Package 'STMedianPolish'

June 22, 2015

Type Package

Title Spatio-Temporal Median Polish

Version 0.1

Date 2015-06-21

Author William Martinez, Carlos Melo <cmelo@udistrital.edu.co>

Maintainer William Martinez <willimarti2008@gmail.com>

Depends R (>= 2.15.0), maptools, reshape2, sp, spacetime, zoo

Description Analysis by spatio-temporal data using the decomposition in n-dimensional arrays and using median polish technique.

License GPL (>= 2)

LazyData true

Encoding latin1

NeedsCompilation no

Repository CRAN

Date/Publication 2015-06-22 01:52:24

R topics documented:

`ConstructMPst` *Construct Spatio - temporal regular data.*

Description

Create an spatio - temporal object with regular data to order employing median polish technique.

Usage

```
ConstructMPst(valuest,time,pts,Delta)
```

Arguments

`valuest`	it's a data.frame in which different columns refer to different locations, and each row reflects a particular observation time.
`time`	indicate the time of valuest, the intervals of time must be regular.
`pts`	it's a data.frame that hold three dimensions spatial coordinates `x`, `y` and `z`.
`Delta`	vector with number of divisions of each spatial direction. c(Delta `x`, Delta `y`, Delta `z`).

Details

Table composed for coordinates of center and average of position of stations for unit tridimensional array in space - time, in which show a average value of site.

Value

An object of class ConstructMPst with the following list of components:

`results`	average value of the set of stations into unity spatio - temporal defined for delta.
`Value`	array with the results organized in dimensions defined in Delta.
`valuest`	valuest
`pts`	pts
`time`	time
`Delta`	Delta

References

Berke, O. (2001). *Modified median polish kriging and its application to the wolfcamp - aquifer data.* Environmetrics, 12(8):731-748.[link]

Examples

```
## Not run:
data(Metadb)
x<-matrix(0,1,37)
for(i in 1:37){
 x[,i] <- 2007 + (seq(0, 36)/12)[i]
}
x<-as.Date (as.yearmon(x), frac = 1)
time = as.POSIXct(x, tz = "GMT")

MPST<-ConstructMPst(Metadb[,-c(1:4)],time,pts=Metadb[,2:4],Delta=c(7,6,5))
## End(Not run)
```

DemMeta *Digital Elevation Model Resolution 90 meters.*

Description

Digital elevation model with resolution 250 meters of Hydrogeological zone west of Meta river. Spatial reference system: Datum Magna Sirgas Origen Bogota.

Usage

```
data(DemMeta)
```

Format

The format is: Formal class 'SpatialGridDataFrame' [package "sp"]

Source

http://gdem.ersdac.jspacesystems.or.jp/search.jsp

Examples

```
data(DemMeta)
Gridxy<- spsample(DemMeta, cellsize=2000, n=300,"regular")
plot(Gridxy)
```

HZRMeta *Hydrogeological zone west of Meta river.*

Description

Map of hydrogeological zone west of Meta river. Spatial reference system: Datum Magna Sirgas Origen Bogota.

Usage

```
data(HZRMeta)
```

Format

The format is: Formal class 'SpatialPolygonsDataFrame' [package "sp"]

Source

http://www.arcgis.com/home/item.html?id=103b63dcc9f448acbd63f22b728b1a02

Examples

```
data(HZRMeta)
Gridxy<- spsample(HZRMeta, cellsize=2000, n=300,"regular")
plot(Gridxy)
```

MedianPolishM *Median polish multidimensional.*

Description

Fits an additive model for multidimensional array, using Tukey's median polish procedure.

Usage

```
MedianPolishM(data, ...)
```

Arguments

data	object of class array, table, or matrix, see details.
...	default arguments, see MedianPolishM.default

Details

The function MedianPolishM is generic. See the documentation for MedianPolishM.default for further details.

Value

An object of class medpolish with the following named components in a list:

`residuals`	the residuals.
`overall`	the fitted constant term.
`effects`	the fitted every dimensions effects fo array multidimensional.
`iter`	number of iterations used in the range maxiter.

References

Hoaglin, D. C., Mosteller, F., & Tukey, J. W. (Eds.). (2011). *Exploring data tables, trends, and shapes* (Vol. 101). John Wiley & Sons.[link]

`MedianPolishM.ConstructMPst`

Median polish multidimensional.

Description

Fits an additive model for multidimensional array, using Tukey's median polish procedure.

Usage

```
## S3 method for class 'ConstructMPst'
MedianPolishM(data, eps, maxiter, na.rm, ...)
```

Arguments

`data`	class `ConstructMPst`.
`eps`	real number greater than `0`, default 0.01. A tolerance for convergence: see Details
`maxiter`	the maximum number of iterations. Default 10.
`na.rm`	logical. If the data contains NA's. Default TRUE.
`...`	ignored.

Details

The model fitted is additive $\mu + \alpha_a + \beta_b + \xi_c + \tau_t$, where μ is an overall mean, α_a is the a-th row effect, β_b is the effect b-th column effect, ξ_c is the c-th layer effect, τ_t is the t-th time effect. The algorithm works by alternately removing medians of every spatio - temporal dimensions, and continues until the proportional reduction in the sum of absolute residuals is less than eps or until there have been maxiter iterations. If na.rm is FALSE the presence of any NA value in x will cause an error, otherwise NA values are ignored. MedianPolishM returns an object of class MedianPolishM (see below). There is a plotting method for this class, `plot.MedianPolishM`.

Value

An object of class medpolish with the following named components in a list:

`residuals`	the residuals.
`overall`	the fitted constant term.
`effects`	the fitted every space - time effects.
`iter`	number of iterations used in the range maxiter.

References

Hoaglin, D. C., Mosteller, F., & Tukey, J. W. (Eds.). (2011). *Exploring data tables, trends, and shapes* (Vol. 101). John Wiley & Sons.[link]

`MedianPolishM.default` *Median polish multidimensional.*

Description

Fits an additive model for multidimensional array, using Tukey's median polish procedure.

Usage

```
## Default S3 method:
MedianPolishM(data, eps = 0.01, maxiter = 10L,
  na.rm = TRUE, ...)
```

Arguments

`data`	object of class array, table, or matrix, see details.
`eps`	real number greater than `0`, default 0.01. A tolerance for convergence: see Details
`maxiter`	the maximum number of iterations. Default 10.
`na.rm`	logical. If the data contains NA's. Default TRUE.
`...`	ignored.

Details

the model fitted is additive $constant + dim_1 + dim_2 + \cdots + dim_n$. The algorithm works by alternately removing medians of $dim_1, \cdots, dim_n$, and continues until the proportional reduction in the sum of absolute residuals is less than eps or until there have been maxiter iterations. If na.rm is FALSE the presence of any NA value in x will cause an error, otherwise NA values are ignored. MedianPolishM returns an object of class MedianPolishM (see below). There are a plotting method for this class, `plot.MedianPolishM`.

Value

An object of class medpolish with the following named components in a list:

`residuals`	the residuals.
`overall`	the fitted constant term.
`effects`	the fitted every dimensions effects of array multidimensional.
`iter`	number of iterations used in the range maxiter.

References

Hoaglin, D. C., Mosteller, F., & Tukey, J. W. (Eds.). (2011). *Exploring data tables, trends, and shapes* (Vol. 101). John Wiley & Sons.[link]

Examples

```
A<-MedianPolishM(UCBAdmissions, eps=0.1, maxiter=2, na.rm=TRUE)
plot(A)
```

Metadb *Monthly precipitation Meta.*

Description

Records of 102 pluviometrics station of the 'Instituto de Hidrologia, Meteorologia y Estudios Ambientales de Colombia' (IDEAM), to the west of hidrological zone Meta river. Every station has 37 records of the precipitation monthly from january 2007 to january 2010.

Usage

```
data(Metadb)
```

Format

The format is: formal class 'data.frame'

Source

http://www.ideam.gov.co/

Examples

```
data(Metadb)
str(Metadb)
names(Metadb)
```

Mpplot *Traces of the space.*

Description

Plot of three - dimensional perspective spatial, divides every window into quadrats defined for delta (see ConstructMPst) and counts the numbers of points in each quadrat.

Usage

```
Mpplot(MpData)
```

Arguments

MpData	object of class ConstructMPst.

Value

Graphic in three perspectives the space data "x", "y", "z" with divisions that containing the number of points in each quadrat.

Examples

```
data(Metadb)
x<-matrix(0,1,37)
for(i in 1:37){
 x[,i] <- 2007 + (seq(0, 36)/12)[i]
}
x<-as.Date (as.yearmon(x), frac = 1)
time = as.POSIXct(x, tz = "GMT")

MPST<-ConstructMPst(Metadb[,-c(1:4)],time,pts=Metadb[,2:4],Delta=c(7,6,5))
Mpplot(MPST)
```

plot.MedianPolishM *Plot Median polish multidimensional.*

Description

Plot the effects of an additive model for multidimensional array, using Tukey's median polish procedure.

Usage

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

Arguments

x	object of class MedianPolishM.
...	ignored.

Details

The object of class MedianPolish has a list of components of effects that allow to graphic after each iterations, the behavior of this components. If the medianpolish is apply to data of class ConstructutMPst, this method has a specific graphic for data with space - time variability.

References

Hoaglin, D. C., Mosteller, F., & Tukey, J. W. (Eds.). (2011). *Exploring data tables, trends, and shapes* (Vol. 101). John Wiley & Sons.[link]

Examples

```
A<-MedianPolishM(UCBAdmissions, eps=0.1, maxiter=2, na.rm=TRUE)
plot(A)
```

---

removetrendMPst *Median polish trend*

Description

Direct method to remove trend of spatio - temporal data througth median polish.

Usage

```
removetrendMPst(MPST,eps=0.01, maxiter=10L)
```

Arguments

MPST	object of class ConstructMPst
eps	real number greater than 0, default 0.01. A tolerance for convergence of median polish.
maxiter	the maximum number of iterations. Default 10.

Details

Robust method introduced for Cressie(1993) and enhanced by Berke(2001) to remove trend of a space - time process with data $\{y(\mathbf{s}_{abc}, t), a = 1, ..., U; b = 1, ..., V; c = 1, ..., W, t = 1, ..., n\}$

$$Y(\mathbf{s}_{abc}, t) = \mu_y(\mathbf{s}_{abc}, t) + \delta_{abct}$$

where

$$\mu_y(\mathbf{s}_{abc}, t) = \mu + \alpha_a + \beta_b + \xi_c + \tau_t$$

and δ_{abct} is a fluctuation arising from natural variability and from the measurement process. Additionally, μ is an overall mean, α_a is the a-th row effect, β_b is the effect b-th column effect, ξ_c is the c-th layer effect, τ_t is the t-th time effect.

Value

data.frame with the following fields:

ET	indicate the time of a observation
x	spatial coordinates x
y	spatial coordinates y
z	spatial coordinates z
Trend	trend calculated through median polish space - time
Value	observed values
Residual	$Residual = Value - Trend$

References

Berke, O. (2001). *Modified median polish kriging and its application to the wolfcamp - aquifer data.* Environmetrics, 12(8):731-748.[link]

Cressie, N. (1993). *Statistics for spatial data.* Wiley series in probability and statistics.[link]

Examples

```
## Not run:
data(Metadb)
x<-matrix(0,1,37)
for(i in 1:37){
 x[,i] <- 2007 + (seq(0, 36)/12)[i]
}
x<-as.Date (as.yearmon(x), frac = 1)
time = as.POSIXct(x, tz = "GMT")

MPST<-ConstructMPst(Metadb[,-c(1:4)],time,pts=Metadb[,2:4],Delta=c(7,6,5))
residuals<-removetrendMPst(MPST,eps=0.01, maxiter=2)
## End(Not run)
```

---

splineMPST *Median polish Spline.*

Description

The "splineMPST" is dessigned to represent the variability of effects of spatio - temporal data on a surface, from robust median polish algoritm and planar interpolation.

Usage

```
splineMPST(Grid,Ef_t,MPST,eps, maxiter)
```

Arguments

Grid	grid with the coordinates in space "x", "y", "z", where will be viewed trend.
Ef_t	it's the temporal scenary to look trend.
MPST	object of class ConstructMPst.
eps	real number greater than 0, default 0.01. A tolerance for convergence.
maxiter	the maximum number of iterations, default 10.

Value

Data frame, where columns show the trend in each spatio - temporal location.

References

Berke, O. (2001). *Modified median polish kriging and its application to the wolfcamp - aquifer data.* Environmetrics, 12(8):731-748.[link]

Cressie, N. (1993). *Statistics for spatial data.* Wiley series in probability and statistics.[link]

Examples

```
## Not run:
data(Metadb)
x<-matrix(0,1,37)
for(i in 1:37){
 x[,i] <- 2007 + (seq(0, 36)/12)[i]
}
x<-as.Date (as.yearmon(x), frac = 1)
time = as.POSIXct(x, tz = "GMT")
length(time)

MPST<-ConstructMPst(Metadb[,-c(1:4)],time,pts=Metadb[,2:4],Delta=c(7,6,5))

MpSTData<-MedianPolishM(MPST,eps=0, maxiter=5, na.rm=TRUE)

data(DemMeta)
xy = SpatialPoints(Metadb[,2:4],CRS(proj4string(DemMeta)))

data(HZRMeta)
proj4string(HZRMeta)<-CRS(proj4string(DemMeta))

polygon1 = polygons(HZRMeta)
Gridxy<- spsample(polygon1, cellsize=2000, n=300,"regular")

Grid<-data.frame(Gridxy,over(Gridxy,DemMeta))
colnames(Grid)<-c("East", "North","height")

TendenciaGrilla<-splineMPST(Grid,Ef_t=time[10:15],MPST,eps=0.01, maxiter=2)
```

```
IDs = paste("ID",1:length(TendenciaGrilla[,5]))
mydata = data.frame(values = TendenciaGrilla[,5], ID=IDs)
wind.ST1 = STFDF(SpatialPixels(Gridxy),time[10:15],mydata)
stplot(wind.ST1,col.regions=bpy.colors(40),par.strip.text = list(cex=0.7)
      ,main="Spline median polish: Monthly Precipitation")
## End(Not run)
```

Index