

Package ‘SpPOP’

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Type Package

Title Generation of Spatial Population under Different Levels of Relationships among Variables

Version 0.1.0

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Description The developed package can be used to generate a spatial population for different levels of relationships among the dependent and auxiliary variables along with spatially varying model parameters. A spatial layout is designed as a $[0, k-1] \times [0, k-1]$ square region on which observations are collected at $(k \times k)$ lattice points with a unit distance between any two neighbouring points along the horizontal and vertical axes. For method details see Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018).<[doi:10.1080/10485252.2018.1499907](https://doi.org/10.1080/10485252.2018.1499907)>. The generated spatial population can be utilized in Geographically Weighted Regression model based analysis for studying the spatially varying relationships among the variables. Furthermore, various statistical analysis can be performed on this spatially generated data.

Imports stats, qpdf, numbers

License GPL (≥ 2.0)

Encoding UTF-8

RoxygenNote 7.2.3

Suggests rmarkdown, knitr

VignetteBuilder knitr

NeedsCompilation no

Repository CRAN

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Contents

| | |
|------------------|-----------|
| SpPOP_linear1 | 2 |
| SpPOP_linear2 | 3 |
| SpPOP_linear3 | 4 |
| SpPOP_linear4 | 5 |
| SpPOP_linear5 | 6 |
| SpPOP_nonlinear1 | 7 |
| SpPOP_nonlinear2 | 8 |
| SpPOP_nonlinear3 | 9 |
| SpPOP_nonlinear4 | 10 |
| SpPOP_nonlinear5 | 11 |
| Index | 12 |

| | |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_linear1 | <i>Generation of spatial population along with spatially varying model parameters generated based on linear function of latitudes and longitudes</i> |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population along with spatially varying model parameters generated based on linear function of latitudes and longitudes

Usage

```
SpPOP_linear1(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and one explanatory variable (i.e. X). The auxiliary variable has been generated following $U(0,1)$ and the regression coefficients are generated as linear function of latitudes and longitudes.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_linear1<-SpPOP_linear1(100,10,c(1:10),c(1:10))
```

| | |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_linear2 | <i>Generation of spatial population includes multiple auxiliary variables along with spatially varying model parameters generated based on linear function of latitudes and longitudes</i> |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population includes multiple auxiliary variables along with spatially varying model parameters generated based on linear function of latitudes and longitudes

Usage

```
SpPOP_linear2(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and three explanatory variables (i.e. X1, X2, and X3). The auxiliary variables have been generated independently from uniform distribution $U(0,1)$ and the regression coefficients are generated as linear function of latitudes and longitudes.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_linear2<-SpPOP_linear2(100,10,c(1:10),c(1:10))
```

| | |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_linear3 | <i>Generation of spatial population along with spatially varying model parameters generated based on linear function of latitudes and longitudes</i> |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population along with spatially varying model parameters generated based on linear function of latitudes and longitudes

Usage

```
SpPOP_linear3(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and one explanatory variable (i.e. X). The auxiliary variable has been generated following $U(0,2)$ and the regression coefficients are generated as linear function of locations.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_linear3<-SpPOP_linear3(100,10,c(1:10),c(1:10))
```

| | |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_linear4 | <i>Generation of spatial population along with spatially varying model parameters generated based on linear function of latitudes and longitudes</i> |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population along with spatially varying model parameters generated based on linear function of latitudes and longitudes

Usage

```
SpPOP_linear4(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and one explanatory variable (i.e. X). The auxiliary variable has been generated following $U(0,2)$ and the regression coefficients are generated as linear function of locations.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_linear4<-SpPOP_linear4(100,10,c(1:10),c(1:10))
```

| | |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_linear5 | <i>Generation of spatial population along with spatially varying model parameters generated based on linear function of latitudes and longitudes</i> |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population along with spatially varying model parameters generated based on linear function of latitudes and longitudes

Usage

```
SpPOP_linear5(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and two explanatory variables (i.e. X1 and X2). The auxiliary variables are independently drawn from the uniform distribution $U(0,2)$ and normal distribution $N(1,1)$ and the regression coefficients are generated as linear function of locations.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_linear5<-SpPOP_linear5(100,10,c(1:10),c(1:10))
```

| | |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_nonlinear1 | <i>Generation of spatial population along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes</i> |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes

Usage

```
SpPOP_nonlinear1(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and one explanatory variable (i.e. X). The auxiliary variable has been generated following $U(0,1)$ and the regression coefficients are generated as non-linear function of latitudes and longitudes.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_nonlinear1<-SpPOP_nonlinear1(100,10,c(1:10),c(1:10))
```

| | |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_nonlinear2 | <i>Generation of spatial population along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes</i> |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes

Usage

```
SpPOP_nonlinear2(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and one explanatory variable (i.e. X). The auxiliary variable has been generated following $U(0,1)$ and the regression coefficients are generated as non-linear function of latitudes and longitudes.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_nonlinear2<-SpPOP_nonlinear2(100,10,c(1:10),c(1:10))
```

| | |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_nonlinear3 | <i>Generation of spatial population includes multiple auxiliary variables along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes</i> |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population includes multiple auxiliary variables along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes

Usage

```
SpPOP_nonlinear3(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and one explanatory variable (i.e. X1, X2, and X3). The auxiliary variables has been generated independently from uniform distribution $U(0,1)$ and the regression coefficients are generated as non-linear function of latitudes and longitudes.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_nonlinear3<-SpPOP_nonlinear3(100,10,c(1:10),c(1:10))
```

| | |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_nonlinear4 | <i>Generation of spatial population along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes</i> |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes

Usage

```
SpPOP_nonlinear4(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and one explanatory variable (i.e. X). The auxiliary variable has been generated following $U(0,2)$ and the regression coefficients are generated as non-linear function of latitudes and longitudes.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_nonlinear4<-SpPOP_nonlinear4(100,10,c(1:10),c(1:10))
```

| | |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| SpPOP_nonlinear5 | <i>Generation of spatial population along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes</i> |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

Description

Generation of spatial population along with spatially varying model parameters generated based on non-linear function of latitudes and longitudes

Usage

```
SpPOP_nonlinear5(N, k, xlat, ylong)
```

Arguments

| | |
|-------|---------------------------------------------|
| N | integer; population size i.e. $N = (k * k)$ |
| k | integer |
| xlat | numeric vector |
| ylong | numeric vector |

Value

The developed function returns a dataframe of spatially generated population consist of simulated response variable (i.e. Y) along with their spatial coordinates, spatially varying coefficients and two explanatory variables (i.e. X1 and X2). The auxiliary variables are drawn independently from uniform distribution $U(0,2)$ and normal distribution $N(1,1)$ and the regression coefficients are generated as non-linear function of latitudes and longitudes.

References

1. Wang, Ning., Mei, Chang-Lin. and Yan, Xiao-Dong. (2008). Local Linear Estimation of Spatially Varying Coefficient Models: An Improvement on the Geographically Weighted Regression Technique. *Environment and Planning A: Economy and Space*, 40(4), 986-1005.<DOI:10.1068/a3941>.
2. Chao, Liu., Chuanhua, Wei. and Yunan, Su. (2018). Geographically weighted regression model-assisted estimation in survey sampling. *Journal of Nonparametric Statistics*. <DOI:10.1080/10485252.2018.1499907>.

Examples

```
sp_nonlinear5<-SpPOP_nonlinear5(100,10,c(1:10),c(1:10))
```

Index

SpPOP_linear1, [2](#)
SpPOP_linear2, [3](#)
SpPOP_linear3, [4](#)
SpPOP_linear4, [5](#)
SpPOP_linear5, [6](#)
SpPOP_nonlinear1, [7](#)
SpPOP_nonlinear2, [8](#)
SpPOP_nonlinear3, [9](#)
SpPOP_nonlinear4, [10](#)
SpPOP_nonlinear5, [11](#)