Package 'mgwnbr'

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Type Package

Title Multiscale Geographically Weighted Negative Binomial Regression

Version 0.3.0

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Description Fits a geographically weighted regression model with different scales for each covariate. Uses the negative binomial distribution as default, but also accepts the normal, Poisson, or logistic distributions.
Can fit the global versions of each regression and also the geographically weighted alternatives with only one scale, since they are all particular cases of the multiscale approach.
Hanchen Yu (2024). ``Exploring Multiscale Geographically Weighted Negative Binomial Regression'', Annals of the American Association of Geographers <doi:10.1080/24694452.2023.2289986>.
Fotheringham AS, Yang W, Kang W (2017). ``Multiscale Geographically Weighted Regression (MGWR)'', Annals of the American Association of Geographers <doi:10.1080/24694452.2017.1352480>.
Da Silva AR, Rodrigues TCV (2014). ``Geographically Weighted Negative Binomial Regression - incorporating overdispersion'', Statistics and Computing <doi:10.1007/s11222-013-9401-9>.

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Depends R (>= 3.5.0)

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Contents

`georgia` *Georgia dataset*

Description

The Georgia census data set from Fotheringham et al. (2002) in dataframe format.

Usage

```
data(georgia)
```

Format

A data frame with with 159 observations on the following 13 variables:

- `AreaKey` - an identification number for each county
- `Latitude` - the latitude of the county centroid
- `Longitud` - the longitude of the county centroid
- `TotPop90` - population of the county in 1990
- `PctRural` - percentage of the county population defined as rural
- `PctBach` - percentage of the county population with a bachelors degree
- `PctEld` - percentage of the county population aged 65 or over
- `PctFB` - percentage of the county population born outside the US
- `PctPov` - percentage of the county population living below the poverty line
- `PctBlack` - percentage of the county population who are black
- `ID` - a numeric vector of IDs
- `X` - a numeric vector of x coordinates
- `Y` - a numeric vector of y coordinates

mgwnbr *Multiscale Geographically Weighted Negative Binomial Regression*

Description

Fits a geographically weighted regression model with different scales for each covariate. Uses the negative binomial distribution as default, but also accepts the normal, Poisson, or logistic distributions. Can fit the global versions of each regression and also the geographically weighted alternatives with only one scale, since they are all particular cases of the multiscale approach.

Usage

```
mgwnbr(
  data,
  formula,
  long,
  lat,
  band_method,
  band_criterion = "cv",
  distribution = "negbin",
  globalmin = TRUE,
  multiscale = TRUE,
  distancekm = FALSE,
  weight = NULL,
  offset = NULL,
  id = NULL,
  h = NULL,
  max_int = 50,
  tol = 10^-307
)
```

Arguments

data	name of the dataset.
formula	regression model formula as in lm.
long	name of the variable containing the longitudes in the dataset.
lat	name of the variable containing the latitudes in the dataset.
band_method	indicates the method to be used for the bandwidth calculation (adaptive_bsq, fixed_bsq, fixed_g).
band_criterion	indicates the criterion to be used for the bandwidth calculation (cv, aic), default value is "cv".
distribution	indicates the probability distribution to be used for the regression (gaussian, poisson, negbin, logistic), default value is"negbin".
globalmin	logical value indicating whether to find a global minimum in the optimization process, default value is TRUE.

multiscale	logical value indicating if multiscale should be used (TRUE, FALSE), default value is TRUE.
distancekm	logical value indicating whether to calculate the distances in km, default value is FALSE.
weight	name of the variable containing the sample weights, default value is NULL.
offset	name of the variable containing the offset values, if null then is set to a vector of zeros, default value is NULL.
id	name of the variable containing the unique identifier of the observations in the dataset, default value is NULL.
h	integer indicating a predetermined bandwidth value, default value is NULL.
max_int	integer indicating the number of iterations, default value is 50.
tol	numeric value indicating the tolerance for small determinants not being considered zero when calculating inverse matrices throughout the model execution, default value is 10^-307.

Value

A list that contains:

- band - Bandwidth values for each covariate.
- fitted_values - MGWR fitted values.
- mgwr_param_estimates - MGWR parameter estimates.
- mgwr_se - MGWR standard errors.
- general_bandwidth - General bandwidth value.
- measures - Goodness of fit statistics.
- ENP - Effective number of parameters.
- alpha_level_5_pct - significance levels for the t tests on parameter significance.
- t_critical - Critical values for the t tests on parameter significance.
- global_param_estimates - Parameter estimates for the global model.
- t_test_dfs - Denominator degrees of freedom for the t tests.
- global_measures - Goodness of fit statistics for the global model.

Examples

```
## Data

data(georgia)

## MGWR Model

mod <- mgwnbr(data=georgia, formula=PctBach~PctBlack+PctFB,
          lat="Y", long="X", globalmin=FALSE, band_method="adaptive_bsq", band_criterion="cv",
               distribution="gaussian", multiscale=TRUE, h=100)
```

```
## Bandwidths
mod$general_bandwidth

## Goodness of fit measures
mod$measures

## GWNBR Model

## Not run:
mod <- mgwnbr(data=georgia, formula=PctBach~PctBlack+PctFB,
          lat="Y", long="X", globalmin=FALSE, band_method="adaptive_bsq", band_criterion="cv",
               distribution="negbin", multiscale=FALSE)

## End(Not run)

## GWPR Model

## Not run:
mod <- mgwnbr(data=georgia, formula=PctBach~PctBlack+PctFB,
          lat="Y", long="X", globalmin=FALSE, band_method="adaptive_bsq", band_criterion="cv",
               distribution="poisson", multiscale=FALSE)

## End(Not run)
```

`print.mgwnbr_model` *Print method for mgwnbr_model objects*

Description

Print method for mgwnbr_model objects

Usage

```
## S3 method for class 'mgwnbr_model'
print(x, ...)
```

Arguments

`x`	An object of class `mgwnbr_model`.
`...`	Additional arguments passed to other methods.

Value

The object (invisibly).

print.summary.mgwnbr_model *Print method for summary.myclass objects*

Description

Print method for summary.myclass objects

Usage

```
## S3 method for class 'summary.mgwnbr_model'
print(x, ...)
```

Arguments

x	An object of class summary.mgwnbr_model.
...	Further arguments passed to print.

Value

The object (invisibly).

summary.mgwnbr_model *Summary method for mgwnbr_model objects*

Description

Summary method for mgwnbr_model objects

Usage

```
## S3 method for class 'mgwnbr_model'
summary(object, ...)
```

Arguments

object	An object of class mgwnbr_model.
...	Additional arguments passed to other methods.

Value

An object of class summary.mgwnbr_model.

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