Package ‘Rwtdttt’

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Type Package

Title Parametric Waiting Time Distribution estimation

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Description Estimation of prescription durations and treatment probability based on the parametric Waiting Time Distribution. Pharmacoepidemiologic databases contains information on medication dispensings at pharmacies. Studies using such data typically require some estimate of duration of treatment after a dispensing (known as the prescription duration), which can be estimated using the parametric Waiting Time Distribution.

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Roxygen list(markdown = TRUE)

Imports bbmle,
class,
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methods,
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stats,
numDeriv

Suggests testthat (>= 3.0.0)

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Encoding UTF-8

LazyData true

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Collate 'Rwtdttt-package.R'
'dfunctions.R'
'wtd-class.R'
'plot.R'
'pred_dur_prob.R'
'wtdttt.R'
'ranwtdttt.R'
'sandwich.R'

Contents

`dexp` *The Exponential distribution*

Description

The Exponential distribution

Usage

```
dexp(x, logitp, lnbeta, delta = 1, log = FALSE)
```

Arguments

`x`	vector of event times (must be between (0; delta))
`logitp`	log-odds of being a prevalent user
`lnbeta`	log of beta (scale)
`delta`	width of interval with positive support (x in (0; delta))
`log`	logical; if TRUE, probabilities p are given as log(p)

`dlnorm` *The Lognormal distribution*

Description

The Lognormal distribution

Usage

```
dlnorm(x, logitp, mu, lnsigma, delta = 1, log = FALSE)
```

Arguments

`x`	vector of event times (must be between (0; delta))
`logitp`	log-odds of being a prevalent user
`mu`	mean on log-scale
`lnsigma`	log of standard deviation on log-scale
`delta`	width of interval with positive support (x in (0; delta))
`log`	logical; if TRUE, density values are returned on log-scale.

`dweib` *The Weibull distribution*

Description

The Weibull distribution

Usage

```
dweib(x, logitp, lnalpha, lnbeta, delta = 1, log = FALSE)
```

Arguments

`x`	vector of event times (must be between (0; delta))
`logitp`	log-odds of being a prevalent user
`lnalpha`	log of alpha (shape)
`lnbeta`	log of beta (scale)
`delta`	width of interval with positive support (x in (0; delta))
`log`	logical; if TRUE, probabilities p are given as log(p)

`plot,wtd,ANY-method` *Make WTD diagnostic plots*

Description

Make diagnostic plots showing the fit of an estimated parametric Waiting Time Distribution (WTD) with respect to the observed histogram of prescription redemptions.

Usage

```
## S4 method for signature 'wtd,ANY'
plot(wtd, x = NULL, y = NULL, ...)
```

Arguments

`wtd`	wtd object, typically result of wtdttt
`x`	ignored
`y`	ignored
`...`	other graphical parameters (see `par`)

`predict,wtd-method` *Make WTD predictions*

Description

Make predictions based on an estimated parametric Waiting Time Distribution (WTD) model, either the probability of a person still being in treatment or the duration of observed prescription redemptions.

Usage

```
## S4 method for signature 'wtd'
predict(
  object,
  newdata = NULL,
  type = "dur",
  iadmean = F,
  distrx = NULL,
  quantile = 0.8,
  se.fit = FALSE,
  na.action = na.pass,
  ...
)
```

Arguments

`object`	a fitted object of class inheriting from "wtd"
`newdata`	An optional data frame in which to look for variables with which to predict. If omitted, the fitted values are used.
`type`	"dur" or "prob". Default "dur".
`distrx`	For type="prob", a vector of dispensing gaps.
`quantile`	For type="dur", quantile of distribution. Default 0.8
`se.fit`	A switch indicating if standard errors are required
`na.action`	function determining what should be done with missing values in `newdata`. The default is to predict `NA`
`...`	further arguments passed to or from other methods

Value

A vector of predictions

`ranwtdttt` *Fit Waiting Time Distribution with random index times*

Description

`ranwtdttt()` estimates maximum likelihood estimates for parametric Waiting Time Distribution (WTD) based on observed prescription redemptions with adjustment for covariates using one or more random index times for each individual. It reports estimates of prevalence fraction and specified percentile of inter-arrival density together with regression coefficients.

Usage

```
ranwtdttt(
  form,
  parameters = NULL,
  data,
  id,
  start,
  end,
  reverse = F,
  nsamp = 4,
  subset,
  na.action = na.pass,
  init,
  control = NULL,
  ...
)
```

Arguments

`form`	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted. The details of the model specification are given under 'Details'
`parameters`	model formulae for distribution parameters
`data`	an optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which wtdttt is called.
`id`	the name of the variable that identifies distinct individuals
`start`	start of observation window
`end`	end of observation window
`reverse`	logical; Fit the reverse waiting time distribution.
`nsamp`	number of samples to take.
`subset`	an optional vector specifying a subset of observations to be used in the fitting process.
`na.action`	a function which indicates what should happen when the data contain NAs. The default is set by the na.action setting of options, and is na.fail if that is unset. The 'factory-fresh' default is na.omit. Another possible value is NULL, no action. Value na.exclude can be useful.

`init`	starting values for the parameters.
`control`	a list of parameters for controlling the fitting process.
`...`	further arguments passed to other methods.

Value

ranwtdttt returns an object of class "wtd" inheriting from "mle".

`sand_vcov` *Calculate a robust variance-covariance matrix using the sandwich estimator*

Description

Calculate a robust variance-covariance matrix using the sandwich estimator

Usage

```
sand_vcov(fit)
```

Arguments

`fit`	an object of class "wtd" returned by `ranwtdttt()`

Value

sand_vcov returns a matrix

`wtdttt` *Fit Waiting Time Distribution*

Description

Estimates the maximum likelihood estimate for a parametric Waiting Time Distribution (WTD) based on observed prescription redemptions with adjustment for covariates. Reports estimates of prevalence fraction and specified percentile of inter-arrival density together with regression coefficients.

Usage

```
wtdttt(
  data,
  form,
  parameters = NULL,
  start = NA,
  end = NA,
  reverse = F,
  id,
  subset = NA,
  na.action = na.pass,
```

```
    init = NULL,
    control = NULL,
    ...
)
```

Arguments

`data`	an optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which wtdttt is called.
`form`	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted. The details of the model specification are given under 'Details'
`parameters`	optional model formulae for distribution parameters
`start`	start of observation window (date or real number)
`end`	end of observation window (date or real number)
`reverse`	logical; Fit the reverse waiting time distribution (default F).
`id`	name of the id variable (optional)
`subset`	an optional vector specifying a subset of observations to be used in the fitting process.
`na.action`	a function which indicates what should happen when the data contain NAs. The default is set by the na.action setting of options, and is na.fail if that is unset. The 'factory-fresh' default is na.omit. Another possible value is NULL, no action. Value na.exclude can be useful.
`init`	starting values for the parameters.
`control`	a list of parameters for controlling the fitting process.
`...`	further arguments passed to other methods.

Value

wtdttt returns an object of class "wtd" inheriting from "mle".

Model formula

The model formula `form` follows the pattern `obstime ~ dist(alpha, beta, gamma)` with

- `obstime`: the redemption time variable (date or real number)
- `dist`: the parametric distribution for the forward or backward recurrence density (FRD/BRD), which must be `dexp()`, `dweib()` or `dlnorm()` i.e named after their corresponding interarrival density (IAD).

The model formula `parameters` follows the pattern `list(alpha ~ "covariate", beta ~ "covariate", gamma ~ 1)` with

- `covariate`: the variable that is informative about the duration to the next prescription redemption and that will affect the estimate of the parameters of the model In the pattern reported above the covariaste only affect alpha and beta, but not gamma (since 1 is supplied after ~)

Data format

The WTD is fit to the first prescription redemption of each individual within an observation window (ordinary WTD), or the last (reverse WTD), respectively.

You may prepare the data to this format, or optionally specify the name of an `id` variable to select the first or last redemption automatically.

If the redemption time data are of type date, a continuity correction will be applied automatically.

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