Package 'gamlss.spatial'

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Type Package

Title Spatial Terms in Generalized Additive Models for Location Scale and Shape Models

Version 2.0.0

Date 2018-05-24

Description It allows us to fit Gaussian Markov Random Field within the Generalized Additive Models for Location Scale and Shape algorithms.

License GPL-2 | GPL-3

URL http://www.gamlss.org/

Depends R (>= 2.15.0), gamlss.dist, gamlss (>= 4.2-7), gamlss.add, spam, mgcv

Imports stats, grDevices, graphics, methods

Suggests knitr, spdep, maptools,

Repository CRAN

NeedsCompilation no

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Spatial Terms in Generalized Additive Models for Location Scale and Shape Models

Description

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Details

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References

Rigby, R. A. and Stasinopoulos D. M. (2005). Generalized additive models for location, scale and shape,(with discussion), *Appl. Statist.*, **54**, part 3, pp 507-554. Rue and Held (2005) *Gaussian markov random fields: theory and applications*, Chapman & Hall, USA.

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Examples

```
library(mgcv)
data(columb)
data(columb.polys)
m1 <- MRFA(columb$crime, columb$district, polys=columb.polys)
draw.polys(columb.polys, m1)
```

`draw.polys` *Additional supporting functions for random Markov fields*

Description

This set of functions are useful to get information and to plot maps.

Usage

```
draw.polys(polys, object = NULL, scheme = NULL,
           swapcolors = FALSE, n.col = 100, ...)
polys2nb(polys)
nb2prec(neighbour,x,area=NULL)
polys2polys(object, neighbour.nb)
nb2nb(neighbour.nb)
```

Arguments

`polys`	an object containing the polygon information for the area
`object`	are either the values to plot in the `draw.polys()` function or a polygons information for a shape file for function `polys2polys`

scheme	scheme of colours to use, it can be "heat", "rainbow", "terrain", "topo", "cm" or any colour
swapcolors	to reverse the colours, it just work for "heat", "rainbow", "terrain", "topo", "cm" options
n.col	range for the colours
neighbour.nb	neighbour information for a shape file for function nb2nb
neighbour	the neighbour information, and if the neighbour is from S4 shape file than use nb2nb to transfer it to the appropriate neighbour for MRF(), MRFA(), mrf() and mrfa().
x	the factor defining the areas
area	all possible areas involved
...	for extra options

Details

draw.polys() plots the fitted values of fitted MRF object.

polys2nb() gets the neighbour information from the polygons.

nb2prec() creates the precision matrix from the neighbour information.

polys2polys() transforms a shape file polygons (S4 object) to the polygons required form for the functions MRF() and MRFA().

nb2nb() transforms from a shape file neighbour (S4 object) to the neighbour required form for functions MRF().

Value

The draw.polys() produces a plot while the rest of the functions produce required object for fitting or plotting.

Author(s)

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References

Stasinopoulos, D. M., Rigby, R. A., Heller, G. Z., Voudouris, V. and De Bastiani, F. (2017) *Flexible Regression and Smoothing: Using GAMLSS in R*. Chapman and Hall, Boca Raton.

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See Also

MRF, MRFA

Examples

```
# bringing the required libraries
library(spdep)
library(maptools)
# reading the shape file from package spdep
bh <- readShapePoly(system.file("etc/shapes/bhicv.shp",
            package="spdep")[1])
# pick up parts of the data and scale them
  BhData <- data.frame(scale(bh@data[,5:8]))
# getting the neighbourhood and the polygons using the package
# spdep functions
   bh.nb <- poly2nb(bh) # neighbourhood
bh.polys <- bh@polygons # polygons
# now getting the information for the S4 object to required format
# from object S4 to object S3
newpolys <- polys2polys(bh.polys,bh.nb)
  newnb  <- nb2nb(bh.nb)
# drawing the map
draw.polys(newpolys[[1]])
# plotting one of the variables in BhData
 poo <-BhData$HLCI
names(poo) <- row.names(BhData)
 draw.polys(newpolys[[1]], poo)
# now get the precision matrix
Prec <- nb2prec(newnb, x=as.factor(row.names(BhData)),
          area=as.factor(row.names(BhData)))
```

---

gamlss.gmrf *Gaussian Markov Random Field fitting within GAMLSS*

Description

The function gmrf() can be used to fit Markov Random Field additive terms within GAMLSS.

Usage

```
gamlss.gmrf(x, y, w, xeval = NULL, ...)
gmrf(x, precision = NULL, neighbour = NULL, polys = NULL,
                 area = NULL, adj.weight = 1000, df = NULL, lambda =
                 NULL, start = 10, method = c("Q", "A"), control =
                 gmrf.control(...), ...)
```

Arguments

x	a factor containing the areas
precision	the precision matrix if set
neighbour	an object containing the neighbour information for the area if set
polys	the polygon information if set
area	this argument is here to allow more areas than the levels of the factor x, see example below
adj.weight	a value to adjust the iterative weight if necessary
df	degrees of freedom for fitting if required, only for method="A"
lambda	The smoothing parameter lambda if known, only for method="A"
start	starting value for the smoothing parameter lambda
method	"Q" for Q-function, or "A" for alternating method
y	working response variable
w	iterative weights
xeval	whether to predict or not
control	to be use for some of the argument of MRF().
...	for extra arguments

Details

The function gmrf() is to support the function MRF() and MRFA() within GAMLSS. It is intended to be called within a GAMLSS formula. The function gmrf() is not intended to be used directly. It is calling the function MRFA() and MRF() within the GAMLSS fitting algorithm. The results using the option method="Q" or method="A" should produce identical results.

Value

a fitted gamlss object

Author(s)

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References

Stasinopoulos, D. M., Rigby, R. A., Heller, G. Z., Voudouris, V. and De Bastiani, F. (2017) *Flexible Regression and Smoothing: Using GAMLSS in R*. Chapman and Hall, Boca Raton. (see also http://www.gamlss.org/)

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See Also

MRF, MRFA

Examples

```
library(gamlss)
library(mgcv)
data(columb)
data(columb.polys)
vizinhos=polys2nb(columb.polys)
precisionC <- nb2prec(vizinhos,x=columb$district)
# MRFA
 m1<- gamlss(crime~ gmrf(district, polys=columb.polys, method="Q"), data=columb)
 m2<- gamlss(crime~ gmrf(district, polys=columb.polys, method="A"), data=columb)
AIC(m1,m2, k=0)
draw.polys(columb.polys, getSmo(m2), scheme="topo")
```

MRF *Markov Random Fields Fitting Functions*

Description

The functions `MRF()` and `MRFA()` are used to fit a Gaussian Markov Random Fields (MRF) model. They are used by the functions `mrf()` and `mrfa()` respectively to fit a MRF additive term within GAMLSS

Usage

```
MRF(y, x, precision = NULL, neighbour = NULL, polys = NULL,
            area = NULL, weights = rep(1, length(y)), sig2e = 1,
            sig2b =             1, sig2e.fix = FALSE,
            sig2b.fix = FALSE, penalty = FALSE,
            delta = c(0.01, 0.01), shift = c(0, 0))

MRFA(y, x, precision = NULL, neighbour = NULL, polys = NULL,
           area = NULL, weights = rep(1, length(y)),
           lambda = NULL, df = NULL, start = 10)
```

Arguments

y	response variable
x	a factor containing the areas
precision	the precision matrix if set
neighbour	an object containing the neighbour information for the area if set
polys	the polygon information if set
area	this argument is here to allow more areas than the levels of the factor x, see example below.
weights	prior weights
sig2e	starting values for the error variance
sig2b	starting values for the random field variance
sig2e.fix	whether sig2e is fixed in the fitting, default equals FALSE
sig2b.fix	whether sig2B is fixed in the fitting, default equals FALSE
penalty	whether quadratic penalty is required to help convergence in for flat likelihoods, this is equivalent of putting a normal prior distribution for the log-sigmas e.g. logsig2e-N(shift, 1/delta)
delta	the precision of the prior
shift	the mean of the prior
lambda	smoothing parameter for MRFA function
start	starting value for the smoothing parameter lambda for MRFA function
df	for fixing the degrees of freedom (only in MRFA())

Details

There are two functions for fitting Markov random fields: i) MRF()) which uses the Q-function (marginal likelihood) for estimating the sig2e and sig2b parameters and ii) MRFA() which estimates the smoothing parameter lambda=sig2e/sig2b using the "alternating" method.

Value

a fitted MRF object

Author(s)

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References

Stasinopoulos, D. M., Rigby, R. A., Heller, G. Z., Voudouris, V. and De Bastiani, F. (2017) *Flexible Regression and Smoothing: Using GAMLSS in R*. Chapman and Hall, Boca Raton. (see also http://www.gamlss.org/)

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See Also

mrf

Examples

```
library(mgcv)
data(columb)
data(columb.polys)
vizinhos=polys2nb(columb.polys)
precisionC <- nb2prec(vizinhos,x=columb$district)
# MRFA
 m1<-MRFA(columb$crime, columb$district, polys=columb.polys)
m11<-MRFA(columb$crime, columb$district, precision=precisionC)
m12<-MRFA(columb$crime, columb$district,  neighbour=vizinhos)
draw.polys(columb.polys, m12, scheme="heat",swapcolors=TRUE)
## Not run:
# MRF
  m2<-MRF(columb$crime, columb$district, polys=columb.polys)
 m21<-MRF(columb$crime, columb$district, precision=precisionC)
 m22<-MRF(columb$crime, columb$district, neighbour=vizinhos)
AIC(m1, m11,m12,m2, m21, m22, k=0)
draw.polys(columb.polys, m12, scheme="heat",swapcolors=TRUE)
# removing one area
columb2 <- columb[-5,]
# creating new precision matrix
precisionC2 <- nb2prec(vizinhos,x=columb$district,area=columb$district)
# MRFA
# new data but declaring  area
```

```
m11<-MRFA(columb2$crime, columb2$district, polys=columb.polys, area=columb$district)
# new data old polys
m112<-MRFA(columb2$crime, columb2$district, polys=columb.polys)
# new data old precision old area
m111<-MRFA(columb2$crime, columb2$district, precision=precisionC,area=columb$district)
# new data old neighbour old area
m121<-MRFA(columb2$crime, columb2$district,  neighbour=vizinhos,area=columb$district)
# new data new precision old area
m113<-MRFA(columb2$crime, columb2$district, precision=precisionC2,area=columb$district)
AIC(m11,m112,m111,m121,m113, k=0)
m11<-MRFA(columb2$crime, columb2$district, polys=columb.polys, area=columb$district)
# new data old polys
m112<-MRFA(columb2$crime, columb2$district, polys=columb.polys)
# new data old precision old area
m111<-MRFA(columb2$crime, columb2$district, precision=precisionC,area=columb$district)
# new data old neighbour old area
m121<-MRFA(columb2$crime, columb2$district,  neighbour=vizinhos,area=columb$district)
# new data new precision old area
m113<-MRFA(columb2$crime, columb2$district, precision=precisionC2,area=columb$district)
AIC(m11,m112,m111,m121,m113, k=0)
draw.polys(columb.polys, fitted(m11))

## End(Not run)
```

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