

Package ‘SPODT’

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Type Package

Title Spatial Oblique Decision Tree

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Description SPODT is a spatial partitioning method based on oblique decision trees, in order to classify study area into zones of different risks, determining their boundaries

License GPL (>= 2)

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SPODT-package	<i>Spatial Oblique Decision Tree</i>
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Description

SPODT is a spatial partitioning method based on oblique decision trees, in order to classify study area into zones of different risks, determining their boundaries

Details

Package:	SPODT
Type:	Package
Version:	0.9
Date:	2014-04-23
License:	GPL(>=2)

The main functions are `spodt()` that provides the spatial classification, `spodt.tree()` that provides the partition tree, `spodtSpatialLines()`, an object of `SpatialLines` class that contains the final spatial classification, and `test.spodt()` that provides a Monte Carlo test of the final spatial classification.

Author(s)

Jean Gaudart, Nathalie Graffeo, Guillaume Barbet, Bernard Fichet, Roch Giorgi (Aix-Marseille University)

Maintainer: Jean Gaudart <jean.gaudart@univ-amu.fr>

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306

- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```

data(dataMALARIA)
#Example : number of malaria episodes per child at each household,
           #from November to December 2009, Bandiagara, Mali.
#Copyright: Pr Ogobara Doumbo, MRTC, Bamako, Mali. email: okd[at]icermali.org
coordinates(dataMALARIA)<-c("x","y")
class(dataMALARIA)
proj4string(dataMALARIA)<-"+proj=longlat +datum=WGS84 +ellps=WGS84"
dataMALARIA<-spTransform(dataMALARIA, CRS("+proj=merc +datum=WGS84 +ellps=WGS84"))

gr<-0.07 #graft parameter
rtw<-0.01 #rtwo.min
parm<-25 #min.parent
childm<-2 #min.child
lmx<-7

sp<-spodt(dataMALARIA@data[,2]~1, dataMALARIA, weight=TRUE, graft=gr, min.ch=childm,
           min.parent=parm, level.max=lmx, rtwo.min=rtw)

spodt.tree(sp)

ssp<-spodtSpatialLines(sp,dataMALARIA)
plot(ssp)
points(dataMALARIA,cex=log(dataMALARIA@data$z*10))

#test.spodt(dataMALARIA@data[,2]~1, dataMALARIA, sp@R2, "rpois",
#           c(length(dataMALARIA@data$loc),mean(dataMALARIA@data$z)), 10,
#           weight=TRUE, graft=gr, level.max=lmx, min.parent=parm,
#           min.child=childm,rtwo.min=rtw)

#the warning "root is a leaf" tells that no split can be provided by the
#spodt function according to the splitting parameters

```

dataBALL0

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a ball shape situation: No cluster situation.

Usage

```
data(dataBALL0)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector
 x a numeric vector
 y a numeric vector
 z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataBALL0)
dataset<-dataBALL0
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

`dataBALL0_5`*Example data file*

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a ball shape situation: Clustered data with moderate high values outside a ball shape.

Usage

```
data(dataBALL0_5)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector
x a numeric vector
y a numeric vector
z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataBALL0_5)
dataset<-dataBALL0_5
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

dataBALL1_5

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a ball shape situation: Clustered data with high values outside a ball shape.

Usage

```
data(dataBALL1_5)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector
x a numeric vector
y a numeric vector
z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataBALL1_5)
dataset<-dataBALL1_5
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

dataBALL2

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a ball shape situation: Clustered data with very high values outside a ball shape.

Usage

```
data(dataBALL2)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector

x a numeric vector

y a numeric vector

z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataBALL2)
dataset<-dataBALL2
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

dataCOV

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect 6 situations evolving through time: rotated square cluster (2 situations), no cluster (2 situations), and V-border shapes (2 situations).

Usage

```
data(dataCOV)
```

Format

A data frame with 1800 observations on the following 6 variables (300 locations).

i a numeric vector

x a numeric vector

y a numeric vector

z a numeric vector

V1 a numeric vector

V2 a factor with levels ("sq2", "sq1.5", "sq0", "v0", "v1.5", "v2")

Details

- *i*: identification of each localization.
- *x*: longitudinal coordinate.
- *y*: latitudinal coordinate.
- *z*: the dependant variable.
- *V1*: a numeric cofactor (1 to 6) to be split according to a non oblique algorithm.
- *V2*: a qualitative variable to be split according to a non oblique algorithm (6 levels).

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
#data(dataCOV)
#dataset<-dataCOV
#coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area with a covariable analysis
#sp<-spodt(dataset@data$z~V1, dataset, weight=FALSE, graft=0,
```

```
# min.ch=150, min.parent=200, level.max=3, rtwo.min=0.15)
#spodt.tree(sp)
```

dataMALARIA

Example data file

Description

Field observation data. To assess the SpODT algorithm analysing the number of malaria episodes per child at each household, from November to December 2009, Bandiagara, Mali. Copyright: Pr Ogobara Doumbo, MRTC, Bamako, Mali. email: okd[at]icermali.org

Usage

```
data(dataMALARIA)
```

Format

A data frame with 168 observations on the following 4 variables (168 locations).

loc a numeric vector

x a numeric vector

y a numeric vector

z a numeric vector

Details

- loc: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. *International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.*

Examples

```

data(dataMALARIA)
#Example : number of malaria episodes per child at each household,
            #from November to December 2009, Bandiagara, Mali.
#Copyright: Pr Ogobara Doubo, MRTC, Bamako, Mali. email: okd[at]icermali.org
coordinates(dataMALARIA)<-c("x","y")
class(dataMALARIA)
proj4string(dataMALARIA)<-"+proj=longlat +datum=WGS84 +ellps=WGS84"
dataMALARIA<-spTransform(dataMALARIA, CRS("+proj=merc +datum=WGS84 +ellps=WGS84"))

gr<-0.07 #graft parameter
rtw<-0.01 #rtwo.min
parm<-25 #min.parent
childm<-2 #min.child
lmx<-7

sp<-spodt(dataMALARIA@data[,2]~1, dataMALARIA, weight=TRUE, graft=gr, min.ch=childm,
           min.parent=parm, level.max=lmx, rtwo.min=rtw)

ssp<-spodtSpatialLines(sp,dataMALARIA)
plot(ssp)
points(dataMALARIA,cex=log(dataMALARIA@data$z*10))

```

dataSQUARE0

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a rotated square shape situation: No cluster situation.

Usage

```
data(dataSQUARE0)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector

x a numeric vector

y a numeric vector

z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataSQUARE0)
dataset<-dataSQUARE0
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)

#the warning "root is a leaf" tells that no split can be provided by the
#spodt function according to the splitting parameters
```

dataSQUARE0_5

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a rotated square shape situation: moderate high values within a rotated square cluster.

Usage

```
data(dataSQUARE0_5)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector
 x a numeric vector
 y a numeric vector
 z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataSQUARE0_5)
dataset<-dataSQUARE0_5
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

`dataSQUARE1_5`*Example data file*

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a rotated square shape situation: high values within a rotated square cluster.

Usage

```
data(dataSQUARE1_5)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector
x a numeric vector
y a numeric vector
z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. *International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.*

Examples

```
data(dataSQUARE1_5)
dataset<-dataSQUARE1_5
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

dataSQUARE2

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a rotated square shape situation: very high values within a rotated square cluster.

Usage

```
data(dataSQUARE2)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector
x a numeric vector
y a numeric vector
z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataSQUARE2)
dataset<-dataSQUARE2
coordinates(dataset)<-c("x", "y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

dataV0

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a V-shape situation: no cluster.

Usage

```
data(dataV0)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector

x a numeric vector

y a numeric vector

z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataV0)
dataset<-dataV0
coordinates(dataset)<-c("x", "y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

dataV0_5

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a V-shape situation: moderate high values under a V-shape border.

Usage

```
data(dataV0_5)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector

x a numeric vector

y a numeric vector

z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataV0_5)
dataset<-dataV0_5
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

dataV1_5	<i>Example data file</i>
----------	--------------------------

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a V-shape situation: high values under a V-shape border.

Usage

```
data(dataV1_5)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector
x a numeric vector
y a numeric vector
z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. *International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.*

Examples

```
data(dataV1_5)
dataset<-dataV1_5
coordinates(dataset)<-c("x","y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

dataV2

Example data file

Description

Simulated data for SPODT functions. To assess the SpODT algorithm to detect a V-shape situation: very high values under a V-shape border.

Usage

```
data(dataV2)
```

Format

A data frame with 300 observations on the following 4 variables (300 locations).

i a numeric vector
x a numeric vector
y a numeric vector
z a numeric vector

Details

- i: identification of each localization.
- x: longitudinal coordinate.
- y: latitudinal coordinate.
- z: the dependant variable.

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

Examples

```
data(dataV2)
dataset<-dataV2
coordinates(dataset)<-c("x", "y")
#coordinates are planar ones
#Example : split the area without covariable analysis
sp<-spodt(dataset@data$z~1, dataset, weight=FALSE, graft=0.2)

ssp<-spodtSpatialLines(sp,dataset)
plot(ssp)
points(dataset,cex=dataset@data$z)
```

spodt

Spatial Oblique Decision Tree main function

Description

The spodt function provides a spatial partitioning.

Usage

```
spodt(formula, data, weight = FALSE, graft = 0,
      level.max = 5, min.parent = 10, min.child = 5, rtwo.min = 0.001)
```

Arguments

`formula` a [formula](#), with a response but no interaction terms. The left hand side has to contain the quantitative response variable. The right hand side should contain the quantitative and qualitative variables to be split according to a non oblique algorithm. For single spatial analysis (with no cofactor) the right hand side should be `~1`.

<code>data</code>	a <code>SpatialPointsDataFrame</code> containing the coordinates and the variables. <code>spodt</code> needs planar coordinates. Geographic coordinates have to be projected. Otherwise, euclidian coordinates can be used.
<code>weight</code>	logical value indicating whether the interclass variances should be weighted or not.
<code>graft</code>	if not equals to 0, a numerical value in]0;1] indicating the minimal modification of <code>R2global</code> requires to grafted the final classes.
<code>level.max</code>	the maximal level of the regression tree above which the splitting algorithm is stopped.
<code>min.parent</code>	the minimal size of a node below which the splitting algorithm is stopped.
<code>min.child</code>	the minimal size of the children classes below which the split is refused and algorithm is stopped.
<code>rtwo.min</code>	the minimal value of R2 above which the node split is refused and algorithm is stopped. Specified as a numerical value between 0 and 1.

Value

The `spodt` function computes an object of class `spodt` with the different components of the classification tree, i.e. i) at each step: the point locations within each class, the R2 coefficients of the splitting line; ii) global results: the `R2global` (`object@R2`), the final partition (`object@partition`) including the graft results.

Author(s)

Jean Gaudart, Nathalie Graffeo, Guillaume Barbet, Bernard Fichet, Roch Giorgi (Aix-Marseille University)

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

See Also

[spodt.tree](#), [spodtSpatialLines](#), [test.spodt](#)

Examples

```

data(dataMALARIA)
#Example : number of malaria episodes per child at each household,
#           #from November to December 2009, Bandiagara, Mali.
#Copyright: Pr Ogobara Doumbo, MRTC, Bamako, Mali. email: okd[at]licermali.org
coordinates(dataMALARIA)<-c("x","y")
class(dataMALARIA)
proj4string(dataMALARIA)<-"+proj=longlat +datum=WGS84 +ellps=WGS84"
dataMALARIA<-spTransform(dataMALARIA, CRS("+proj=merc +datum=WGS84 +ellps=WGS84"))

gr<-0.07 #graft parameter
rtw<-0.01 #rtwo.min
parm<-25 #min.parent
childm<-2 #min.child
lmx<-7

sp<-spodt(dataMALARIA@data[,2]~1, dataMALARIA, weight=TRUE, graft=gr, min.ch=childm,
          min.parent=parm, level.max=lmx, rtwo.min=rtw)

sp
sp@R2

#the warning "root is a leaf" tells that no split can be provided by the
# spodt function according to the splitting parameters

```

spodt-class

Class "spodt" Spatial Oblique Decision Tree object

Description

This class of objects is returned by the "spodt" function to represent a spatial oblique decision tree model.

Slots

racine: Object of class "virtual.spodt" the root of the tree
R2: Object of class "numeric" the explained variance coefficient issued from a split
partition: Object of class "vector" the final partition issued from the "spodt" function
adj: Object of class "matrix" adjacence matrix between spatial classes in a partition. Used for the grafting function
cl.grf: Object of class "matrix" class matrix after grafting
sgmts.grf: Object of class "matrix" border of each class to be grafted
brd: Object of class "matrix" all spatial borders

Author(s)

Jean Gaudart, Nathalie Graffeo, Guillaume Barbet, Bernard Fichet, Roch Giorgi (Aix-Marseille University)

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

See Also

[spodt](#), [spodt.tree](#), [spodtSpatialLines](#), [test.spodt](#)

Examples

```
showClass("spodt")
```

spodt.tree

Spatial Classification Tree

Description

This graphical function provides the tree issued from the `spodt` function.

Usage

```
spodt.tree(object)
```

Arguments

`object` `object` is an object of class `spodt`, usually, a result of a call to `spodt`.

Value

Each step of the classification are presented with main statistics. For graphical convenience, grafted classes are not presented but only indicated by class id number.

Author(s)

Jean Gaudart, Nathalie Graffeo, Guillaume Barbet, Bernard Fichet, Roch Giorgi (Aix-Marseille University)

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

See Also

[spodt](#), [spodtSpatialLines](#), [test.spodt](#)

Examples

```
data(dataMALARIA)
#Example : number of malaria episodes per child at each household,
           #from November to December 2009, Bandiagara, Mali.
#Copyright: Pr Ogobara Doumbo, MRTC, Bamako, Mali. email: okd[at]licermali.org
coordinates(dataMALARIA)<-c("x","y")
class(dataMALARIA)
proj4string(dataMALARIA)<-"+proj=longlat +datum=WGS84 +ellps=WGS84"
dataMALARIA<-spTransform(dataMALARIA, CRS("+proj=merc +datum=WGS84 +ellps=WGS84"))

gr<-0.07 #graft parameter
rtw<-0.01 #rtwo.min
parm<-25 #min.parent
childm<-2 #min.child
lmx<-7

sp<-spodt(dataMALARIA@data[,2]~1, dataMALARIA, weight=TRUE, graft=gr, min.ch=childm,
           min.parent=parm, level.max=lmx, rtwo.min=rtw)
spodt.tree(sp)
```

spodtSpatialLines

Boundaries of the spatial classification issued from SPODT

Description

This function creates a SpatialLines object that contains the boundaries of the spatial classification issued from the spodt function.

Usage

```
spodtSpatialLines(object, data)
```

Arguments

object	an object of class <code>spodt</code> , usually, a result of a call to <code>spodt</code> .
data	a <code>SpatialPointsDataFrame</code> containing the coordinates and the variables. <code>spodt</code> needs planar coordinates. Geographic coordinates have to be projected. Otherwise, euclidian coordinates can be used.

Value

A `SpatialLines` object that contains the boundaries of the spatial classification issued from the `spodt` function.

Author(s)

Jean Gaudart, Nathalie Graffeo, Guillaume Barbet, Bernard Fichet, Roch Giorgi (Aix-Marseille University)

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

See Also

[spodt](#), [spodt.tree](#), [test.spodt](#)

Examples

```
data(dataMALARIA)
#Example : number of malaria episodes per child at each household,
#          #from November to December 2009, Bandiagara, Mali.
#Copyright: Pr Ogobara Doumbo, MRTC, Bamako, Mali. email: okd[at]licermali.org
coordinates(dataMALARIA)<-c("x","y")
class(dataMALARIA)
proj4string(dataMALARIA)<-"+proj=longlat +datum=WGS84 +ellps=WGS84"
dataMALARIA<-spTransform(dataMALARIA, CRS("+proj=merc +datum=WGS84 +ellps=WGS84"))
```

```

gr<-0.07 #graft parameter
rtw<-0.01 #rtwo.min
parm<-25 #min.parent
childm<-2 #min.child
lmx<-7

sp<-spodt(dataMALARIA@data[,2]~1, dataMALARIA, weight=TRUE, graft=gr, min.ch=childm,
          min.parent=parm, level.max=lmx, rtwo.min=rtw)

ssp<-spodtSpatialLines(sp,dataMALARIA)
plot(ssp)
points(dataMALARIA,cex=log(dataMALARIA@data$z*10))

```

test.spodt

Monte Carlo hypothesis test of the SPODT classification

Description

The test.spodt function provides Monte Carlo hypothesis test of the final classification issued from the spodt function. This function performs simulations of the specified null hypothesis and the classification of each simulated data set, using the same rules than the observed dataset classification.

Usage

```

test.spodt(formula, data, R2.obs, rdist, par.rdist, nb.sim,
           weight=FALSE, graft=0, level.max=5, min.parent=10,
           min.child=5, rtwo.min=0.001)

```

Arguments

formula	a formula , with a response but no interaction terms. The left hand side has to contain the quantitative response variable. The right hand side should contain the quantitative and qualitative variables to be split according to a non oblique algorithm. For single spatial analysis (with no cofactor) the right hand side should be ~1.
data	a SpatialPointsDataFrame containing the coordinates and the variables. spodt needs planar coordinates. Geographic coordinates have to be projected. Otherwise, euclidian coordinates can be used.
R2.obs	the R2global issued from the previous spodt final classification of the observed dataset. Specified as a numerical value between 0 and 1.
rdist	a description of the distribution of the dependent variable under the null hypothesis. This can be a character string naming a random generation of a specified distribution, such as "rnorm"(Gaussian distribution), "rpois" (Poisson distribution), "rbinom" (binomial distribution), "runif" (uniform distribution)

par.rdist	a list of the parameters needed for the random generation, depending on the null hypothesis distribution, such as $c(n, mean, sd)$ (Gaussian distribution), $c(n, lambda)$ (Poisson distribution), $c(n, size, prob)$ (binomial distribution), $c(n, min, max)$ (uniform distribution)
nb.sim	the number of simulation, specified as a positive integer.
weight	logical value indicating whether the interclass variances should be weighted or not.
graft	if not equals to 0, a numerical value in]0;1] indicating the minimal modification of R2global requires to grafted the final classes.
level.max	the maximal level of the regression tree above which the splitting algorithm is stopped.
min.parent	the minimal size of a node below which the splitting algorithm is stopped.
min.child	the minimal size of the children classes below which the split is refused and algorithm is stopped.
rtwo.min	the minimal value of R2 above which the node split is refused and algorithm is stopped. Specified as a numerical value between 0 and 1.

Value

The `test.spodt` function computes classification trees for simulated dataset. It provides the `R2global` empirical distribution under the null hypothesis, compared to the observed `R2global`, and a p-value.

Author(s)

Jean Gaudart, Nathalie Graffeo, Guillaume Barbet, Bernard Fichet, Roch Giorgi (Aix-Marseille University)

References

- Gaudart J, Graffeo N, Coulibaly D, Barbet G, Rebaudet S, Dessay N, Doumbo O, Giorgi R. SPODT: An R Package to Perform Spatial Partitioning. *Journal of Statistical Software* 2015;63(16):1-23. <http://www.jstatsoft.org/v63/i16/>
- Gaudart J, Poudiougou B, Ranque S, Doumbo O. Oblique decision trees for spatial pattern detection: optimal algorithm and application to malaria risk. *BMC Medical Research Methodology* 2005;5:22
- Gaudart J, Giorgi R, Poudiougou B, Toure O, Ranque S, Doumbo O, Demongeot J. Detection de clusters spatiaux sans point source predefini: utilisation de cinq methodes et comparaison de leurs resultats. *Revue d'Epidemiologie et de Sante Publique* 2007;55(4):297-306
- Fichet B, Gaudart J, Giusiano B. Bivariate CART with oblique regression trees. International conference of Data Science and Classification, International Federation of Classification Societies, Ljubljana, Slovenia, July 2006.

See Also

[spodt](#), [spodt.tree](#), [spodtSpatialLines](#)

Examples

```

data(dataMALARIA)
#Example : number of malaria episodes per child at each household,
#           #from November to December 2009, Bandiagara, Mali.
#Copyright: Pr Ogobara Doumbo, MRTC, Bamako, Mali. email: okd[at]licermali.org
coordinates(dataMALARIA)<-c("x","y")
class(dataMALARIA)
proj4string(dataMALARIA)<-"+proj=longlat +datum=WGS84 +ellps=WGS84"
dataMALARIA<-spTransform(dataMALARIA, CRS("+proj=merc +datum=WGS84 +ellps=WGS84"))

gr<-0.07 #graft parameter
rtw<-0.01 #rtwo.min
parm<-25 #min.parent
childm<-2 #min.child
lmx<-7

sp<-spodt(dataMALARIA@data[,2]~1, dataMALARIA, weight=TRUE, graft=gr, min.ch=childm,
           min.parent=parm, level.max=lmx, rtwo.min=rtw)

#to test the previous split using Monte-Carlo approach, and hypothesing a
#Poisson distribution of the dependant variable through the area
test.spodt(dataMALARIA@data[,2]~1, dataMALARIA, sp@R2, "rpois",
           c(length(dataMALARIA@data$loc),mean(dataMALARIA@data$z)), 10,
           weight=TRUE, graft=gr, level.max=lmx, min.parent=parm,
           min.child=childm,rtwo.min=rtw)

#the warning "root is a leaf" tells that no split can be provided by the
#spodt function according to the splitting parameters

```

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