

# Package: SecDim (via r-universe)

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**Type** Package

**Title** The Second Dimension of Spatial Association

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**Version** 3.2

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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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**Repository** CRAN

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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>

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|        |   |
|--------|---|
| 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.*

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**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>

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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>

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|                 |  |
|-----------------|--|
| 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>

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|             |  |
|-------------|--|
| 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)

```

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selectvarlm

*Selecting variables using linear regression*


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**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)

```

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|              |  |
|--------------|--|
| 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 |
|---|---------------------------------------|

**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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