Package 'mudens'

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Type Package

Title Density Estimate

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Description
Compute a density estimate from a vector of right-censored survival time using kernel functions.

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Imports survival, Rcpp

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License GPL (>= 2)

LinkingTo Rcpp

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R topics documented:

kernden *Calculate global bandwidth kernel estimates of density function*

Description

Estimates global bandwidth kernel from right-censored data using the Epanechnikov kernel described in Silverman BW (1986).

Usage

```
kernden(times, status, estgrid, bandwidth)
```

Arguments

times	A vector of survival times. It does not need to be sorted.
status	A vector indicating censoring: 0 - censored (alive), 1 - uncensored (dead). If status is missing, all the observations are assumed uncensored.
estgrid	A vector of time points at which the estimation will be made.
bandwidth	Bandwidth used to determine the degree of smoothing. Larger values of bandwidth will result in smoother of mean estimates. It is suggested to start with a value of approximately 20% of the range of the survival times.

Details

Calculate global bandwidth kernel estimates of density function for survival times

Value

Returns an object containing the time points of estimations (estgrid) and corresponding density estimates (denest).

Author(s)

R. Herrick and Dan Serachitopol

References

Hess, K.R. and Zhong, M. Density Function Estimation for Possibly Right-Censored Data Using Kernel Functions. Submitted.

`lines.mudens` *Plots estimated density function from an object of class 'mudens'.*

Description

Add connected segments to a plot of estimated density function from an object of class 'mudens'.

Usage

```
## S3 method for class 'mudens'
lines(x,...)
```

Arguments

`x`	Object of class mudens (output from calling mudens function)
`...`	Additional arguments for basic `lines(.)` function to be passed along.

Details

Plots estimated density function from an object of class 'mudens'.

Plots estimated density function from an object of class 'mudens'. Default time limits are those provided to mudens, which default to zero and the max observed time. Default y-axis limits are 0 and the maximum estimated density.

Author(s)

Kenneth R. Hess

References

Hess, K.R. and Zhong, M. Density Function Estimation for Possibly Right-Censored Data Using Kernel Functions. Submitted.

See Also

mudens

mudens *Estimate density function from right-censored survival data*

Description

Estimate density function from a vector of right-censored survival times using kernel functions. Options include three types of bandwidth functions, three types of boundary correction, and four shapes for the kernel function. Uses the global and local bandwidth selection algorithms and the boundary kernel formulations described in Mueller and Wang (1994). The nearest neighbor bandwidth formulation is based on that described in Gefeller and Dette (1992). The statistical properties of many of these estimators are reported and compared in Hess et al. The `mudens(.)` function is an R wrapper around C code and returns an object of class 'mudens' based on the density estimation in the HADES program developed by H.G. Mueller.

Usage

```
mudens(times, delta, subset, min.time, max.time, bw.grid, bw.pilot,
bw.smooth, bw.method="local", b.cor="both", n.min.grid=51,
n.est.grid = 101, kern="epanechnikov")
```

Arguments

`times`	A vector of survival times. It does not need to be sorted.
`delta`	A vector indicating censoring: `0` - censored (alive), `1` - uncensored (dead). If delta is missing, all the observations are assumed uncensored.
`subset`	A logical vector indicating the observations used in analysis. `TRUE` - observation is used, `FALSE` - observation is not used. If missing, all the observations will be used.
`min.time`	Left bound of the time domain used in analysis. If missing, `min.time` is set to `0`.
`max.time`	Right bound of the time domain used in analysis. If missing, `max.time` is the maximum value of times.
`bw.grid`	Bandwidth grid used in the MSE minimization. If `bw.method="global"` and `bw.grid` has one component only, no MSE minimization is performed. The hazard estimates are computed for the value of `bw.grid`. If `bw.grid` is missing, then a bandwidth grid of 21 components is built, having as bounds: `[0.2*bw.pilot, 20*bw.pilot]`
`bw.pilot`	Pilot bandwidth used in the MSE minimization. If missing, the default value is the one recommended by Mueller and Wang (1994): `bw.pilot = (max.time-min.time)/(8*nz^0.2)`, where `nz` is the number of uncensored observations.
`bw.smooth`	Bandwidth used in smoothing the local bandwidths. Not used if `bw.method="global"`. If missing: `bw.smooth=5*bw.pilot`.

bw.method	Algorithm to be used. Possible values are: "global" - same bandwidth for all grid points. In this case, the optimal bandwidth is obtained by minimizing the IMSE. "local" - different bandwidths at each grid point, and the optimal bandwidth at a grid point is obtained by minimizing the local MSE. "knn" - k nearest neighbors distance bandwidth, and the optimal number of neighbors is obtained by minimizing the IMSE. Note: The default value is "local". Only the first letter needs to be given (e.g. "g", instead of "global").
b.cor	Boundary correction type. Possible values are: "none" - no boundary correction, "left" - left only correction, "both" - left and right corrections. The default value is set to "both". Only the first letter needs to be given (e.g. b.cor="n").
n.min.grid	Number of points in the minimization grid. This value greatly influences the computing time. Default value is 51.
n.est.grid	Number of points in the estimation grid, where hazard estimates are computed. Default value is 101.
kern	Boundary kernel function to be used. Possible values are: "rectangle", "epanechnikov", "biquadratic", "triquadratic". The default value is "epanechnikov". Only the first letter needs to be given (e.g. kern="b").

Details

Estimate density function from a vector of right-censored survival times.

The mudens object contains a list of the input data and parameter values as well as a variety of output data. The density function estimate is contained in the haz.est element and the corresponding time points are in est.grid. The unsmoothed and smoothed local bandwidths are in bw.loc and bw.loc.sm, respectively.

When setting bw.method='local' or 'knn', to check the shape of the bandwidth function used in the estimation, use plot(fitpinmin.grid, fit$bw.loc) to plot the unsmoothed bandwidths and use lines(fit$est.grid, fit$bw.loc.sm) to superimpose the smoothed bandwidth function. We can also use bw.smooth to change the amount of smoothing used on the bandwidth function.

For bw.method='global', use plot(fit$bw.grid, fit$globlmse) to check the minimization process, and plot the estimated IMSE values over the bandwidth search grid; while for bw.method='k', use plot(fit$k.grid, fit$k.imse).

You may want to repeat the search using a finer grid over a shorter interval to fine-tune the optimization or if the observed minimum is at the extreme of the grid you should specify a different grid.

Value

Returns an object of class 'mudens', containing input and output values. Methods working on such an object are: plot, lines, summary. For a detailed description of its components, see object.mudens in the mudens package.

Author(s)

Kenneth R. Hess

References

Hess, K.R. and Zhong, M. Density Function Estimation for Possibly Right-Censored Data Using Kernel Functions. Submitted.

H.G. Mueller and J.L. Wang. Hazard Rates Estimation Under Random Censoring with Varying Kernels and Bandwidths. Biometrics 50:61-76, March, 1994.

O.Gefeller and H. Dette. Nearest Neighbor Kernel Estimation of the Hazard Function From Censored Data. J. Statist. Comput. Simul., Vol.43:93-101, 1992.

Examples

```
time <- rexp(1000)
stat <- sample(c(0,1), 1000, 0.5)
fit <- mudens(time, stat)
summary(fit)
```

---

plot.mudens *Plots estimated density function from an object of class 'mudens'.*

Description

Plot estimated density function from an object of class 'mudens'.

Usage

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

Arguments

x	Object of class mudens (output from calling mudens function)
...	Additional arguments of basic plot(.) function to be passed along.

Details

Plots estimated density function from an object of class 'mudens'.

Default time limits are those provided to mudens, which default to zero and the time corresponding to the maximum value of the times. Default y-axis limits are 0 and the maximum estimated density.

Author(s)

Kenneth R. Hess

References

Hess, K.R. and Zhong, M. Density Function Estimation for Possibly Right-Censored Data Using Kernel Functions. Submitted.

See Also

mudens

`summary.mudens` *Display the most important input parameters used in calling the 'mudens' function*

Description

It also displays some of the output data. Common to all three methods: (1) number of observations, (2) number of censored observations, (3) bandwidth method used (global, local or nearest neighbor), (4) boundary correction type (none, left only, both left and right), (5) kernel type (rectangle, Epanechnikov, biquadradic, triquadratic), (6) minimum time, (7) maximum time, (8) number of points in MSE minimization grid, (9) number of points in estimation grid, (10) pilot bandwidth, (11) estimated IMSE for optimal bandwidth.

This function will also report the following two results for different selections of methods: (12) Smoothing Bandwidth and (13) Optimal Number of Nearest Neighbor. If `bw.method="global"`, this function will display the optimal global bandwidth. If `bw.method="knn"`, it will show optimal number of nearest neighbors. If `bw.method="local"` and `bw.method="knn"`, the summary result will include the smoothing bandwidth used to smooth the optimal local bandwidths.

Usage

```
## S3 method for class 'mudens'
summary(object, ...)
```

Arguments

`object`	object of class `mudens` (output from calling `mudens(.)` function)
`...`	Additional arguments to be passed along.

Details

Display the most important input parameters used in calling the 'mudens' function

Value

The summary result for mudens estimation

Author(s)

Kenneth R. Hess

References

Hess, K.R. and Zhong, M. Density Function Estimation for Possibly Right-Censored Data Using Kernel Functions. Submitted.

See Also

mudens

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