Package 'StepGWR'

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Type Package

Title A Hybrid Spatial Model for Prediction and Capturing Spatial
Variation in the Data

Version 0.1.0

Depends R(>= 2.10)

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

Description It is a hybrid spatial model that combines the variable selection capabilities of step-
wise regression methods with the predictive power of the Geographically
Weighted Regression(GWR) model.The developed hybrid model follows a two-
step approach where the stepwise variable selection method is applied first to identify
the subset of predictors that have the most significant impact on the response vari-
able, and then a GWR model is fitted using those selected variables for spatial
prediction at test or unknown locations. For method details,see Le-
ung, Y., Mei, C. L. and Zhang, W. X. (2000).<DOI:10.1068/a3162>.This hybrid spa-
tial model aims to
improve the accuracy and interpretability of GWR predictions by selecting a subset of rele-
vant variables through a stepwise selection process.This approach is particularly
useful for modeling spatially varying relationships and improving the accuracy of spatial predic-
tions.

License GPL (>= 2.0)

Encoding UTF-8

RoxygenNote 7.2.3

Imports stats, qpdf, numbers,MASS

NeedsCompilation no

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StepGWR_exponential	*StepGWR: a hybrid spatial model that combines the variable selection capabilities of stepwise regression with the predictive power of Geographically Weighted Regression (GWR) model*

Description

StepGWR: a hybrid spatial model that combines the variable selection capabilities of stepwise regression with the predictive power of Geographically Weighted Regression (GWR) model

Usage

```
StepGWR_exponential(data_sp, bw, split_value, exponential_kernel)
```

Arguments

data_sp	A dataframe containing a response variable and the predictor variables, as well as the coordinates of the locations. In the dataframe, first column is the response variable (y), last two columns are coordinates i.e., Latitude and Longitudes and in between them is the set of predictor variables(X's).
bw	A numeric value specifying the bandwidth parameter for the GWR model. It can be noted that, optimum bandwidth parameter value can vary and depends on the spatial pattern of the dataset.
split_value	Splitting value for dividing the dataset into training and testing set, e.g. 0.8 or 0.7
exponential_kernel	
	Spatial weight function of the GWR model, e.g. exponential_kernel

Value

A list with the following components: - 'Important_vars ': Selected important variables based on stepwise regression - 'GWR_y_pred_test': The predicted values based on GWR at test locations - 'rrmse': root means square error - 'R_squared': R square value - 'mse': mean squared error - 'mae': mean absolute error

References

1. Leung, Y., Mei, C. L. and Zhang, W. X. (2000). Statistical tests for spatial non-stationarity based on the geographically weighted regression model. Environment and Planning A, 32(1),9-32.<DOI:10.1068/a3162>. 2. Brunsdon, C., Fotheringham, A.S. and Charlton, M,E. (1996).Geographically weighted regression: a method for exploring spatial non-stationarity. Geogr Anal.28(4),281-298.<DOI:10.1111/j.1538-4632.1996.tb00936.x>.

Examples

```
n<- 100
p<- 7
m<-sqrt(n)
id<-seq(1:n)
x<-matrix(runif(n*p), ncol=p)
e<-rnorm(n, mean=0, sd=1)
xy_grid<-expand.grid(c(1:m),c(1:m))
Latitude<-xy_grid[,1]
Longitude<-xy_grid[,2]
B0<-(Latitude+Longitude)/6
B1<-(Latitude/3)
B2<-(Longitude/3)
B3<-(2*Longitude)
B4<-2*(Latitude+Longitude)/6
B5<-(4*Longitude/3)
B6<-2*(Latitude+Longitude)/18
B7<-(4*Longitude/18)
y<-B0+(B1*x[,1])+(B2*x[,2])+(B3*x[,3])+(B4*x[,4])+(B5*x[,5])+(B6*x[,6])+(B7*x[,7])+e
data_sp<-data.frame(y,x,Latitude,Longitude)
StepGWR_exp<-StepGWR_exponential(data_sp,0.5,0.8,exponential_kernel)
```

StepGWR_gaussian	*StepGWR: a hybrid spatial model that combines the variable selection capabilities of stepwise regression with the predictive power of Geographically Weighted Regression (GWR) model*

Description

StepGWR: a hybrid spatial model that combines the variable selection capabilities of stepwise regression with the predictive power of Geographically Weighted Regression (GWR) model

Usage

```
StepGWR_gaussian(data_sp, bw, split_value, gaussian_kernel)
```

Arguments

data_sp	A dataframe containing a response variable and the predictor variables, as well as the coordinates of the locations. In the dataframe, first column is the response variable (y), last two columns are coordinates i.e., Latitude and Longitudes and in between them is the set of predictor variables(X's).
bw	A numeric value specifying the bandwidth parameter for the GWR model. It can be noted that, optimum bandwidth parameter value can vary and depends on the spatial pattern of the dataset.
split_value	Splitting value for dividing the dataset into training and testing set, e.g. 0.8 or 0.7
gaussian_kernel	Spatial weight function of the GWR model, e.g. gaussian_kernel

Value

A list with the following components: - 'Important_vars ': Selected important variables based on stepwise regression - 'GWR_y_pred_test': The predicted values based on GWR at test locations - 'rrmse': root means square error - 'R_squared': R square value - 'mse': mean squared error - 'mae': mean absolute error

References

1. Leung, Y., Mei, C. L. and Zhang, W. X. (2000). Statistical tests for spatial non-stationarity based on the geographically weighted regression model. Environment and Planning A, 32(1),9-32.<DOI:10.1068/a3162>. 2. Brunsdon, C., Fotheringham, A.S. and Charlton, M,E. (1996).Geographically weighted regression: a method for exploring spatial non-stationarity. Geogr Anal.28(4),281-298.<DOI:10.1111/j.1538-4632.1996.tb00936.x>.

Examples

```
n<- 100
p<- 7
m<-sqrt(n)
id<-seq(1:n)
x<-matrix(runif(n*p), ncol=p)
e<-rnorm(n, mean=0, sd=1)
xy_grid<-expand.grid(c(1:m),c(1:m))
Latitude<-xy_grid[,1]
Longitude<-xy_grid[,2]
B0<-(Latitude+Longitude)/6
B1<-(Latitude/3)
B2<-(Longitude/3)
B3<-(2*Longitude)
B4<-2*(Latitude+Longitude)/6
B5<-(4*Longitude/3)
B6<-2*(Latitude+Longitude)/18
B7<-(4*Longitude/18)
y<-B0+(B1*x[,1])+(B2*x[,2])+(B3*x[,3])+(B4*x[,4])+(B5*x[,5])+(B6*x[,6])+(B7*x[,7])+e
data_sp<-data.frame(y,x,Latitude,Longitude)
StepGWR_gau<-StepGWR_gaussian(data_sp,0.8,0.7,gaussian_kernel)
```

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