

Package ‘SecDim’

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Type Package

Title The Second Dimension of Spatial Association

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Description Most of the current methods explore spatial association using observations at sample locations, which are defined as the first dimension of spatial association (FDA). The proposed concept of the second dimension of spatial association (SDA), as described in Yongze Song (2022) <[doi:10.1016/j.jag.2022.102834](https://doi.org/10.1016/j.jag.2022.102834)>, aims to extract in-depth information about the geographical environment from locations outside sample locations for exploring spatial association.

Imports stats, RcppArmadillo, methods, geosphere

Depends R (>= 4.1.0)

License GPL-2

RoxygenNote 7.2.3

LazyData true

LazyDataCompression xz

Encoding UTF-8

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

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grids	<i>Spatial grid dataset.</i>
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Description

Spatial datasets of explanatory variables at a 500-m resolution.

Usage

grids

Format

grids: A data frame of explanatory variables with 68757 rows and 11 columns.

Author(s)

Yongze Song <yongze.song@curtin.edu.au>

gsdvar	<i>Generating second-dimension variables for a spatial variable</i>
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Description

Generating second-dimension variables for a spatial variable

Usage

```
gsdvar(
  pointlocation,
  gridlocation,
  gridvar,
  distbuf = seq(1, 10, 1),
  quantileprob = seq(0, 1, 0.1)
)
```

Arguments

pointlocation A matrix or data frame of point locations
 gridlocation A matrix or data frame of grid locations
 gridvar A matrix or data frame of grid variables
 distbuf A vector of distance buffer values
 quantileprob A vector of quantile probability values

Value

A data frame containing the selected variables for the second dimension

Examples

```
data(obs)
data(grids)
pointlocation <- obs[sample(nrow(obs), 20), c("Lon", "Lat")]
gridlocation <- grids[, c("Lon", "Lat")]
gridvar <- grids$Elevation
system.time({
  sdavars <- gsdvar(pointlocation, gridlocation, gridvar,
    distbuf = c(1, 2, 3), quantileprob = c(0, 0.5, 1))
})
```

 obs

Spatial datasets of trace elements.

Description

Spatial datasets of trace elements.

Usage

```
obs
```

Format

obs: A data frame of trace elements with 614 rows and 5 variables

Author(s)

Yongze Song <yongze.song@curtin.edu.au>

rmvoutlier *Removing outliers.*

Description

Function for removing outliers.

Usage

```
rmvoutlier(x, coef = 2.5)
```

Arguments

x A vector of a variable
coef A number of the times of standard deviation. The default value is 2.5.

Value

Location of outliers in the vector

Examples

```
data("obs")  
obs$Cr_ppm <- log(obs$Cr_ppm)  
krm <- rmvoutlier(obs$Cr_ppm)  
krm
```

sample_vars_fda *Spatial datasets of the first dimension variables of trace elements.*

Description

Spatial datasets of the first dimension variables of trace elements.

Usage

```
sample_vars_fda
```

Format

sample_vars_fda: A list with 8 elements

Author(s)

Yongze Song <yongze.song@curtin.edu.au>

sample_vars_sda	<i>Spatial datasets of the second dimension variables of trace elements.</i>
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Description

Spatial datasets of the second dimension variables of trace elements.

Usage

```
sample_vars_sda
```

Format

sample_vars_sda: A list with 8 elements

Author(s)

Yongze Song <yongze.song@curtin.edu.au>

sdapredvars	<i>Preparing explanatory variables data for SDA-based prediction</i>
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Description

Function for preparing explanatory variables data for SDA-based prediction or the testing data for cross validation

Usage

```
sdapredvars(xlist)
```

Arguments

xlist A list of the SDA explanatory variables

Value

A data.frame of variables for prediction or validation

Examples

```

data("obs")
data("sample_vars_sda")
obs$Cr_ppm <- log(obs$Cr_ppm)
krm <- rmvoutlier(obs$Cr_ppm)
y <- obs$Cr_ppm[-krm]
x <- list(sample_vars_sda[[1]][-krm, 1:11])
kvalidate <- sample(length(y), 0.3*length(y), replace = FALSE)
yv <- y[kvalidate]
xv <- lapply(x, function(x) x[kvalidate,])
sdaxv <- sdapredvars(xv)
sdayxv <- cbind(yv, sdaxv)

```

selectvarlm

Selecting variables using linear regression

Description

Function for selecting variables using linear regression

Usage

```
selectvarlm(y, x, ctr.vif = 10)
```

Arguments

y	A vector of a response variable
x	A data.frame of explanatory variables
ctr.vif	A number of VIF threshold

Value

A data.frame of selected variables

Examples

```

data("obs")
data("sample_vars_sda")
obs$Cr_ppm <- log(obs$Cr_ppm)
krm <- rmvoutlier(obs$Cr_ppm)
y <- obs$Cr_ppm[-krm]
x <- sample_vars_sda$Elevation[-krm, 1:11]
sx <- selectvarlm(y, x)

```

selectvarsda	<i>Selecting variables for the SDA model</i>
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Description

Function for selecting variables for the second deminsion of spatial association (SDA) model

Usage

```
selectvarsda(y, xlist)
```

Arguments

y	A vector of a response variable
xlist	A list of the SDA explanatory variables

Value

A list of the selected the second dimension variables

Examples

```
data("obs")
data("sample_vars_sda")
obs$Cr_ppm <- log(obs$Cr_ppm)
krm <- rmvoutlier(obs$Cr_ppm)
y <- obs$Cr_ppm[-krm]
x <- list(sample_vars_sda[[1]][-krm, 1:11])
system.time({ # ~0.01s
  sx <- selectvarsda(y, xlist = x)
})
```

vif	<i>Fast calculation of the variance inflation factor (VIF)</i>
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Description

Function for fast calculation of the variance inflation factor (VIF)

Usage

```
vif(x)
```

Arguments

x	A data.frame of explanatory variables
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Value

Variance inflation factor (VIF) values of variables

Examples

```
data("sample_vars_sda")  
x <- sample_vars_sda$Elevation[, sample(55, 10)]  
vif(x)
```


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