Package 'GWnnegPCA'

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Type Package

Title Geographically Weighted Non-Negative Principal Components Analysis

Version 0.0.2

Description
Implements a geographically weighted non-negative principal components analysis, which consists of the fusion of geographically weighted and sparse non-negative principal components analyses (Tsutsumida N. et al., (2019) <doi:10.17608/k6.auckland.9850826.v1>).

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Encoding UTF-8

LazyData true

Language en-US

Depends R (>= 3.5.0)

Imports sp, sf, GWmodel, nsprcomp, methods

SystemRequirements C++11, GDAL (>= 2.0.1), GEOS (>= 3.4.0), PROJ (>= 4.8.0)

NeedsCompilation no

Author Narumasa Tsutsumida [aut, cre] (<https://orcid.org/0000-0002-6333-0301>)

Maintainer Narumasa Tsutsumida <rsnaru.jp@gmail.com>

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R topics documented:

gw_nsprcomp *Geographically Weighted non-negative Principal Component Analysis*

Description

Implementation of geographically weighted non-negative principal component analysis, whcih consists of the fusion of GWPCA and sparse non-negative PCA.

Usage

```
gw_nsprcomp(data, elocat, vars, bw, k = 2, kernel, adaptive = TRUE,
          p = 2, theta = 0, longlat = FALSE, dMat = NULL, n.obs = NA,
      n.iter = 1, ncomp = k, nneg = TRUE, localcenter = TRUE, localscale = FALSE,...)
```

Arguments

data	a Spatial*DataFrame either SpatialPointsDataFrame or SpatialPolygonsDataFrame as defined in package sp.
elocat	Same as GWmodel::gwpca. two-column numeric array or Spatial*DataFrame object for providing evaluation locations, i.e. SpatialPointsDataFrame or SpatialPolygonsDataFrame as defined in package sp.
vars	the number of retained components; k must be less than the number of variables.
bw	bandwidth used in the weighting function, possibly calculated by bw.gwpca;fixed (distance) or adaptive bandwidth(number of nearest neighbours).
k	the number of retained components; k must be less than the number of variables
kernel	Same as GWmodel::gwpca. Function chosen as follows: gaussian: wgt = exp(-.5*(vdist/bw)^2); exponential: wgt = exp(-vdist/bw); bisquare: wgt = (1-(vdist/bw)^2)^2 if vdist < bw, wgt=0 otherwise; tricube: wgt = (1-(vdist/bw)^3)^3 if vdist < bw, wgt=0 otherwise; boxcar: wgt=1 if dist < bw, wgt=0 otherwise see help(GWmodel::gw.weight) more detail.
adaptive	if TRUE calculate an adaptive kernel where the bandwidth corresponds to the number of nearest neighbours (i.e. adaptive distance); default is FALSE, where a fixed kernel is found (bandwidth is a fixed distance).
p	the power of the Minkowski distance, default is 2, i.e. the Euclidean distance.
theta	an angle in radians to rotate the coordinate system, default is 0.
longlat	if TRUE, great circle distances will be calculated.
dMat	a pre-specified distance matrix, it can be calculated by the function gw.dist .
n.obs	Number of observations used to find the correlation matrix if using a correlation matrix. Used for finding the goodness of fit statistics. Must be specified if using a correlaton matrix and finding confidence intervals.
n.iter	Same as psych::fa. Number of bootstrap interations to do in fa or fa.poly
ncomp	the number of principal components (PCs) to be computed. With the default setting, PCs are computed until x is fully deflated. ncomp can be specified implicitly if k is given as a vector.

nneg	a logical value indicating whether the loadings should be non-negative, i.e. the PAs should be constrained to the non-negative orthant.
localcenter	If TRUE, local weighted x is centered. The default is TRUE.
localscale	If TRUE, local weighted x is scaled. The default is FALSE.
...	arguments passed to or from other methods.

Value

loadings	The localized loadings
score	The PC score by the localized non-negative PCA.
sdev	The localized standard deviation of the principal components.

Author(s)

N. Tsutsumida

References

Tsutsumida N., Murakami D.,Yoshida T., Nakaya T. Exploring geographically weighted non negative principal component analysis for producing index. The 27th meeting of GIS association of Japan, Tokyo, 20-21 October, 2018 (Japanese), http://www.gisa-japan.org/conferences/proceedings/2018/papers/C52.pdf

Tsutsumida N., Murakami D., Yoshida T., Nakaya T., Lu B., and P. Harris. Geographically Weighted Non-negative Principal Component Analysis for Exploring Spatial Variation in Multidimensional Composite Index, Geocomputation 2019, https://doi.org/10.17608/k6.auckland.9850826.v1

Examples

```
### This example implements the GWnnegPCA for the same data used in the GWmodel example.

library(GWmodel)
data(DubVoter)
Data.scaled <- scale(as.matrix(Dub.voter@data[, 4:11]))
Coords <- as.matrix(cbind(Dub.voter$X, Dub.voter$Y))
Data.scaled.spdf <- SpatialPointsDataFrame(Coords, as.data.frame(Data.scaled))

bw_gwnnegpca_ans <- 200

gwnnegpca_ans <- gw_nsprcomp(
  data = Data.scaled.spdf,
  vars = colnames(Data.scaled.spdf@data),
  bw = bw_gwnnegpca_ans,
  k = 8,
  kernel="bisquare",
  adaptive = TRUE,
  nneg=TRUE,
  center=FALSE
)
```

```
Dub.voter$gwnnegpcaload_DiffAdd <- gwnnegpca_ans$loadings[,"DiffAdd","PC1"]
Dub.voter$gwnnegpcaload_LARent <- gwnnegpca_ans$loadings[,"LARent","PC1"]
Dub.voter$gwnnegpcaload_SC1 <- gwnnegpca_ans$loadings[,"SC1","PC1"]

spplot(Dub.voter[c("gwnnegpcaload_DiffAdd","gwnnegpcaload_LARent","gwnnegpcaload_SC1")])

### Compare with standard gwpca
bw_gwpca_ans <- bw.gwpca(
  Data.scaled.spdf,
  vars = colnames(Data.scaled.spdf@data),
  k = 3,
  robust = FALSE,
  adaptive = TRUE
)

gwpca_ans <- gwpca(
  Data.scaled.spdf,
  vars = colnames(Data.scaled.spdf@data),
  bw = bw.gwpca.basic,
  k = 8,
  robust = FALSE,
  adaptive = TRUE
)

Dub.voter$gwpcaload_DiffAdd <- gwpca_ans$loadings[,"DiffAdd","PC1"]
Dub.voter$gwpcaload_LARent <- gwpca_ans$loadings[,"LARent","PC1"]
Dub.voter$gwpcaload_SC1 <- gwpca_ans$loadings[,"SC1","PC1"]

spplot(Dub.voter[c("gwpcaload_DiffAdd","gwpcaload_LARent","gwpcaload_SC1")])
```

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