  hp,
  hstr = NULL,
  dist = NULL,
  des = NULL,
  des_t = NULL,
  method = "Nelder-Mead",
  maxit = 100
)
```

Arguments

init	: initial point for optimisation step under the parameterisation (log(scale), log(shape1), log(shape2), alpha, beta) for scale-shape1-shape2 models or (mu, log(scale), alpha, beta) for log-location scale models.
times	: times to event
status	: vital status indicators (TRUE or 1 = observed, FALSE or 0 = censored)
hp	: population hazard (for all individuals)
hstr	: hazard structure: No covariates ("baseline"), AFT model with PGW baseline hazard ("AFT"), PH model with PGW baseline hazard ("PH"), AH model with PGW baseline hazard ("AH"), GH model with PGW baseline hazard ("GH") *GH is not available with Weibull dist
dist	: distribution for the baseline hazard: Power Generalised Weibull ("PGW") Generalised Gamma ("GenGamma")) Exponentiated Weibull ("EW") Weibull ("Weibull") Gamma ("Gamma") LogNormal ("LogNormal") LogLogistic ("LogLogistic")
des	: design matrix for hazard-level effects
des_t	: design matrix for time-level effects (it is recommended not to use splines here)
method	: "nlminb" or optimisation method to be used in optim (see ?optim)
maxit	: maximum number of iterations in optim or nlminb

Value

It returns the output from optim or nlminb for the selected model and the negative log likelihood function

---

GHMLE *GHMLE function: Hazard Regression Models with a parametric baseline hazard*

Description

GHMLE function: Hazard Regression Models with a parametric baseline hazard

Usage

```
GHMLE(
  init,
  times,
  status,
  hstr = NULL,
  dist = NULL,
  des = NULL,
  des_t = NULL,
  method = "Nelder-Mead",
  maxit = 100
)
```

Arguments

init	: initial point for optimisation step under the parameterisation (log(scale), log(shape1), log(shape2), alpha, beta) for scale-shape1-shape2 models or (mu, log(scale), alpha, beta) for log-location scale models.
times	: times to event
status	: vital status indicators (TRUE or 1 = observed, FALSE or 0 = censored)
hstr	: hazard structure: No covariates ("baseline"), AFT model with PGW baseline hazard ("AFT"), PH model with PGW baseline hazard ("PH"), AH model with PGW baseline hazard ("AH"), GH model with PGW baseline hazard ("GH") *GH is not available with Weibull dist
dist	: distribution for the baseline hazard: Power Generalised Weibull ("PGW") Generalised Gamma ("GenGamma")) Exponentiated Weibull ("EW") Weibull ("Weibull") Gamma ("Gamma") LogNormal ("LogNormal") LogLogistic ("LogLogistic")
des	: design matrix for hazard-level effects
des_t	: design matrix for time-level effects (it is recommended not to use splines here)
method	: "nlminb" or optimisation method to be used in optim (see ?optim)
maxit	: maximum number of iterations in optim or nlminb

Value

It returns the output from optim or nlminb for the selected model and the negative log likelihood function

---

hew *Power Exponentiated Weibull (EW) hazard function. https://rpubs.com/FJRubio/EWD*

Description

Power Exponentiated Weibull (EW) hazard function. https://rpubs.com/FJRubio/EWD

Usage

```
hew(t, sigma, nu, gamma, log = FALSE)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter
log:	log scale (TRUE or FALSE)

Value

the value of the EW hazard function

hgamma — *Gamma (G) hazard function.*

Description

Gamma (G) hazard function.

Usage

```
hgamma(t, shape, scale, log = FALSE)
```

Arguments

t	: positive argument
shape	: shape parameter
scale	: scale parameter
log:	log scale (TRUE or FALSE)

Value

the value of the Gamma hazard function

hggamma — *Generalised Gamma (GG) hazard function. https://rpubs.com/FJRubio/GG*

Description

Generalised Gamma (GG) hazard function. https://rpubs.com/FJRubio/GG

Usage

```
hggamma(t, sigma, nu, gamma, log = FALSE)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter
log:	log scale (TRUE or FALSE)

Value

the value of the GG hazard function

hllogis *Log-logistic (LL) hazard function.*

Description

Log-logistic (LL) hazard function.

Usage

```
hllogis(t, mu, sigma, log = FALSE)
```

Arguments

t	: positive argument
mu	: mean parameter in the log scale
sigma	: scale parameter in the log scale
log:	log scale (TRUE or FALSE)

Value

the value of the LL hazard function

hlnorm *Lognormal (LN) hazard function.*

Description

Lognormal (LN) hazard function.

Usage

```
hlnorm(t, mu, sigma, log = FALSE)
```

Arguments

t	: positive argument
mu	: mean parameter in the log scale
sigma	: scale parameter in the log scale
log:	log scale (TRUE or FALSE)

Value

the value of the LN hazard function

HMLE_TVC *Maximum Likelihood Estimation for Parametric Hazard Models with Time-Varying Covariates*

Description

'HMLE_TVC()' fits parametric survival models in the presence of **time-varying covariates**, using maximum likelihood estimation.

The function supports:

* **Proportional Hazards (PH)** models with time-varying covariates * Fully parametric baseline hazards (2-parameter or 3-parameter)

* **Accelerated Failure Time (AFT)** models with time-varying covariates * Fully parametric baseline hazards (2-parameter or 3-parameter)

The likelihood is constructed from the cumulative hazard differences across observation intervals for each individual, using a counting-process representation.

For each individual, the data must contain several rows: one per time-varying covariate measurement, along with the corresponding time.

Usage

```
HMLE_TVC(
  init,
  df,
  status,
  hstr = NULL,
  dist = NULL,
  method = "Nelder-Mead",
  maxit = 100
)
```

Arguments

init	: initial point for optimisation step under the parameterisation (log(scale), log(shape1), log(shape2), beta) for scale-shape1-shape2 models or (mu, log(scale), beta) for log-location scale models.
df	A data frame in **long format**, containing one row per individual per covariate-measurement time. Required columns: * 'ID' — individual identifier * 'time' — time at which the covariates are measured * 'des*' — covariate columns used in the model (e.g., 'des1', 'des2', ...) The last row for each ID represents the individual's event/censoring time, even if the event time does not coincide with a measurement time.
status	vector of event indicators (1 = event at the final time; 0 = censored)
hstr	Hazard structure ("PH" or "AFT")
dist	: distribution for the baseline hazard: Power Generalised Weibull ("PGW") Generalised Gamma ("GenGamma")) Exponentiated Weibull ("EW") Weibull ("Weibull") Gamma ("Gamma") LogNormal ("LogNormal") LogLogistic ("LogLogistic")

method	Optimisation method for the likelihood. Either ‘"nlminb"‘ or a valid ‘optim()‘ method.
maxit	Maximum number of optimisation iterations.

Details

Likelihood formulation for PH models

For each individual \(i\), let \(t_i1 < t_i2 < \cdots < t_iK_i\) denote the *observation / measurement times*.

The cumulative hazard contribution over interval \((t_ij-1, t_ij)\) is:

$$\Delta H_{ij} = [H_0(t_{ij}) - H_0(t_{ij-1})] \exp(x_{ij}^\top \beta),$$

where \(x_ij\) is the vector of covariates measured at time \(t_ij\).

The full log-likelihood is:

$$\ell = \sum_i \left(- \sum_j \Delta H_{ij} + \delta_i \log \left[h_0(T_i) \exp(x_{iK}^\top \beta) \right] \right),$$

where:

* \(\Delta H_ij\) comes from cumulative hazard increments * \(T_i = t_iK\) is the final event or censoring time * \(\delta_i\) is the event indicator * hazard and cumulative hazard are computed based on ‘dist‘

The function internally: 1. Splits the data by ID 2. Computes cumulative hazard at all measurement times 3. Computes increments \(\Delta H_ij\) for each ID 4. Constructs the likelihood 5. Optimises over \(\beta\) and baseline parameters

Value

A list containing:

* The full output from ‘optim()‘ or ‘nlminb()‘ * The **negative log-likelihood function** used for optimisation * A vector giving, for each ID, the cumulative hazard increments used in the likelihood

Returned invisibly where appropriate.

Data structure

The input data frame must contain:

* varying number of rows per ID * strictly increasing ‘time‘ within each ID * last row containing the event/censoring time

Covariates must be named as ‘des1‘, ‘des2‘, etc.

hpgw — *Power Generalised Weibull (PGW) hazard function. http://rpubs.com/FJRubio/PGW*

Description

Power Generalised Weibull (PGW) hazard function. http://rpubs.com/FJRubio/PGW

Usage

```
hpgw(t, sigma, nu, gamma, log = FALSE)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter
log:	log scale (TRUE or FALSE)

Value

the value of the PGW hazard function

hweibull — *Weibull (W) hazard function.*

Description

Weibull (W) hazard function.

Usage

```
hweibull(t, sigma, nu, log = FALSE)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter
log:	log scale (TRUE or FALSE)

Value

the value of the Weibull hazard function

pggamma *Generalised Gamma (GG) cumulative distribution function. https://rpubs.com/FJRubio/GG*

Description

Generalised Gamma (GG) cumulative distribution function. https://rpubs.com/FJRubio/GG

Usage

```
pggamma(t, sigma, nu, gamma, log.p = FALSE)
```

Arguments

t	: positive argument
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter
log.p:	log scale (TRUE or FALSE)

Value

the value of the GG cumulative distribution function

qew *Power Exponentiated Weibull (EW) quantile function. https://rpubs.com/FJRubio/EWD*

Description

Power Exponentiated Weibull (EW) quantile function. https://rpubs.com/FJRubio/EWD

Usage

```
qew(p, sigma, nu, gamma)
```

Arguments

p	: probability. A value in (0,1)
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter

Value

the value of the EW quantile function

qggamma *Generalised Gamma (GG) quantile function. https://rpubs.com/FJRubio/GG*

Description

Generalised Gamma (GG) quantile function. https://rpubs.com/FJRubio/GG

Usage

```
qggamma(p, sigma, nu, gamma)
```

Arguments

p	: probability. A value in (0,1)
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter

Value

the value of the GG quantile function

qllogis *Log-logistic (LL) quantile function.*

Description

Log-logistic (LL) quantile function.

Usage

```
qllogis(p, mu, sigma)
```

Arguments

p	: probability. A value in (0,1)
mu	: mean parameter in the log scale
sigma	: scale parameter in the log scale

Value

the value of the LL quantile function

qpgw *Power Generalised Weibull (PGW) quantile function. http://rpubs.com/FJRubio/PGW*

Description

Power Generalised Weibull (PGW) quantile function. http://rpubs.com/FJRubio/PGW

Usage

```
qpgw(p, sigma, nu, gamma)
```

Arguments

p	: probability. A value in (0,1)
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter

Value

the value of the PGW quantile function

rggamma *Generalised Gamma (GG) random number generation. https://rpubs.com/FJRubio/GG*

Description

Generalised Gamma (GG) random number generation. https://rpubs.com/FJRubio/GG

Usage

```
rggamma(n, sigma, nu, gamma)
```

Arguments

n	: number of observations
sigma	: scale parameter
nu	: shape parameter
gamma	: shape parameter

Value

generates random deviates

`rpgw` *Power Generalised Weibull (PGW) random number generation. http://rpubs.com/FJRubio/PGW*

Description

Power Generalised Weibull (PGW) random number generation. http://rpubs.com/FJRubio/PGW

Usage

```
rpgw(n, sigma, nu, gamma)
```

Arguments

`n`	: number of observations
`sigma`	: scale parameter
`nu`	: shape parameter
`gamma`	: shape parameter

Value

generates random deviates

`sggamma` *Generalised Gamma (GG) survival function. https://rpubs.com/FJRubio/GG*

Description

Generalised Gamma (GG) survival function. https://rpubs.com/FJRubio/GG

Usage

```
sggamma(t, sigma, nu, gamma, log.p = FALSE)
```

Arguments

`t`	: positive argument
`sigma`	: scale parameter
`nu`	: shape parameter
`gamma`	: shape parameter
`log.p:`	log scale (TRUE or FALSE)

Value

the value of the GG survival function

simGH *simGH function: Function to simulate times to event from a model with a GH structure for different parametric baseline hazards. Distributions: LogNormal, LogLogistic, GenGamma, Gamma, Weibull, PGW, EW. See: https://github.com/FJRubio67/HazReg*

Description

simGH function: Function to simulate times to event from a model with a GH structure for different parametric baseline hazards. Distributions: LogNormal, LogLogistic, GenGamma, Gamma, Weibull, PGW, EW. See: https://github.com/FJRubio67/HazReg

Usage

```
simGH(
  seed,
  n,
  des = NULL,
  des_h = NULL,
  des_t = NULL,
  theta,
  beta_h = NULL,
  beta_t = NULL,
  beta = NULL,
  hstr,
  baseline
)
```

Arguments

seed	: seed for simulation
n	: sample size (number of individuals)
des	: Design matrix for AFT, PH, and AH models
des_h	: Design matrix for GH model (hazard scale)
des_t	: Design matrix for GH model (time scale)
theta	: parameters of the baseline hazard
beta_h	: regression parameters multiplying the hazard for GH model
beta_t	: regression parameters multiplying the time scale for GH model
beta	: regression parameters for AFT, PH, and AH models
hstr	: hazard structure (AH, AFT, PH, GH)
baseline	: baseline hazard distribution

Value

a vector containing the simulated times to event

sim_TVC *Simulate Event Times from a Time-Varying Covariates Survival Model*

Description

Simulates event times from a survival model with time-varying covariates using the probability integral transform. The function supports proportional hazards (PH) and accelerated failure time (AFT) models with parametric baseline hazards.

Usage

```
sim_TVC(seed, df, chfun, hstr, theta, beta)
```

Arguments

`seed`	Integer random seed for reproducibility.
`df`	A data frame containing the longitudinal covariate information with: • `ID`: individual identifier. • `time`: observation times for covariate measurements. • Covariate columns named with prefix `"des"` (e.g., `des1`, `des2`, ...). Covariates are assumed to be piecewise constant between observation times.
`chfun`	A function computing the baseline cumulative hazard, e.g. `chfun(time, ...)`.
`hstr`	Character string specifying the hazard structure. Either `"PH"` for proportional hazards or `"AFT"` for accelerated failure time models.
`theta`	Numeric vector of baseline hazard parameters. The length of `theta` determines whether a two- or three-parameter baseline is used.
`beta`	Numeric vector of regression coefficients corresponding to the time-varying covariates.

Details

For each individual i, a uniform random variable $U_i \sim \text{Unif}(0,1)$ is generated. If the survival probability at the last observed time $t_{\max,i}$ satisfies

$$S_i(t_{\max,i}) > U_i,$$

the individual is right-censored at $t_{\max,i}$. Otherwise, the event time T_i is obtained by solving

$$S_i(t) = U_i$$

for $t \in (0, t_{\max,i}]$, where $S_i(t)$ is the individual-specific survival function accounting for time-varying covariates.

The survival function is evaluated via `SPred_TVC` and `SPred_TVC_i`, ensuring consistency with the underlying cumulative hazard specification.

The simulation assumes that covariates are left-continuous and piecewise constant over time. Event times are generated conditional on the observed covariate history up to the last follow-up time for each individual.

This function is suitable for simulation studies involving time-varying covariates under parametric PH or AFT models.

Value

A list with components:

- `time`: numeric vector of simulated event or censoring times.
- `status`: event indicator (1 = event, 0 = right-censored).

See Also

`CH_TVC`, `SPred_TVC`, `SPred_TVC_i`

`spgw` *Power Generalised Weibull (PGW) survival function. http://rpubs.com/FJRubio/PGW*

Description

Power Generalised Weibull (PGW) survival function. http://rpubs.com/FJRubio/PGW

Usage

```
spgw(t, sigma, nu, gamma, log.p = FALSE)
```

Arguments

`t`	: positive argument
`sigma`	: scale parameter
`nu`	: shape parameter
`gamma`	: shape parameter
`log.p:`	log scale (TRUE or FALSE)

Value

the value of the PGW survival function

`SPred_TVC` *Compute the Survival Function for a Proportional Hazards or Accelerated Failure Model (2- and 3-parameter baseline)*

Description

Computes the survival function $exp(-H(t \mid x(t)))$ at the last time point for each individual under a proportional hazards (PH) model or Accelerated Failure Time (AFT) model with a two-parameter or three-parameter parametric baseline hazard.

Usage

```
SPred_TVC(df, beta, theta, chfun, hstr)
```

Arguments

df	A data frame containing: • 'time': numeric vector of time points. • Covariate columns named with prefix '"des"' (e.g., 'des1', 'des2', ...), representing $x(t)$.
beta	Numeric vector of regression coefficients.
theta	Numeric baseline parameters of the cumulative hazard.
chfun	A function computing the baseline cumulative hazard: 'chfun(time, theta[1], theta[2])' or 'chfun(time, theta[1], theta[2], theta[3])'.
hstr	Hazard structure ("PH" or "AFT")

Details

The PH model assumes

$$H(t \mid x(t)) = H_0(t; a_0, b_0, c_0) \exp(x(t)^\top \beta).$$

In the AFT model, event time is rescaled as

$$H(t \mid x(t)) = H_0(t \exp(x(t)^\top \beta); a_0, b_0, c_0).$$

Value

A numeric vector with the survival function evaluated at the last time point in 'df'.

SPred_TVC_i — *Compute the Individual Survival Function at an Arbitrary Time Point for a Proportional Hazards or Accelerated Failure Model (2- and 3-parameter baseline)*

Description

Computes the individual-specific survival function $S_i(t) = \exp\{-H_i(t \mid x_i(t))\}$ at a user-specified time point t for a given individual i, under a proportional hazards (PH) model or an accelerated failure time (AFT) model with time-varying covariates.

Usage

```
SPred_TVC_i(df, i, t, beta, theta, chfun, hstr)
```

Arguments

df	A data frame containing: • 'ID': individual identifier. • 'time': numeric vector of observation times. • Covariate columns named with prefix '"des"' (e.g., 'des1', 'des2', ...), representing the time-varying covariate process $x_i(t)$.
i	Integer specifying the individual for whom the survival function is to be evaluated.

t	Numeric value giving the time point at which the survival function is evaluated. Must lie within the observation window of individual ‘i‘.
beta	Numeric vector of regression coefficients.
theta	Numeric baseline parameters of the cumulative hazard.
chfun	A function computing the baseline cumulative hazard: ‘chfun(time, theta[1], theta[2])‘ or ‘chfun(time, theta[1], theta[2], theta[3])‘.
hstr	Character string specifying the hazard structure: ‘"PH"‘ for proportional hazards or ‘"AFT"‘ for accelerated failure time.

Details

The cumulative hazard for individual i is defined as:

$$H_i(t \mid x_i(t)) = \int_0^t h_0(u; a_0, b_0, c_0) \exp\{x_i(u)^\top \beta\}\, du$$

for the PH model, and

$$H_i(t \mid x_i(t)) = H_0\big(t \exp\{x_i(t)^\top \beta\}; a_0, b_0, c_0\big)$$

for the AFT model.

Time-varying covariates are assumed to be piecewise constant between the observation times provided in ‘df‘. If the evaluation time ‘t‘ does not coincide with an observed time point for individual ‘i‘, the covariate values are taken to be those at the most recent time strictly less than ‘t‘.

This function relies on ‘CH_TVC()‘ to compute the cumulative hazard over the observed time grid augmented with the evaluation time ‘t‘. The cumulative hazard is then extracted at time ‘t‘, and the survival function is obtained as $\exp\{-H_i(t)\}$.

The resulting survival function is continuous in time but may exhibit changes in slope at covariate change points, reflecting the piecewise-constant nature of the time-varying covariates.

Value

A numeric scalar giving the survival probability $S_i(t)$ for individual ‘i‘ at time ‘t‘.

See Also

CH_TVC, SPred_TVC

Index