Package ‘SocialNetworks’

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Type Package

Title Generates social networks based on distance.

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Author Glenna Nightingale, Peter Nightingale

Maintainer Glenna Nightingale <glenna.evans@gmail.com>

Description Generates social networks using either of two
approaches: using either pairwise distances or territorial area intersections.

License GPL

Imports Rcpp (>= 0.11.0)

LinkingTo Rcpp

NeedsCompilation yes

Repository CRAN

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R topics documented:

`calculate.areas` *Makes a social network based on the xy spatial coordinates provided.*

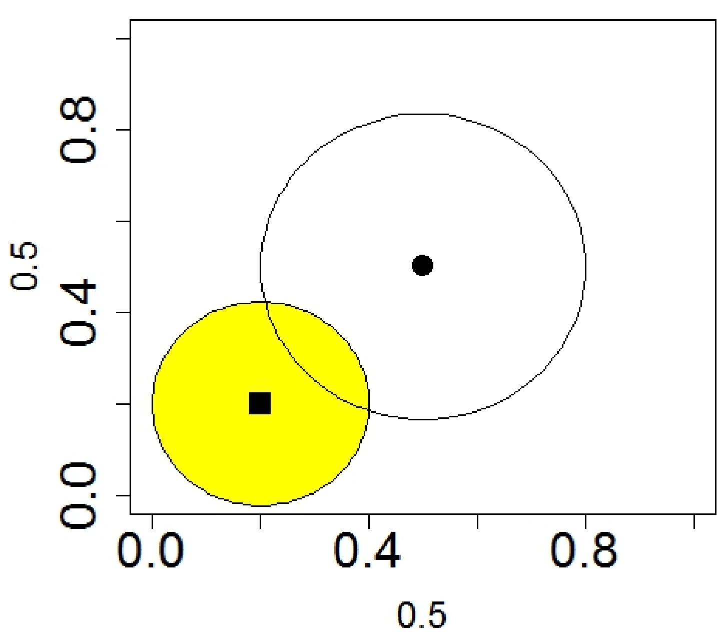
Description

This method uses the area of the intersection between the territorial zones or home bases between each pair of individuals. For a spatial point pattern X, the association of individual j on individual i, Aij, is calculated as the percentage of the overlap of the discs centered at points X_i and X_j of the total area of the territorial area for individual i. The radius for each disc is the inputted interaction radius. The interaction radius for a given population can be identical for each individual, or different. The interaction radius represents the area within which an individual extracts nutrients or exerts its influence, or communicates an action.

The associations calcuated using this method can be asymmetric. In this case, the interaction radii for two given individuals would be different, implying that the proportion of the overlap between the zones for the individuals is different for each individual. As as example, Figure 1 illustrates the effect of different interaction radii per individual. Individual i is represented by the filled square and individual j is represented by the filled circle. The percentage of the overlap between the two territorial zones in the total area of territorial zone i is larger than that in territorial j, suggesting that the effect of individual j on i is greater than that of i on j.

The calculations are done based on a Monte Carlo method.

Figure 1: Territorial zones for individuals i and j



Usage

```
calculate.areas(arg1, arg2, arg3, numpts)
```

Arguments

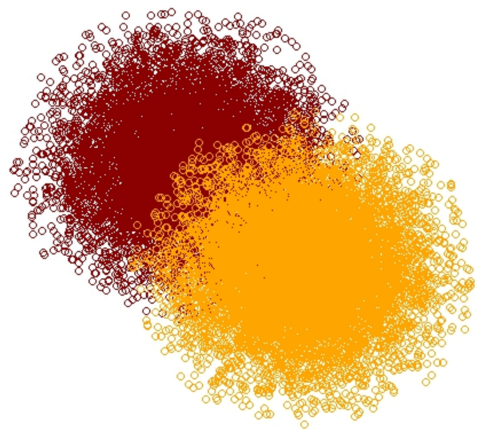
`arg1`	x coordinates for individuals
`arg2`	y coordinates for individuals
`arg3`	interaction radii for each individual (they can all be equal)
`numpts`	number of Monte Carlo simulations #'

`calculate.gradedareas` *Makes a spatially derived social network.*

Description

This method uses the area of the intersection between the territorial zones or home bases between each pair of individuals. For a spatial point pattern X, the association of individual j on individual i, Aij, is calculated as the percentage of the overlap of the discs centered at points X_i and X_j of the total area of the territorial area for individual i. The radius for each disc is the inputted interaction radius. The interaction radius for a given population can be identical for each individual, or different. The interaction radius represents the area within which an individual extracts nutrients or exerts its influence, or communicates an action.

This function is similar to the calculate.areas function. The difference, however, between these two functions is that for this function we assume that the strength of interaction for any given individual gradually decreases with distance. As shown in the cartoon below for two individuals, the discs of points denote two individuals distinguished by colour. As the distance from the center of each disc (the inidividual is located at the center of the disc) decreases, the density of the points (representing the strength of the individual's influence or strength of interaction) decreases also. This is an illustration of the concept of the interaction function that we adopt for



this function. The associations calcuated using this method can be asymmetric. In this case, the interaction radii for two given individuals would be different, implying that the proportion of the overlap between the zones for the individuals is different for each individual. As as example, Figure 1 illustrates the effect of different interaction radii per individual. Individual i is represented by the filled square and individual j is represented by the filled circle. The percentage of the overlap between the two territorial zones in the total area of territorial zone i is larger than that in territorial j, suggesting that the effect of individual j on i is greater than that of i on j.

The calculations are done based on a Monte Carlo method.

Usage

```
calculate.gradedareas(arg1, arg2, arg3, numpts)
```

Arguments

arg1	x coordinates for individuals
arg2	y coordinates for individuals
arg3	interaction radii for each individual (they can all be equal)
numpts	number of Monte Carlo simulations #'

Examples

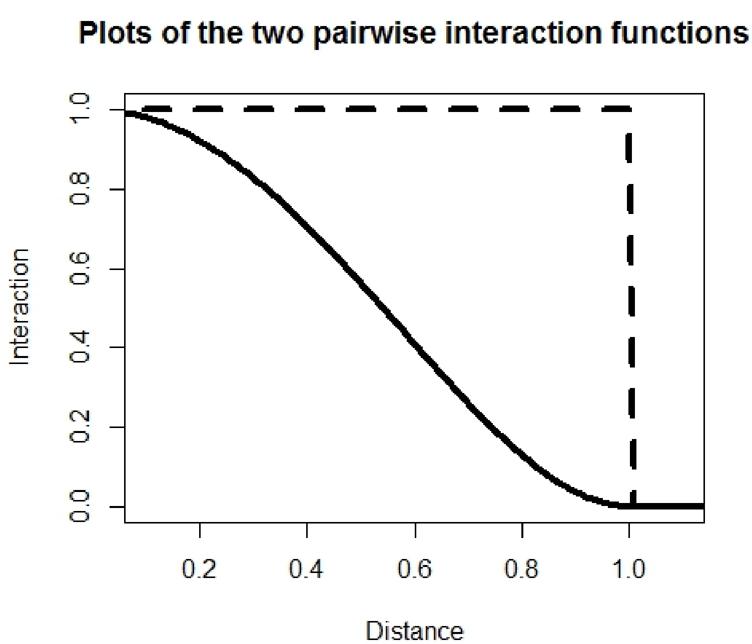
```
a = c(0.4, 0.5, 0.5,0.6)
```

```
b = c(0.1, 0.2, 0.3, 0.4)
d = c(0.1, 0.1, 0.1, 0.1)
e = 1000000
calculate.gradedareas(a,b,d,e)
```

`calculateassociations` *Generates social network based on xy spatial coordinates of individuals.*

Description

This method uses the pairwise distances between each pair of individuals. For a spatial point pattern X, the association of individual j on individual i, Aij, is calculated using the distances between points X_i and X_j using a smooth interaction function first introduced by Illian (2009). If d represents the distance between points X_i and X_j, and the interaction radius for individual i is R_i, then the association of j on i is calculated as: ((1-(d/R_i)^2))^2 if d>0 and d<=R_i, and 0 otherwise. This function has been described as a smooth interaction function because the value of the association calculated decreases smoothly as a function of distance. This is in contrast to associations calcuated using a binary function where the association =1 if d<=R and 0 otherwise. Such a function is based on the assumption that the association is constant (1) at all distances less than R_i, and 0 for distances greater than R_i. The figure below shows a plot of both functions (the binary interaction function is represented by the dotted line) for an example where R=1.



Usage

```
calculateassociations(x, y, ir)
```

Arguments

`x`	a list of x coordinates for all the individuals
`y`	a list of y coordinates for all the individuals
`ir`	a list of interaction radii for all the individuals

References

Illian, Moller, Waagepetersen, 2009. Hierarchical spatial point process analysis for a plant community of high biodiversity.Environ. Ecol. Stat. vol 16, pp 389-405

`SocialNetworks` *Generates social networks*

Description

Generates a social network based on user inputted spatial xy coordinates.

Details

Package:	SocialNetworks
Type:	Package
Version:	1.1
Date:	2014-08-20
License:	GPL

Author(s)

Glenna Nightingale

Peter Nightingale

Maintainer: Glenna Nightingale <glenna.evans@gmail.com>

References

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Hoppitt, W. and Laland, K. N. (2013). Social Learning: An Introduction to Mechanisms, Methods, and Models. Princeton University Press.

Illian, Moller, Waagepetersen, (2009). Hierarchical spatial point process analysis for a plant community of high biodiversity.Environ. Ecol. Stat. vol 16, pp 389-405

Examples

```
#Using pairwise distances to calcualate inter-individual associations
# generate a social network from a regular spatial point pattern ir = 0.06
#---------------------------------------------------------------------------

x = c(0.1023117, 0.1119260, 0.1625270, 0.3594291, 0.4220571, 0.4606205, 0.5927459,
 0.6847543, 0.7065195, 0.7760657, 0.9827536)

y = c(0.2525266, 0.3346728, 0.5275355, 0.2447207, 0.2765606, 0.4999600, 0.5928410,
 0.8356211, 0.2506116, 0.8994760, 0.1432255)

#plot(x,y)
irset = c(rep(0.06,11))
calculateassociations(x,y,irset)


# generate a social network from a clustered spatial point pattern
#------------------------------------------------------------------

 x =
  c(0.77302412, 0.82946034, 0.65776305, 0.62294479, 0.58577335, 0.39332654,
  0.36893684, 0.40518735, 0.53956642, 0.56596859, 0.62802969, 0.10380876,
 0.71058751, 0.65943692, 0.88056259, 0.90567566, 0.91166684, 0.89489341,
 0.92668619, 0.01544599, 0.30499431, 0.28249059, 0.30733518, 0.73165075,
 0.17712420, 0.80869511, 0.77351717, 0.75508022, 0.79445346, 0.73134413,
 0.62448310, 0.60180882, 0.66741081, 0.45884352, 0.45282315, 0.45614636,
 0.45270694, 0.44764728, 0.53259346)


 y=
 c(0.943378357, 0.933698623, 0.123641160, 0.146773076, 0.135097659, 0.978760171,
 0.981407654, 0.937111187, 0.080617391, 0.114438404, 0.061834776, 0.370322731,
 0.036576942, 0.003974257, 0.830356964, 0.837171526, 0.884801445, 0.797794654,
 0.844312417, 0.969982888, 0.672246284, 0.692111852, 0.671098280, 0.999097233,
 0.003736065, 0.255322335, 0.282689074, 0.310793806, 0.229047375, 0.266413304,
 0.324984514, 0.279652338, 0.287134158, 0.331962948, 0.365469720, 0.343868765,
0.378876999, 0.331915785, 0.368805652)
```

```
#plot(x,y)
irset = c(rep(0.05,length(x)))
calculateassociations(x,y,irset)



# generate a social network from a random spatial point pattern
#-----------------------------------------------------------------

  x =
 c( 0.74905296, 0.38309725, 0.98627509, 0.02242039, 0.54703348, 0.59173730,
 0.82340399, 0.18718650, 0.49200511, 0.86098261, 0.24848640, 0.15843825,
0.72875205 )
y  =
 c(0.73521480, 0.01661629, 0.51564570, 0.61856835, 0.20815448, 0.29431260,
 0.35507188, 0.18940107, 0.98721494, 0.98129752, 0.76510267, 0.43541222,
0.04601392)


#plot(x,y)
irset = c(rep(0.1,length(x)))
calculateassociations(x,y,irset)


# Using the area of overlap between territorial zones to calcualate associations
# generate a social network for four individuals, where an interaction radius is
# specified for each individual
# Note that the interaction radius for a group of individuals can be identical
#--------------------------------------------------------------------------------

calculate.areas(c(0.1, 0.2, 0.3,0.4), c(0.1, 0.2, 0.3, 0.4), c(0.1, 0.2, 0.3, 0.4),1000000)
# create a social network for four individuals, with a separate interaction radius
#for each individual
```

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