

Package ‘mvna’

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Title Nelson-Aalen estimator of the cumulative hazard in multistate models

Version 1.2

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Description This package computes the Nelson-Aalen estimator of the cumulative transition hazard for multistate models.

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License GPL (>= 2)

Depends lattice

Suggests Rgraphviz, gridBase

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`abortion`*Pregnancies exposed to coumarin derivatives*

Description

Outcomes of pregnancies exposed to coumarin derivatives. The aim is to investigate whether exposure to coumarin derivatives increases the probability of spontaneous abortions. Apart from spontaneous abortion, pregnancy may end in induced abortion or live birth. Moreover, data are left-truncated as women usually enter the study several weeks after conception.

Usage

```
data(abortion)
```

Format

A data frame with 1186 observations on the following 5 variables.

`id` Identification number

`entry` Entry times into the cohort

`exit` Event times

`group` Group. 0: control, 1: exposed to coumarin derivatives

`cause` Cause of failure. 1: induced abortion, 2: life birth, 3: spontaneous abortion

Source

Meiester, R. and Schaefer, C (2008). Statistical methods for estimating the probability of spontaneous abortion in observational studies – Analyzing pregnancies exposed to coumarin derivatives. *Reproductive Toxicology*, 26, 31–35

Examples

```
data(abortion)
```

`lines.mvna`*Lines method for 'mvna' objects*

Description

Lines method for `mvna` objects.

Usage

```
## S3 method for class 'mvna':
lines(x, tr.choice, col = 1, lty, conf.int = FALSE,
      level = 0.95, var.type = c("aalen", "greenwood"),
      ci.fun = c("log", "linear", "arcsin"), ci.col = col,
      ci.lty = 3, ...)
```

Arguments

<code>x</code>	An object of class <code>mvna</code> .
<code>tr.choice</code>	A character vector of the form <code>c("from to", "from to")</code> specifying which transitions should be displayed. By default, all the transition hazards are plotted.
<code>col</code>	A vector of colours. Default is black.
<code>lty</code>	A vector of line types. Default is 1:number of transitions.
<code>conf.int</code>	Logical. Indicates whether to display pointwise confidence interval. Default is FALSE.
<code>level</code>	Level of the confidence interval. Default is 0.95.
<code>var.type</code>	Specifies the variance estimator that should be used to compute the confidence interval. One of "aalen" or "greenwood". Default is "aalen".
<code>ci.fun</code>	Specifies the transformation applied to the confidence interval. Choices are "linear", "log", "arcsin". Default is "log".
<code>ci.col</code>	Colours of the confidence interval lines. By default, <code>ci.col</code> equals <code>col</code> .
<code>ci.lty</code>	Line types for the confidence intervals. Default is 3.
<code>...</code>	Further arguments for <code>lines</code> .

Value

No value returned.

Author(s)

Arthur Allignol, <arthur.allignol@fdm.uni-freiburg.de>

See Also

[mvna](#), [plot.mvna](#)

Examples

```
data(sir.adm)

## data set transformation
data(sir.adm)
id <- sir.adm$id
from <- sir.adm$pneu
```

```

to <- ifelse(sir.adm$status==0,"cens",sir.adm$status+1)
times <- sir.adm$time
dat.sir <- data.frame(id,from,to,time=times)

## Possible transitions
tra <- matrix(ncol=4,nrow=4,FALSE)
tra[1:2,3:4] <- TRUE

na.pneu <- mvna(dat.sir,c("0","1","2","3"),
               tra,"cens")

plot(na.pneu, tr.choice = c("0 2"), conf.int = TRUE,
     col = 1, lty = 1, legend = FALSE)

lines(na.pneu, tr.choice = c("1 2"), conf.int = TRUE,
     col = 2, lty = 1)

```

msmplot

Combined plot of the multistate model and the cumulative hazards.

Description

This function uses the package **Rgraphviz** to display the multistate model. Next **GrisBase** is used to put the cumulative hazard plots near the arrows representing transitions.

Usage

```

## S3 method for class 'mvna':
msmplot(object, tr.choice, graph, layout = "dot",
        recip.edges = "combined", order = "LR", unit = "npc",
        width, height, just = "center",
        mgp = c(1.3, 0.4, 0), cex = 0.6,
        mtext = TRUE, label.plots, side = 3, lcex = 0.9,
        conf.int = TRUE, level = 0.05, xlab = "Time", ylab = "",
        ...)

```

Arguments

object	An object of class mvna.
tr.choice	A character vector of the form ("from to", "from to") describing the transitions to plot. By default, the estimated cumulative hazards are displayed for all transitions.
graph	Optional. An object of class Ragraph . People familiar with the Rgraphviz and/or willing to have a better control on how the multistate model is displayed can provide here their own Ragraph object. If not provided, the multistate plot is done internally.
layout	If graph is not provided, permits to specify the layout of the multistate plot.

<code>recip.edges</code>	If <code>graph</code> is not provided, permits to specify how to handle reciprocated edges, defaults is 'combined'.
<code>order</code>	Order for the display of the nodes. Default is 'LR', that is from left to right.
<code>unit</code>	A string specifying the units used for creating the viewports in which the cumulative hazards will be plotted. Default is "npc". See the grid vignette for the possible values.
<code>width</code>	A vector giving the width of the viewport for plotting the cumulative hazards.
<code>height</code>	A vector giving the height of the viewport.
<code>just</code>	A string or numeric vector indicating the justification of the viewport.
<code>mgp</code>	Margin line for the axis title, axis labels and axis line in the cumulative hazards plots. Default is <code>c(1.3, 0.4, 0)</code> , smaller than the default value in <code>par</code> due to the fact the plots will usually be small.
<code>cex</code>	A numerical value giving the amount by which plotting text and symbols should be magnified relative to the default.
<code>mtext</code>	A logical indicating whether to display a label above the plot.
<code>label.plots</code>	If <code>mtext = TRUE</code> , specifies the labels. Default is the transition numbers.
<code>side</code>	Gives the side where to put the label (1=bottom, 2=left, 3=top, 4=right). Default is 3.
<code>lcex</code>	Character expansion factor. This is an absolute value. Therefore, this value will be evaluate with respect with <code>cex</code> above.
<code>conf.int</code>	A logical indicating whether plot confidence intervals. Default is TRUE
<code>level</code>	Level for the confidence interval. Default is 0.05
<code>xlab</code>	Label for the x-axis.
<code>ylab</code>	Label for the y-axis.
<code>...</code>	Further arguments for the plot method.

Details

This functions permits to display the cumulative hazards estimates in multistate models in an original manner. A drawing of the multistate model is provided along with the display of the estimated cumulative hazards that are put along the arrows that describes the possible transitions.

The multistate model is displayed using the **Rgraphviz** package. By default, the `Ragraph` object needed for the display is computed internally, letting few options for the user to be modified. For a finer control, the user can provide his own `Ragraph` object using the `agopen` function.

The cumulative hazards plots are positioned by the user using the `grid.locator` function. One has just to click where he wants the plot to be. The order of the transitions is displayed on the prompt. The `width`, `height`, `angle` and `just` arguments permit to adjust the way the plots are displayed.

Value

object with the invisible flag set

Note

The **Rgraphviz** package requires the graphviz software to be installed.

Rgraphviz binaries for windows are not available on CRAN, but are on bioconductor.

Author(s)

Arthur Allignol, <arthur.allignol@fdm.uni-freiburg.de>

See Also

[mvna](#)

Examples

```
data(sir.cont)

sir.cont <- sir.cont[order(sir.cont$id, sir.cont$time), ]
for (i in 2:nrow(sir.cont)) {
  if (sir.cont$id[i]==sir.cont$id[i-1]) {
    if (sir.cont$time[i]==sir.cont$time[i-1]) {
      sir.cont$time[i-1] <- sir.cont$time[i-1] - 0.5
    }
  }
}

### Computation of the transition probabilities
# Possible transitions
tra <- matrix(ncol=3,nrow=3,FALSE)
tra[1, 2:3] <- TRUE
tra[2, c(1, 3)] <- TRUE

# mvna
temp <- mvna(sir.cont, c("0", "1", "2"), tra, "cens")

## Not run:
msmplot(temp, width = c(0.25, 0.25, 0.2, 0.25),
         height = c(0.2, 0.2, 0.18, 0.2), lcex=0.8)

## End(Not run)
```

mvna

Nelson-Aalen estimator in multistate models

Description

This function computes the multivariate Nelson-Aalen estimator of the cumulative transition hazards in multistate models, that is, for each possible transition, it computes an estimate of the cumulative hazard.

Usage

```
mvna(data, state.names, tra, cens.name)
```

Arguments

<code>data</code>	A <code>data.frame</code> of the form <code>data.frame(id,from,to,time)</code> or <code>(id,from,to,entry,exit)</code> id: patient id from: the state from where the transition occurs to: the state to which a transition occurs time: time when a transition occurs entry: entry time in a state exit: exit time from a state This <code>data.frame</code> is transition-oriented, <i>i.e.</i> it contains one row per transition, and possibly several rows per patient. Specifying an entry and exit time permits to take into account left-truncation.
<code>state.names</code>	A vector of character giving the states names.
<code>tra</code>	A quadratic matrix of logical values describing the possible transitions within the multistate model.
<code>cens.name</code>	A character giving the code for censored observations in the column <code>to</code> of <code>data</code> . If there is no censored observations in your data, put <code>NULL</code> .

Details

This functions computes the Nelson-Aalen estimator as described in Anderson et al. (1993), along with the two variance estimators described in eq. (4.1.6) and (4.1.7) of Andersen et al. (1993) at each transition time.

Value

Returns a list named after the possible transitions, *e.g.* if we define a multistate model with two possible transitions: from state 0 to state 1, and from state 0 to state 2, the returned list will have two parts named "0 1" and "0 2". Each part contains a `data.frame` with columns:

<code>na</code>	Nelson-Aalen estimates at each transition times.
<code>var.aalen</code>	Variance estimator given in eq. (4.1.6) of Andersen et al. (1993).
<code>var.greenwood</code>	Variance estimator given in eq. (4.1.7) of Andersen et al. (1993).
<code>time</code>	The transition times.

The list also contains:

<code>time</code>	All the event times.
<code>n.risk</code>	A matrix giving the number at individual at risk in the transient states just before an event.
<code>n.event</code>	An array which gives the number of transitions at each event times.
<code>n.cens</code>	A matrix giving the number a censored observations at each event times.

state.names The same as in the function call.
 cens.name The same as in the function call.
 trans A data frame, with columns `from` and `to`, that gives the possible transitions.

Note

The variance estimator (4.1.6) may overestimate the true variance, and the one defined eq. (4.1.7) may underestimate the true variance (see Klein (1991) and Andersen et al. (example IV.1.1, 1993)), especially with small sample set. Klein (1991) recommends the use of the variance estimator of eq. (4.1.6, "aalen") because he found it to be less biased.

Author(s)

Arthur Allignol, <arthur.allignol@fdm.uni-freiburg.de>

References

Andersen, P.K., Borgan, O., Gill, R.D. and Keiding, N. (1993). *Statistical models based on counting processes*. Springer Series in Statistics. New York, NY: Springer.
 Klein, J.P. Small sample moments of some estimators of the variance of the Kaplan-Meier and Nelson-Aalen estimators. *Scandinavian Journal of Statistics*, 18:333–340, 1991.

See Also

[sir.adm](#), [sir.cont](#)

Examples

```
data(sir.cont)

# Modification for patients entering and leaving a state
# at the same date
sir.cont <- sir.cont[order(sir.cont$id, sir.cont$time), ]
for (i in 2:nrow(sir.cont)) {
  if (sir.cont$id[i]==sir.cont$id[i-1]) {
    if (sir.cont$time[i]==sir.cont$time[i-1]) {
      sir.cont$time[i-1] <- sir.cont$time[i-1] - 0.5
    }
  }
}

# Matrix of logical giving the possible transitions
tra <- matrix(ncol=3,nrow=3,FALSE)
tra[1, 2:3] <- TRUE
tra[2, c(1, 3)] <- TRUE

# Computation of the Nelson-Aalen estimates
na <- mvna(sir.cont,c("0","1","2"),tra,"cens")

# plot
xyplot(na)
```

```

### example with left-truncation
data(abortion)

# Data set modification in order to be used by mvna
names(abortion) <- c("id", "entry", "exit", "from", "to")
abortion$to <- abortion$to + 1

## computation of the matrix giving the possible transitions
tra <- matrix(FALSE, nrow = 5, ncol = 5)
tra[1:2, 3:5] <- TRUE

na.abortion <- mvna(abortion, as.character(0:4), tra, NULL)

plot(na.abortion, tr.choice = c("0 4", "1 4"),
     curvlab = c("Control", "Exposed"),
     bty = "n", legend.pos = "topleft")

```

plot.mvna

Plot method for a mvna object

Description

Plot method for an object of class `mvna`. This function plots estimates of the cumulative transition hazards in one panel.

Usage

```

## S3 method for class 'mvna':
plot(x, tr.choice, xlab = "Time",
     ylab = "Cumulative Hazard", col = 1, lty, xlim, ylim,
     conf.int = FALSE, level = 0.95,
     var.type = c("aalen", "greenwood"),
     ci.fun = c("log", "linear", "arcsin"),
     ci.col = col, ci.lty = 3,
     legend = TRUE, legend.pos, curvlab, legend.bty = "n", ...)

```

Arguments

<code>x</code>	An object of class <code>mvna</code> .
<code>tr.choice</code>	A character vector of the form <code>c("from to", "from to")</code> specifying which transitions should be plotted. Default, all the cumulative transition hazards are plotted.
<code>xlab</code>	x-axis label. Default is "Time".
<code>ylab</code>	y-axis label. Default is "Cumulative Hazard".
<code>col</code>	Vector of colour. Default is black.
<code>lty</code>	Vector of line type. Default is 1:number of transitions

xlim	Limits of x-axis for the plot
ylim	Limits of y-axis for the plot
conf.int	Logical. Whether to display pointwise confidence intervals. Default is FALSE.
level	Level of the pointwise confidence intervals. Default is 0.95.
var.type	A character vector specifying the variance that should be used to compute the pointwise confidence intervals. Choices are "aalen" or "greenwood". Default is "aalen".
ci.fun	One of "log", "linear" or "arcsin". Indicates which transformation to apply to the confidence intervals.
ci.col	Colour for the confidence intervals. By default, the colour specified by col is used.
ci.lty	Line type for the confidence intervals. Default is 3.
legend	A logical specifying if a legend should be added
legend.pos	A vector giving the legend's position. See legend for further details.
curvlab	A character or expression vector to appear in the legend. Default is the name of the transitions.
legend.bty	Box type for the legend.
...	Further arguments for plot method.

Details

This plot method permits to draw several cumulative transition hazards on the same panel.

Value

No value returned

Author(s)

Arthur Allignol <arthur.allignol@fdm.uni-freiburg.de>

See Also

[mvna](#)

Examples

```
data(sir.cont)

# Modification for patients entering and leaving a state
# at the same date
sir.cont <- sir.cont[order(sir.cont$id, sir.cont$time), ]
for (i in 2:nrow(sir.cont)) {
  if (sir.cont$id[i]==sir.cont$id[i-1]) {
    if (sir.cont$time[i]==sir.cont$time[i-1]) {
      sir.cont$time[i-1] <- sir.cont$time[i-1] - 0.5
    }
  }
}
```

```

    }
  }

  tra <- matrix(ncol=3,nrow=3,FALSE)
  tra[1, 2:3] <- TRUE
  tra[2, c(1, 3)] <- TRUE

  na.cont <- mvna(sir.cont,c("0","1","2"),tra,"cens")

  plot(na.cont, tr.choice=c("0 2", "1 2"))

```

predict.mvna *Calculates Nelson-Aalen estimates at specified time-points*

Description

This function gives the Nelson-Aalen estimates at time-points specified by the user.

Usage

```

## S3 method for class 'mvna':
predict(object, times, tr.choice, level = 0.95,
        var.type = c("aalen", "greenwood"),
        ci.fun = c("log", "linear", "arcsin"), ...)

```

Arguments

object	An object of class mvna
times	Time-points at which one wants the estimates
tr.choice	A vector of character giving for which transitions one wants estimates. By default, the function will give the Nelson-Aalen estimates for all transitions.
level	Level of the pointwise confidence intervals. Default is 0.95.
var.type	Variance estimator displayed and used to compute the pointwise confidence intervals. One of "aalen" or "greenwood". Default is "aalen".
ci.fun	Which transformation to apply for the confidence intervals. Choices are "linear", "log" or "arcsin". Default is "log".
...	Other arguments to predict

Value

Returns a list named after the possible transitions, *e.g.* if we define a multistate model with two possible transitions: from state 0 to state 1, and from state 0 to state 2, the returned list will have two parts named "0 1" and "0 2". Each part contains a data.frame with columns:

times	Time points specified by the user.
na	Nelson-Aalen estimates at the specified times.

var.aalen or var.greenwood
 Depending on what was specified in var.type.

lower Lower bound of the pointwise confidence intervals.

upper Upper bound.

Author(s)

Arthur Allignol, <arthur.allignol@fdm.uni-freiburg.de>

References

Andersen, P.K., Borgan, O., Gill, R.D. and Keiding, N. (1993). *Statistical models based on counting processes*. Springer Series in Statistics. New York, NY: Springer.

See Also

[mvna](#), [summary.mvna](#)

Examples

```
data(sir.cont)

# Modification for patients entering and leaving a state
# at the same date
sir.cont <- sir.cont[order(sir.cont$id, sir.cont$time), ]
for (i in 2:nrow(sir.cont)) {
  if (sir.cont$id[i]==sir.cont$id[i-1]) {
    if (sir.cont$time[i]==sir.cont$time[i-1]) {
      sir.cont$time[i-1] <- sir.cont$time[i-1] - 0.5
    }
  }
}

# Matrix of logical giving the possible transitions
tra <- matrix(ncol=3,nrow=3,FALSE)
tra[1, 2:3] <- TRUE
tra[2, c(1, 3)] <- TRUE

# Computation of the Nelson-Aalen estimates
na <- mvna(sir.cont,c("0","1","2"),tra,"cens")

# Using predict
predict(na,times=c(1,5,10,15))
```

print.mvna	<i>Print method for 'mvna' object</i>
------------	---------------------------------------

Description

Print method for an object of class `mvna`. It prints estimates of the cumulative hazard along with estimates of the variance described in eq. (4.1.6) and (4.1.7) of Andersen et al. (1993) at several time points obtained with the `quantile` function.

Usage

```
## S3 method for class 'mvna':  
print(x, ...)
```

Arguments

<code>x</code>	An object of class <code>mvna</code>
<code>...</code>	Other arguments for print method

Value

No value returned.

Author(s)

Arthur Allignol, <arthur.allignol@fdm-freiburg.de>

See Also

[mvna](#)

sir.adm	<i>Pneumonia on admission in intensive care unit patients</i>
---------	---

Description

Pneumonia status on admission for intensive care unit (ICU) patients, a random sample from the SIR-3 study.

Usage

```
data(sir.adm)
```

Format

The data contains 747 rows and 4 variables:

id: Randomly generated patient id

pneu: Pneumonia indicator. 0: No pneumonia, 1: Pneumonia

status Status indicator. 0: censored observation, 1: discharged, 2: dead

time: Follow-up time in day

Source

Beyersmann, J., Gastmeier, P., Grundmann, H., Baerwolff, S., Geffers, C., Behnke, M., Rueden, H., and Schumacher, M. Use of multistate models to assess prolongation of intensive care unit stay due to nosocomial infection. *Infection Control and Hospital Epidemiology*, 27:493-499, 2006.

Examples

```
# data set transformation
data(sir.adm)
id <- sir.adm$id
from <- sir.adm$pneu
to <- ifelse(sir.adm$status==0, "cens", sir.adm$status+1)
times <- sir.adm$time
dat.sir <- data.frame(id, from, to, time=times)

# Possible transitions
tra <- matrix(ncol=4, nrow=4, FALSE)
tra[1:2, 3:4] <- TRUE

na.pneu <- mvna(dat.sir, c("0", "1", "2", "3"),
               tra, "cens")
xyplot(na.pneu, tr.choice=c("0 2", "1 2", "0 3", "1 3"),
       aspect=1, strip=strip.custom(bg="white",
       factor.levels=c("No pneumonia on admission -- Discharge",
                       "Pneumonia on admission -- Discharge",
                       "No pneumonia on admission -- Death",
                       "Pneumonia on admission -- Death"),
       par.strip.text=list(cex=0.9)),
       scales=list(alternating=1), xlab="Days",
       ylab="Nelson-Aalen estimates")
```

sir.cont

Ventilation status in intensive care unit patients

Description

Time-dependent ventilation status for intensive care unit (ICU) patients, a random sample from the SIR-3 study.

Usage

```
data(sir.cont)
```

Format

A data frame with 1161 rows and 4 columns:

id: Randomly generated patient id

from: State from which a transition occurs

to: State to which a transition occurs

time: Time when a transition occurs

The possible states are:

0: No ventilation

1: Ventilation

2: End of stay.

And `cens` stands for censored observations.

Details

This data frame consists in a random sample of the SIR-3 cohort data. It focuses on the effect of ventilation on the length of stay (combined endpoint discharge/death). Ventilation status is considered as a transient state in an illness-death model.

The data frame is directly formatted to be used with the `mvna` function, i.e., it is transition-oriented with one row per transition.

Source

Beyersmann, J., Gastmeier, P., Grundmann, H., Baerwolff, S., Geffers, C., Behnke, M., Rueden, H., and Schumacher, M. Use of multistate models to assess prolongation of intensive care unit stay due to nosocomial infection. *Infection Control and Hospital Epidemiology*, 27:493-499, 2006.

Examples

```
data(sir.cont)

# Matrix of possible transitions
tra <- matrix(ncol=3,nrow=3,FALSE)
tra[1, 2:3] <- TRUE
tra[2, c(1, 3)] <- TRUE

# Modification for patients entering and leaving a state
# at the same date
sir.cont <- sir.cont[order(sir.cont$id, sir.cont$time), ]
for (i in 2:nrow(sir.cont)) {
  if (sir.cont$id[i]==sir.cont$id[i-1]) {
    if (sir.cont$time[i]==sir.cont$time[i-1]) {
      sir.cont$time[i-1] <- sir.cont$time[i-1] - 0.5
    }
  }
}
```

```

    }
  }
}

# Computation of the Nelson-Aalen estimates
na.cont <- mvna(sir.cont,c("0","1","2"),tra,"cens")

xyplot(na.cont,tr.choice=c("0 2","1 2"),aspect=1,
       strip=strip.custom(bg="white",
                           factor.levels=c("No ventilation -- Discharge/Death",
                                             "Ventilation -- Discharge/Death"),
                           par.strip.text=list(cex=0.9)),
       scales=list(alternating=1,xlab="Days",
                   ylab="Nelson-Aalen estimates")

```

summary.mvna

Summary method for objects of class 'mvna'

Description

Summary method for `mvna` objects. The function returns a list containing the cumulative transition hazards, variance and other informations.

Usage

```

## S3 method for class 'mvna':
summary(object, level = 0.95,
        var.type = c("aalen", "greenwood"),
        ci.fun = c("log", "linear", "arcsin"), ...)

## S3 method for class 'mvna':
print.summary(x, ...)

```

Arguments

<code>object</code>	An object of class <code>mvna</code> .
<code>level</code>	Level of the pointwise confidence interval. Default is 0.95.
<code>var.type</code>	Which of the "aalen" or "greenwood" variance estimator should be displayed and used to compute the pointwise confidence intervals. Default is "aalen".
<code>ci.fun</code>	Which transformation to apply to the confidence intervals. One of "linear", "log", "arcsin". Default is "log".
<code>...</code>	Further arguments.
<code>x</code>	An object of class <code>summary.mvna</code> .

Value

Returns an object of class `mvna` which is a list of data frames named after the possible transitions. Each data frame contains the following columns:

<code>time</code>	Event times at which the cumulative hazards are estimated.
<code>na</code>	Estimated cumulative transition hazards.
<code>var.aalen</code> or <code>var.greenwood</code>	Variance estimates. The name depends on the <code>var.type</code> argument. Default will be <code>var.aalen</code> .
<code>lower</code>	Lower bound of the pointwise confidence interval.
<code>upper</code>	Upper bound.
<code>n.risk</code>	Number of individuals at risk of experiencing an event just before t .
<code>n.event</code>	Number of transitions at time t .

Author(s)

Arthur Allignol, <arthur.allignol@fdm.uni-freiburg.de>

See Also

[mvna](#)

Examples

```
data(sir.adm)

## data set transformation
data(sir.adm)
id <- sir.adm$id
from <- sir.adm$pneu
to <- ifelse(sir.adm$status==0, "cens", sir.adm$status+1)
times <- sir.adm$time
dat.sir <- data.frame(id, from, to, time=times)

## Possible transitions
tra <- matrix(ncol=4, nrow=4, FALSE)
tra[1:2, 3:4] <- TRUE

na.pneu <- mvna(dat.sir, c("0", "1", "2", "3"),
               tra, "cens")

summ.na.pneu <- summary(na.pneu)

## cumulative hazard for 0 -> 2 transition:
summ.na.pneu$"0 2"$na
```

xyplot.mvna

*Panel plots for object of class 'mvna'***Description**

xyplot function for objects of class mvna. Estimates of the cumulative hazards are plotted as a function of time for all the transitions specified by the user. The function can also plot several types of pointwise confidence interval (see Andersen et al. (1993) p.208).

Usage

```
## S3 method for class 'mvna':
xyplot(x, data = NULL, xlab = "Time",
       ylab = "Cumulative Hazard", tr.choice = "all",
       conf.int = TRUE, var.type = c("aalen", "greenwood"),
       ci.fun = c("log", "linear", "arcsin"), level = 0.95,
       col = c(1, 1, 1), lty = c(1, 3, 3),
       ci.type = c(1, 2), ...)
```

Arguments

x	An object of class mvna.
data	<i>Useless.</i>
xlab	x-axis label. Default is "Time".
ylab	y-axis label. Default is "Cumulative Hazard"
tr.choice	A character vector of the form c("from to", "from to") specifying which transitions should be plotted. Default is "all".
conf.int	A logical whether plot pointwise confidence interval. Default is TRUE
var.type	One of "aalen" or "greenwood". Specifies which variance estimator is used to compute the confidence intervals.
ci.fun	One of "log", "linear" or "arcsin". Indicates the transformation applied to the pointwise confidence intervals. Default is "log".
level	Level of the confidence interval. Default is 0.95.
col	Vector of colour for the plot. Default is black.
lty	Vector of line type. Default is c(1, 3, 3).
ci.type	<i>DEPRECATED</i>
...	Other arguments for xyplot.

Value

An object of class trellis.

Note

These plots are highly customizable, see [Lattice](#) and [xyplot](#). For example, if one want to change strip background color and the title of each strip, it can be added 'strip=strip.custom(bg="a color",factor.levels="a title","another title")'. One can use 'aspect="1"' to get the size of the panels isometric.

Author(s)

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References

Andersen, P.K., Borgan, O., Gill, R.D. and Keiding, N. (1993). *Statistical models based on counting processes*. Springer Series in Statistics. New York, NY: Springer.

Deepayan Sarkar (2006). lattice: Lattice Graphics. R package version 0.13-8.

See Also

[xyplot](#), [mvna](#), [sir.adm](#), [sir.cont](#)

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