Package 'spatialClust'

September 3, 2016

Type Package

Title Spatial Clustering using Fuzzy Geographically Weighted Clustering

Version 1.1.1

Author Imam Habib Pamungkas and Setia Pramana

Maintainer Imam Habib Pamungkas <imamhabibpamungkas@gmail.com>

Description Perform Spatial Clustering Analysis using Fuzzy Geographically Weighted Clustering. Provide optimization using Gravitational Search Algorithm.

Depends rgeos (>= 0.3-15), sp (>= 1.1-0), ggplot2 (>= 2.0.0), maptools (>= 0.8-37), R(>= 2.10.0)

License GPL-2

LazyData TRUE

RoxygenNote 5.0.1

Repository CRAN

Repository/R-Forge/Project spatialclust

Repository/R-Forge/Revision 12

Repository/R-Forge/DateTimeStamp 2016-09-03 02:39:23

Date/Publication 2016-09-03 10:01:14

NeedsCompilation no

R topics documented:

dist 2
example 2
fgwc 3
fgwc.gsa 4
map 6
population 7
scale 7
spClustIndex 8
visualize 9

Index 11

`dist` *distance data.*

Description

Contains distance matrix all region in Central Java Data take from Central Java shapefile source: bps.go.id

Usage

```
dist
```

Format

An object of class `matrix` with 35 rows and 35 columns.

`example` *data example.*

Description

Educational Data of Central Java in 2014 source: jateng.bps.go.id - educational data publication

Usage

```
example
```

Format

A data frame with twelve variables

fgwc *Fuzzy Geographically Weighted Clustering (FGWC)*

Description

This function used to perform Fuzzy Geographically Weighted Clustering of X dataset.

Usage

```
fgwc(X, population, distance, K = 2, m = 2, beta = 0.5, a = 1, b = 1,
  max.iteration = 100, threshold = 10^-5, RandomNumber = 0)
```

Arguments

X	data frame n x p
population	dataset 1 x n number of population each region (row)
distance	shapefile or distance matrik n x n
K	specific number of cluster (must be >1)
m	fuzzifier / degree of fuzziness
beta	proportion of geographically effect (if 0 equal Fuzzy C-Means)
a	power for increase population effect
b	power for increase distance effect
max.iteration	maximum iteration to convergence
threshold	threshold of convergence
RandomNumber	specific seed

Details

This function perform Fuzzy Geographically Weighted Clustering by G.A Mason and R.Jacobson (2007). Fuzzy Geographically Weighted Clustering is one of fuzzy clustering methods to clustering dataset become K cluster. Number of cluster (K) must be greater than 1. To control the overlaping or fuzziness of clustering, parameter m must be specified. Maximum iteration and threshold is specific number for convergencing the cluster. Random Number is number that will be used for seeding to firstly generate fuzzy membership matrix. population dataset, shapefile or distance matrix is used to give geographically weighted for membership matrix.

Clustering will produce fuzzy membership matrix (U) and fuzzy cluster centroid (V). The greatest value of membership on data point will determine cluster label. Centroid or cluster center can be use to interpret the cluster. Both membership and centroid produced by calculating mathematical distance. Fuzzy Geographically Weighted Clustering calculate distance with Euclideans norm. So it can be said that cluster will have sperichal shape of geometry.

Value

func.obj objective function that calculated.

U matrix n x K consist fuzzy membership matrix

V matrix K x p consist fuzzy centroid

D matrix n x K consist distance of data to centroid that calculated

Clust.desc cluster description (dataset with additional column of cluster label)

References

G. A. Mason and R. D. Jacobson.(2007). Fuzzy Geographically Weighted Clustering, in Proceedings of the 9th International Conference on Geocomputation, no. 1998, pp. 1-7

Bezdek, J. C., Ehrlich, R., & Full, W. (1984). FCM: The Fuzzy C-Means Clustering Algorithm. Computers and Geosciences Vol 10, 191-203

See Also

`fgwc.gsa` for optimize using Gravitational Search Algorithm, `spClustIndex` for cluser validation, `visualize` for cluster visualizatiion

Examples

```
#load data example
X <- example

#if using matrix distance
distance <- dist

#if using shapefile
#library(rgdal) for call readOGR
#distance <- readOGR(dsn = 'folder/.',"shapefile name")

#load population data
pop <- population

clust <- fgwc(X,pop,distance,K=2,m=1.5,beta=0.5)
```

`fgwc.gsa` *Fuzzy Geographically Weighted Clustering (FGWC) optimized by Gravitational Search Algorithm*

Description

This function used to perform Fuzzy Geographically Weighted Clustering of X dataset. by using this function the initialization phase of FGWC will be optimized using Gravitational Search Algorithm

Usage

```
fgwc.gsa(X, population, distance, K = 2, m = 2, beta = 0.5, a = 1,
  b = 1, max.iteration = 100, threshold = 10^-5, RandomNumber = 0)
```

Arguments

X	data frame n x p
population	dataset 1 x n number of population each region (row)
distance	shapefile or distance matrik n x n
K	specific number of cluster (must be >1)
m	fuzzifier / degree of fuzziness
beta	proportion of geographically effect (if 0 equal Fuzzy C-Means)
a	power for increase population effect
b	power for increase distance effect
max.iteration	maximum iteration to convergence
threshold	threshold of convergence
RandomNumber	specific seed

Details

This function perform Fuzzy Geographically Weighted Clustering optimized using Gravitational Search Algorithm(GSA). using this method the initilitation phase will be handle by GSA to get optimal result. Number of cluster (K) must be greater than 1. To control the overlaping or fuzziness of clustering, parameter m must be specified. Maximum iteration and threshold is specific number for convergencing the cluster. Random Number is number that will be used for seeding to firstly generate fuzzy membership matrix. population dataset, shapefile or distance matrix is used to give geographically weighted for membership matrix.

Clustering will produce fuzzy membership matrix (U) and fuzzy cluster centroid (V). The greatest value of membership on data point will determine cluster label. Centroid or cluster center can be use to interpret the cluster. Both membership and centroid produced by calculating mathematical distance. Fuzzy Geographically Weighted Clustering calculate distance with Euclideans norm. So it can be said that cluster will have sperichal shape of geometry.

Value

func.obj objective function that calculated.

U matrix n x K consist fuzzy membership matrix

V matrix K x p consist fuzzy centroid

D matrix n x K consist distance of data to centroid that calculated

Clust.desc cluster description (dataset with additional column of cluster label)

References

G. A. Mason and R. D. Jacobson.(2007). Fuzzy Geographically Weighted Clustering, in Proceedings of the 9th International Conference on Geocomputation, no. 1998, pp. 1-7

Bezdek, J. C., Ehrlich, R., & Full, W. (1984). FCM: The Fuzzy C-Means Clustering Algorithm. Computers and Geosciences Vol 10, 191-203

Rashedi, E., Nezamabadi-pour, H., & S. Saryazdi. (2009). GSA: A Gravitational Search Algorithm. Information Sciences, vol. 179, no. 13, pp. 2232-224

See Also

`fgwc` for standard Fuzzy Geographically Weighted Clustering, `spClustIndex` for cluser validation, `visualize` for cluster visualizatiion, `scale` for data scalling

Examples

```
#load data example
X <- example

#if using matrix distance
distance <- dist

#if using shapefile
#library(rgdal) for call readOGR
#distance <- readOGR(dsn = 'folder/.',"shapefile name")

#load population data
pop <- population

clust <- fgwc(X,pop,distance,K=2,m=1.5,beta=0.5)
```

`map` *map example.*

Description

Central Java shapefile source: bps.go.id

Usage

```
map
```

Format

A data frame with one variables: `Populasi`

population *population data.*

Description

Contains population data example source: jateng.bps.go.id

Usage

```
population
```

Format

A data frame with one variables: `Populasi`

scale *Data Scalling*

Description

Provide data scalling using z-transform, zero to one scalling and minus one to one scalling

Usage

```
scale(data, method = "zerotoone")
```

Arguments

`data`	matrix data
`method`	scalling technique use "z" for z-transform, "zerotoone" for zero to one scalling and "oneminuseone" minus one to one scalling

Value

scalled matrix data

See Also

`fgwc` for standard Fuzzy Geographically Weighted Clustering, `fgwc.gsa` for optimize using Gravitational Search Algorithm, `spClustIndex` for cluser validation, `visualize` for cluster visualization

Examples

```
#load data
data <- example

#zero to one scalling
data <- scale(data)
data <- scale(data,method="zerotoone")

#z-transform
data <- scale(data,method="z")

#minus one to one scalling
data <- scale(data,method="oneminuseone")
```

`spClustIndex` *Cluster Validity Index*

Description

This function used to validate the clustering result

Usage

```
spClustIndex(fgwc)
```

Arguments

`fgwc`	result(object) from fgwc clustering

Value

validity indeks

See Also

`visualize` for cluster visualizatiion `scale` for data scalling

Examples

```
#load data example
X <- example

#if using matrix distance
distance <- dist

#if using shapefile
#library(rgdal) for call readOGR
#distance <- readOGR(dsn = 'folder/.',"shapefile name")
```

```
#load population data
pop <- population

clust <- fgwc(X,pop,distance,K=2,m=1.5,beta=0.5)

#show cluster validation
spClustIndex(clust)
```

`visualize` *Cluster Visualization*

Description

This function visualize the clustering result

Usage

```
visualize(fgwc)
```

Arguments

`fgwc`	result(object) from fgwc clustering

Value

biPlot

radarPlot

clusterMap

See Also

`spClustIndex` for cluser validation, `scale` for data scalling

Examples

```
#load data example
X <- example

#if using matrix distance
#distance <- dist

#if using shapefile
#library(rgdal) for call readOGR
#distance <- readOGR(dsn = 'folder/.',"shapefile name")
distance <- map
```

```
#load population data
pop <- population

clust <- fgwc(X,pop,distance,K=2,m=1.5,beta=0.5)

#cluster visualization

visualize(clust)
```

Index

∗Topic **datasets**
dist, 2
example, 2
map, 6
population, 7

dist, 2

example, 2

fgwc, 3, *6, 7*
fgwc.gsa, *4*, 4, *7*

map, 6

population, 7

scale, *6*, 7, *8, 9*
spClustIndex, *4*, *6, 7*, 8, *9*

visualize, *4*, *6–8*, 9