Package: smoothAPC (via r-universe)

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Title Smoothing of Two-Dimensional Demographic Data, Optionally Taking
into Account Period and Cohort Effects

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Depends R (>= 3.2.2)

Imports quantreg, SparseM, compiler, lmtest, stats, rgl, colorspace,
methods

Description The implemented method uses for smoothing bivariate thin
plate splines, bivariate lasso-type regularization, and allows
for both period and cohort effects. Thus the mortality rates
are modelled as the sum of four components: a smooth bivariate
function of age and time, smooth one-dimensional cohort
effects, smooth one-dimensional period effects and random
errors.

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URL

LazyData true

RoxygenNote 5.0.1

Suggests testthat, demography

NeedsCompilation no

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Repository https://dokal01.r-universe.dev

RemoteUrl https://github.com/cran/smoothAPC

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autoSmoothAPC   *Smooths demographic data using automatically estimated parameters*
and optionally taking into account period and cohort effects

Description

If period and cohort effects are taken into account (effects = TRUE) the method uses all available
years and diagonals for estimation of the period and cohort effects.

Usage

```
autoSmoothAPC(data, effects = TRUE, cornerLength = 7,
  affdDiagonals = NULL, affdYears = NULL, lower = head(c(0.01, 0.01, 0.01,
  2, 0.001, 2, 0.001), 3 + effects * 4), upper = head(c(1.2, 1.8, 1.2, 12,
  0.4, 12, 0.4), 3 + effects * 4), init = head(c(0.1, 0.1, 0.2, 4, 0.001, 4,
  0.001), 3 + effects * 4), reltol = 0.001, parameters = NULL, trace = F,
  control = list(nnzlmax = 1e+06, nsubmax = 2e+06, tmpmax = 2e+05),
  weights = NULL)
```

Arguments

data	Demographic data (log mortality) presented as a matrix. Row numbers represent ages and column numbers represet time.
effects	Controls if the cohort and period effects are taken into account.
cornerLength	Sets the smallest length of a diagonal to be considered for cohort effects.
affdDiagonals	Diagonals to be used for cohort effects. The first diagonal is at the bottom left corner of the data matrix (maximal age and minimal time in the data matrix).
affdYears	Years to be used for period effects.
lower	Lowest possible values for the optimization procedure.
upper	Highest possible values for the optimization procedure.
init	Initial values for the optimization procedure.
reltol	Relative tolerance parameter to be supplied to optim function.

parameters	Optional model parameters. If not provided, they are estimated.
trace	Controls if tracing is on.
control	The control data passed directly to `rq.fit.sfn` function.
weights	Define how much every observation effect the resulting smooth surface. The parameter must have same dimentions as data parameter. Weights can be set to reciprocal of estimated standard deviation of the data.

Value

A list of four components: smooth surface, period effects, cohort effects and parameters used for smoothing (passed as a parameter or estimated).

Author(s)

Alexander Dokumentov

References

<http://robjhyndman.com/publications/mortality-smoothing/>

See Also

`smoothAPC` and `signifAutoSmoothAPC`. The latter might give slightly better performance.

Examples

```
library(demography)
m <- log(fr.mort$rate$female[1:30, 150:160])
plot(m)
sm <- autoSmoothAPC(m)
plot(sm)
plot(sm, "period")
plot(sm, "cohort")
```

---

plot.matrix	*Presents matrix as a heatmap*

Description

Presents matrix as a heatmap

Usage

```
## S3 method for class 'matrix'
plot(x, labs = c("X", "Y"), color.palette = c("default",
  "special"), main = "", ...)
```

Arguments

x	Matrix to plot.
labs	Vector of labels for X and Y axes.
color.palette	Character string "default" or "special" or a function accepting one argument and returning a color palette (for example [rainbow](#)).
main	Title for the plot.
...	Other parameters. They are currently ignored.

Author(s)

Alexander Dokumentov

Examples

```
plot(matrix(rnorm(100),10,10), main = "Noise")
plot(matrix(1:100,10,10), c("Dimension 1", "Dimension 2"), main = "Value")

library(demography)
m <- log(fr.mort$rate$female[1:30, 150:160])
plot(m)
plot(m, color.palette = "special")
plot(m, color.palette = rainbow)
```

---

plot.smAPC   *Presents demographic data as a heatmap*

Description

Presents demographic data as a heatmap

Usage

```
## S3 method for class 'smAPC'
plot(x, component = c("all", "surface", "period", "cohort",
  "residuals", "original"), labs = c("Age", "Time"),
  color.palette = c("default", "special"), main = "", ...)
```

Arguments

x	Result of smoothing (object of class smAPC).
component	"smooth", "period", "cohort", "residuals" or "original".
labs	Vector of labels for X and Y axes.
color.palette	Character string "default" or "special" or a function accepting one argument and returning a color palette (for example [rainbow](#)).
main	Title for the plot.
...	Other parameters. They are currently ignored.

Author(s)

Alexander Dokumentov

Examples

```
library(demography)
m <- log(fr.mort$rate$female[1:30, 150:160])
sm <- autoSmoothAPC(m)

plot(sm)
plot(sm, "surface")
plot(sm, "cohort")
plot(sm, "period")
plot(sm, "residuals")
plot(sm, "original", main = "Original data")
```

---

plot3d	*Presents data as a 3D surface*

Description

Presents data as a 3D surface

Usage

```
plot3d(x, ...)
```

Arguments

x	Data to plot.
...	Other parameters.

---

plot3d.matrix	*Presents matrix as a 3D surface*

Description

Presents matrix as a 3D surface

Usage

```
## S3 method for class 'matrix'
plot3d(x, labs = c("X", "Y", "Z"),
  color.palette = c("default", "special"), ...)
```

Arguments

x	Matrix to plot.
labs	Vector of labels for X, Y and Z axes.
color.palette	Character string "default" or "special" or a function accepting one argument and returning a color palette (for example rainbow).
...	Other parameters. They are currently ignored.

Author(s)

Alexander Dokumentov

Examples

```
plot3d(matrix(rnorm(100),10,10))
plot3d(matrix(1:100,10,10), c("Dimension 1", "Dimension 2", "Value"))

library(demography)
m <- log(fr.mort$rate$female[1:30, 150:160])
plot3d(m)
plot3d(m, color.palette = "special")
plot3d(m, color.palette = rainbow)
```

---

plot3d.smAPC   *Presents demographic data as a 3D surface*

Description

Presents demographic data as a 3D surface

Usage

```
## S3 method for class 'smAPC'
plot3d(x, component = c("all", "surface", "period", "cohort",
  "residuals", "original"), labs = c("Age", "Time", NA),
  color.palette = c("default", "special"), ...)
```

Arguments

x	Result of smoothing (object of class smAPC).
component	"smooth", "period", "cohort", "residuals" or "original".
labs	Vector of labels for X, Y and Z axes.
color.palette	Character string "default" or "special" or a function accepting one argument and returning a color palette (for example rainbow).
...	Other parameters. They are currently ignored.

Author(s)

Alexander Dokumentov

Examples

```
library(demography)
m <- log(fr.mort$rate$female[1:30, 150:160])
sm <- autoSmoothAPC(m)

plot3d(sm)
plot3d(sm, "surface", color.palette = "special")
plot3d(sm, "cohort")
plot3d(sm, "period")
plot3d(sm, "residuals")
plot3d(sm, "original", color.palette = rainbow)
```

signifAutoSmoothAPC	*Smooths demographic data using automatically estimated parameters and taking into account only significant period and cohort effects*

Description

It is a heuristic procedure which tries to figure out positions of period and cohort effects in the data. It also uses a few steps to estimate model's parameters. The procedure is supposed to outperform [autoSmoothAPC](#) slightly.

Usage

```
signifAutoSmoothAPC(data, p.value = 0.05, cornerLength = 7,
  lower = c(0.01, 0.01, 0.01, 1, 0.001, 1, 0.001), upper = c(1.2, 1.8, 1.2,
  12, 0.4, 12, 0.4), init = c(0.1, 0.1, 0.2, 4, 0.001, 4, 0.001),
  reltol = 0.001, trace = F, control = list(nnzlmax = 1e+06, nsubmax =
  2e+06, tmpmax = 2e+05), weights = NULL)
```

Arguments

data	Demographic data (log mortality) presented as a matrix. Row numbers represent ages and column numbers represet time.
p.value	P-value used to test the period and the cohort effects for significance. The lower the value the fewer diagonals and years will be used to find cohort and period effects.
cornerLength	Minimal length of a diagonal to be considered for cohort effects.
lower	Lowest possible values for the optimization procedure.
upper	Highest possible values for the optimization procedure.

init	Initial values for the optimization procedure.
reltol	Relative tolerance parameter to be supplied to optim function.
trace	Controls if tracing is on.
control	The control data passed directly to [rq.fit.sfn](rq.fit.sfn) function.
weights	Define how much every observation effect the resulting smooth surface. The parameter must have same dimentions as data parameter. Weights can be set to reciprocal of estimated standard deviation of the data.

Value

A list of six components: smooth surface, period effects, cohort effects, parameters used for smoothing, diagonals used for cohort effects and years used for period effects.

Author(s)

Alexander Dokumentov

References

<http://robjhyndman.com/publications/mortality-smoothing/>

See Also

autoSmoothAPC, smoothAPC.

Examples

```
library(demography)
m <- log(fr.mort$rate$female[1:30, 120:139])
plot(m)
sm <- signifAutoSmoothAPC(m)
plot(sm)
plot(sm, "surface")
plot(sm, "period")
plot(sm, "cohort")
```

---

smoothAPC	*Smooths demographic data optionally taking into account period and cohort effects*

Description

Smooths demographic data optionally taking into account period and cohort effects

Usage

```
smoothAPC(data, lambda = 1, lambdaaa = 1, lambdayy = 1, lambdaay = 1,
  lambdaYearsEffect = 5, thetaYearsEffect = 0.1 * lambda,
  lambdaCohortEffect = 5, thetaCohortEffect = 0.1 * lambda,
  cornerLength = 7, effects = TRUE, affdDiagonals = NULL,
  affdYears = NULL, control = list(nnzlmax = 1e+06, nsubmax = 2e+06, tmpmax
  = 2e+05), weights = NULL)
```

Arguments

data	Demographic data (log mortality) presented as a matrix. Row numbers represent ages and column numbers represet time.
lambda	Controls "general flexibility" of the smooth surface.
lambdaaa	Controls "flexibility" of the smooth surface in age direction (first dimension).
lambdayy	Controls "flexibility" of the smooth surface in years direction (second dimension).
lambdaay	Controls "flexibility" of the smooth surface in age and years directions.
lambdaYearsEffect	
	Controls "flexibility" of the period effects.
thetaYearsEffect	
	Reduces the likelihood of period effects.
lambdaCohortEffect	
	Controls "flexibility" of the cohort effects.
thetaCohortEffect	
	Reduces the likelihood of cohort effects.
cornerLength	Sets the smallest length of a diagonal to be considered for cohort effects.
effects	Controls if the cohort and period effects are taken into account.
affdDiagonals	Diagonals to be used for cohort effects.
affdYears	Years to be used for period effects.
control	Control data passed directly to `rq.fit.sfn` function..
weights	Define how much every observation effect the resulting smooth surface. The parameter must have same dimentions as `data` parameter. Weights can be set to reciprocal of estimated standard deviation of the data.

Value

List of three components: smooth surface, period effects, cohort effects.

Author(s)

Alexander Dokumentov

References

<http://robjhyndman.com/publications/mortality-smoothing/>

See Also

[autoSmoothAPC](#), [signifAutoSmoothAPC](#).

Examples

```
library(demography)
m <- log(fr.mort$rate$female[1:30, 150:160])
sm <- smoothAPC(m, lambdaaa = 0.2, lambdayy = 0.1, lambdaay = 0.4, effects = FALSE)
plot(sm, "original")
plot(sm)
```

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