Package ‘GD’

Type Package
Title Geographical Detectors
Date 2019-08-20
Version 1.7
Maintainer Yongze Song <yongze.song@postgrad.curtin.edu.au>
Imports stats, utils, graphics
Depends R (>= 3.4.0)
License GPL-2
RoxygenNote 6.0.1
LazyData true
Suggests knitr, rmarkdown
VignetteBuilder knitr
NeedsCompilation no
Author Yongze Song [aut, cre] (<https://orcid.org/0000-0003-3420-9622>)
Repository CRAN
Date/Publication 2019-08-21 14:10:05 UTC

R topics documented:

disc ......................................................... 2
gd .......................................................... 3
gdeco ...................................................... 3
gdinteract .............................................. 4
Generates discretization parameters for continuous data.

Function for discretizing continuous data and obtaining the different outputs, including discretization intervals, numbers of values within intervals, and visualization of discretization.

Usage

disc(var, n, method = "quantile", ManualItv)

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

## S3 method for class 'disc'
plot(x, ...)

Arguments

var A numeric vector of continuous variable
n The number of intervals
method A character of discretization method
ManualItv A numeric vector of manual intervals
x A list of disc result
... Ignore

Examples

## method is default (quantile); number of intervals is 4
ds1 <- disc(ndvi_40$Tempchange, 4)
ds1

## method is equal; number of intervals is 4
nds2 <- disc(ndvi_40$Tempchange, 4, method = "equal")

## method is manual; number of intervals is 4
manualitv1 <- c(-0.5, 0, 1, 2, 4)
ds3 <- disc(ndvi_40$Tempchange, 4, method = "manual", ManualItv = manualitv1)
**gd**

*Geographical detectors: factor detector.*

**Description**

Function for calculating power determinant using factor detector of geographical detectors and visualization.

**Usage**

```r
gd(formula, data = NULL)
```

## S3 method for class 'gd'

- `print(x, ...)`
- `plot(x, sig = TRUE, ...)`

**Arguments**

- `formula`: A formula of response and explanatory variables
- `data`: A data.frame includes response and explanatory variables
- `x`: A list of factor detector results
- `sig`: If TRUE, only spatial associations that are significant at the 0.05 level will be plotted; If FALSE, all spatial associations will be plotted.
- `...`: Ignore

**Examples**

```r
g1 <- gd(NDVIchange ~ Climatezone + Mining, data = ndvi_40)
g1
plot(g1)
```

**gdeco**

*Geographical detectors: ecological detector.*

**Description**

Function for ecological detector calculation, ecological matrix and visualization.

**Usage**

```r
gdeco(formula, data = NULL)
```

## S3 method for class 'gdeco'

- `print(x, ...)`
- `plot(x, ...)`

**Examples**

```r
g1 <- gdeco(NDVIchange ~ Climatezone + Mining, data = ndvi_40)
g1
plot(g1)
```
Arguments

- `formula` A formula of response and explanatory variables
- `data` A data.frame includes response and explanatory variables
- `x` A list of ecological detector results
- `...` Ignore

Examples

```r
ge1 <- gdeco(NDVIchange ~ Climatezone + Mining, data = ndvi_40)
ge1

data <- ndvi_40[,1:3]
ge2 <- gdeco(NDVIchange ~ ., data = data)
ge2
```

Description

Function for interaction detector calculation and visualization. The types of interactions include "Enhance, nonlinear", "Independent", "Enhance, bi-", "Weaken, uni-" and "Weaken, nonlinear".

Usage

```r
gdinteract(formula, data = NULL)
## S3 method for class 'gdinteract'
print(x, ...)
## S3 method for class 'gdinteract'
plot(x, ...)
```

Arguments

- `formula` A formula of response and explanatory variables
- `data` A data.frame includes response and explanatory variables
- `x` A list of interaction detector results
- `...` Ignore
gdm

Examples

```r
gi1 <- gdinteract(NDVIchange ~ Climatezone + Mining, data = ndvi_40)
gi1
data <- ndvi_40[,1:3]
gi2 <- gdinteract(NDVIchange ~ ., data = data)
gi2
```

---

**gdm**

*Geographical detectors: a one-step function.*

Description

A one-step function for optimal discretization and geographical detectors for multiple variables and visualization.

Usage

```r
gdm(formula, continuous_variable = NULL, data = NULL, discmethod, discitv)
## S3 method for class 'gdm'
print(x, ...)  
## S3 method for class 'gdm'
plot(x, ...)
```

Arguments

- `formula` A formula of response and explanatory variables
- `continuous_variable` A vector of continuous variable names
- `data` A data.frame includes response and explanatory variables
- `discmethod` A character vector of discretization methods
- `discitv` A numeric vector of numbers of intervals
- `x` A list of gdm result
- `...` Ignore

Examples

```r
###############
## NDVI: ndvi_40
###############
## set optional parameters of optimal discretization
## optional methods: equal, natural, quantile, geometric, sd and manual
discre Haram <- c("equal","quantile")
discitv <- c(4:5)
```
### gdm function

```r
dvigdm <- gdm(NDVIchange ~ Climatezone + Mining + Tempchange,
              continuous_variable = c("Tempchange"),
              data = ndvi_40,
              discmethod = discmethod, discitv = discitv)
dvigdm
plot(dvigdm)
```

#### Not run:

```
#######
## H1N1: h1n1_100
#######
## set optional parameters of optimal discretization
discmethod <- c("equal","natural","quantile")
discitv <- c(4:6)
continuous_variable <- colnames(h1n1_100)[-c(1,11)]

### gdm function
h1n1gdm <- gdm(H1N1 ~ .,
                continuous_variable = continuous_variable,
                data = h1n1_100,
                discmethod = discmethod, discitv = discitv)
h1n1gdm
plot(h1n1gdm)
```

#### End(Not run)

---

**gdrisk** *Geographical detectors: risk detector.*

### Description

Function for risk detector calculation, risk matrix and visualization.

### Usage

```r
gdrisk(formula, data = NULL)
```

#### S3 method for class 'gdrisk'

```r
print(x, ...)
```

#### S3 method for class 'gdrisk'

```r
plot(x, ...)
```

### Arguments

- **formula**: A formula of response and explanatory variables
- **data**: A data.frame includes response and explanatory variables
- **x**: A list of risk detector results
- **...**: Ignore
**Examples**

```
gr1 <- gdrisk(NDVIchange ~ Climatezone + Mining, data = ndvi_40)
gr1
plot(gr1)

data <- ndvi_40[,1:3]
gr2 <- gdrisk(NDVIchange ~ ., data = data)
gr2
```
NDVI

Spatial datasets of vegetation index changes.

Description

"NDVI" dataset is the NDVI change data from 2010 to 2014 in Inner Mongolia, China. This dataset consists of NDVI change and potential variables sampled from six sizes of spatial grid units, including 5 km, 10 km, 20 km, 30 km, 40 km and 50 km. The references of more details and data sources will be added.

Usage

ndvi_5
ndvi_10
ndvi_20
ndvi_30
ndvi_40
ndvi_50

Format

ndvi_5: A data frame with 46295 rows and 7 variables
ndvi_10: A data frame with 11567 rows and 7 variables
ndvi_20: A data frame with 2892 rows and 7 variables
ndvi_30: A data frame with 1290 rows and 7 variables
ndvi_40: A data frame with 713 rows and 7 variables
ndvi_50: A data frame with 469 rows and 7 variables

Author(s)

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

optidisc

Optimal discretization for continuous variables and visualization.

Description

Optimal discretization for continuous variables and visualization.
**riskmean**

**Description**

Function for calculating risk means within intervals and visualization.

**Usage**

```r
riskmean(formula, data = NULL)
```

## S3 method for class 'riskmean'

```r
print(x, ...)
```

```r
plot(x, ...)
```

---

**riskmean**

*Geographical detectors: risk means in risk detector.*

---

**Usage**

```r
optidisc(formula, data, 
    discmethod = discmethod, discitv = discitv)
```

## S3 method for class 'optidisc'

```r
print(x, ...)
```

## S3 method for class 'optidisc'

```r
plot(x, ...)
```

---

**Arguments**

- **formula**  
  A formula of response and explanatory variables, where the explanatory variables must be continuous variables to be discretized.
- **data**  
  A data.frame includes response and explanatory variables
- **discmethod**  
  A character vector of discretization methods
- **discitv**  
  A numeric vector of numbers of intervals
- **x**  
  A list of optidisc result
- **...**  
  Ignore

**Examples**

```r
# set optional discretization methods and numbers of intervals
# optional methods: equal, natural, quantile, geometric, sd and manual
discmethod <- c("equal","quantile")
discitv <- c(4:5)
# optimal discretization
odc1 <- optidisc(NDVIchange ~ Tempchange, ndvi_40, discmethod, discitv)
plot(odc1)
```
Arguments

- **formula**: a formula of response and explanatory variables
- **data**: a data.frame includes response and explanatory variables
- **x**: a list of risk mean values
- **...**: ignore

Examples

```r
r1 <- riskmean(NDVIchange ~ Climatezone + Mining, data = ndvi_40)
r1
plot(r1)

data <- ndvi_40[,1:3]
r2 <- riskmean(NDVIchange ~ ., data = data)
r2
```

---

**road_GD**

*Spatial datasets of road damage conditions.*

Description

"road_GD" dataset is the road damage conditions on 5000 road segments, together with the potential factors of speed limit, local soil type, population within 1-km buffer around the road, and the daily vehicle volumes. More details about the data can be found in Yongze Song (2018) <doi:10.1109/TITS.2018.2805817>.

Usage

```r
data(road_GD)
```

Format

A data frame with 5000 rows and 5 variables

Author(s)

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

References

**sesu**

*Comparison of size effects of spatial units.*

**Description**

Function for comparison of size effects of spatial units in spatial heterogeneity analysis.

**Usage**

```r
sesu(gdlist, su)
```

**Arguments**

- `gdlist`: A list of gdm result or gd result
- `su`: A vector of sizes of spatial units

**Examples**

```r
ndvilist <- list(ndvi_30, ndvi_40, ndvi_50)
su <- c(30, 40, 50)  # sizes of spatial units
## "gdm" function
gdlist <- lapply(ndvilist, function(x){
  gdm(NDVIchange ~ Climatezone + Mining, data = x)
})
sesu(gdlist, su)  # size effects of spatial units
```

---

**v2m**

*Converts a vector to a lower triangular matrix.*

**Description**

The function v2m is used in the functions gdrisk, gdinteract and gdeco for converting a vector is from the results of the risk detector result, interaction detector result or ecological detector to a lower triangular matrix.

**Usage**

```r
v2m(vec, diag = FALSE)
```

**Arguments**

- `vec`: A data.frame of risk/interaction/ecological detector result of a strata variable
- `diag`: TRUE/FALSE, indicating if the output matrix is a diagonal matrix.
Index

*Topic **H1N1**  
H1N1, 7  
*Topic **NDVI**  
NDVI, 8  
*Topic **datasets**  
H1N1, 7  
NDVI, 8  
*Topic **dataset**  
H1N1, 7  
NDVI, 8  
road_GD, 10  
*Topic **road_GD**  
road_GD, 10

disc, 2  
gd, 3  
gdeco, 3  
gdinteract, 4  
gdm, 5  
gdrisk, 6  
H1N1, 7  
h1n1_100 (H1N1), 7  
h1n1_150 (H1N1), 7  
h1n1_50 (H1N1), 7  
NDVI, 8  
dovi_10 (NDVI), 8  
dovi_20 (NDVI), 8  
dovi_30 (NDVI), 8  
dovi_40 (NDVI), 8  
dovi_5 (NDVI), 8  
dovi_50 (NDVI), 8  
optidisc, 8  
plot.disc (disc), 2  
plot.gd (gd), 3  
plot.gdeco (gdeco), 3  
plot.gdinteract (gdinteract), 4

plot.gdm (gdm), 5  
plot.gdrisk (gdrisk), 6  
plot.optidisc (optidisc), 8  
plot.riskmean (riskmean), 9  
print.disc (disc), 2  
print.gd (gd), 3  
print.gdeco (gdeco), 3  
print.gdinteract (gdinteract), 4  
print.gdm (gdm), 5  
print.gdrisk (gdrisk), 6  
print.optidisc (optidisc), 8  
print.riskmean (riskmean), 9  
riskmean, 9  
road_GD, 10  

sesu, 11  
v2m, 11