Package 'HS'

October 12, 2022

Type Package

Title Homogenous Segmentation for Spatial Lines Data

Date 2019-08-31

Version 1.1

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

Description Methods of homogenous segmentation for spatial lines data, such as pavement
performance indicators and traffic volumes. Three methods are available for
homogenous segmentation, including cumulative difference approach, minimization
coefficient of variation, and spatial heterogeneity based method.

Imports zoo, ggpubr, data.table, tidyr, reshape2, ggplot2, partitions,
utils

Depends R (>= 3.4.0)

License GPL-2

Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

NeedsCompilation no

Author Yongze Song [aut, cre] (<https://orcid.org/0000-0003-3420-9622>)

Repository CRAN

Date/Publication 2019-09-10 04:40:03 UTC

R topics documented:

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cda | *Cummulative difference approach (CDA) for homogeneous segmentation of spatial lines data.*

Description

Function for homogeneous segmentation of spatial lines data using a cummulative difference approach (CDA).

Usage

```
cda(var = "deflection", length = "length", data, range = NULL)
```

Arguments

var	A character or a character vector of variable names, such as a road pavement performance indicator.
length	A character of road length name in data.
data	A data frame of a dataset.
range	A vector of length threshold.

Examples

```
testdata <- tsdwa[1:100,]
testdata$Length <- testdata$SLK.end - testdata$SLK.start
testdata <- cda(var = "Deflection", length = "Length", testdata)
```

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deflection	*Road deflection dataset.*

Description

The "deflection" dataset is a sample of the road deflection data monitored and collected by Main Roads Western Australia.

Usage

```
deflection
```

Format

deflection: A data frame with 1000 rows and 4 variables.

- id. Number of observation.
- SLK.start. Spatial start location of data. SLK is short for the straight line kilometer.
- SLK.end. Spatial end location of data.
- Deflection. The monitored road deflection value.

Author(s)

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

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findbreak	*Find spaital breaking locations and add a column of breaks.*

Description

Find spaital breaking locations and add a column of breaks.

Usage

```
findbreak(start = "SLK.start", end = "SLK.end", data,
            dist.allow = 0.05, line.no = NULL)
```

Arguments

start	A character of start location name of a spatial line.
end	A character of end location name of a spatial line.
data	A data frame of a dataset.
dist.allow	A number of the maximum allowed breaks within a line segment.
line.no	A character of spatial line name.

Examples

```
testdata <- tsdwa[1:100,]
testdata <- findbreak(start = "SLK.start", end = "SLK.end",
                      data = testdata, dist.allow = 0.05)
```

---

hs   *Homogeneous segmentation function with continuous variables.*

Description

Homogeneous segmentation function with continuous variables.

Usage

```
hs(start = "SLK.start", end = "SLK.end", var = "deflection",
       data, method = "shs", range = NULL)
```

Arguments

start	A character of start location name of a spatial line.
end	A character of end location name of a spatial line.
var	A character or a character vector of variable names, such as a road pavement performance indicator.
data	A data frame of a dataset.
method	A character of homogeneous segmentation method. Available methods include "shs", "cda" and "mcv".
range	A vector of segment length threshold.

Examples

```
testdata <- tsdwa[1:100,]
hs1 <- hs(start = "SLK.start", end = "SLK.end", var = c("Curvature", "Deflection", "BLI"),
          testdata, method = "shs", range = c(0.1, 0.5))
```

| hsctg | *Homogeneous segmentation function with both categorical and conti-nous variables.* |

Description

Homogeneous segmentation function with both categorical and continous variables.

Usage

```
hsctg(start = "SLK.start", end = "SLK.end", var = "deflection",
            data, method = "shs", range = NULL, by.ctg = NULL)
```

Arguments

start	A character of start location name of a spatial line.
end	A character of end location name of a spatial line.
var	A character or a character vector of variable names, such as a road pavement performance indicator.
data	A data frame of a dataset.
method	A character of homogeneous segmentation method. Available methods include "shs", "cda" and "mcv".
range	A vector of segment length threshold.
by.ctg	A vector of categorical variable names.

Examples

```
testdata <- tsdwa[1:300,]
hc1 <- hsctg(start = "SLK.start", end = "SLK.end", var = c("Curvature", "Deflection", "BLI"),
        testdata, method = "shs", range = c(0.1, 0.5), by.ctg = c("SurfType", "PvtType"))
```

| mcv | *Minimization coefficient of variation (MCV) for homogeneous segmen-tation of spatial lines data.* |

Description

Minimization coefficient of variation (MCV) for homogeneous segmentation of spatial lines data.

Usage

```
mcv(var = "deflection", length = "length", data, range = NULL)
```

Arguments

var	A character or a character vector of variable names, such as a road pavement performance indicator.
length	A character of road length name in data.
data	A data frame of a dataset.
range	A vector of segment length threshold.

Examples

```
testdata <- tsdwa[1:100,]
testdata$length <- testdata$SLK.end - testdata$SLK.start
testdata <- mcv(var = "Deflection", length = "length", testdata, range = c(0.1, 0.5))
```

---

preprocessing   *Preprocessing for field monitoring data.*

Description

The preprocessing includes two steps: removing missing data and ordering data by spatial locations.

Usage

```
preprocessing(var = "deflection", location = "SLK", data = data)
```

Arguments

var	A character of the name of a variable in a dataset, such as a road pavement performance indicator.
location	A character of the name of spatial locations in a dataset.
data	A data frame of monitoring data.

Examples

```
testdata <- tsdwa[1:100,]
testdata <- preprocessing(var = "Deflection", location = "SLK.start", data = testdata)
```

---

segbycategory   *Segmentation with categorical variables.*

Description

Segmentation with categorical variables.

Usage

```
segbycategory(data, by = NULL)
```

Arguments

data	A data frame of a dataset.
by	A character or a vector of categorical variable names.

Examples

```
testdata <- tsdwa[1:100,]
testdata <- segbycategory(testdata, by = c("SurfType", "PvtType"))
```

---

segcompare   *Segments comparison of different homogeneous segmentations methods.*

Description

Segments comparison of different homogeneous segmentations methods.

Usage

```
segcompare(start = "SLK.start", end = "SLK.end", var = "deflection",
                  data, segid.matrix, methods = NULL)
## S3 method for class 'segcompare'
print(x, ...)
## S3 method for class 'segcompare'
plot(x, ...)
```

Arguments

start	A character of start location name of a spatial line.
end	A character of end location name of a spatial line.
var	A character or a character vector of variable names, such as a road pavement performance indicator.
data	A list of segmentation result.
segid.matrix	A matrix of segmentations.
methods	A vector of segmentation method names, default NULL.
x	A list of segments comparison result.
...	Ignore

Examples

```
testdata <- tsdwa[1:300, ]
testdata$length <- testdata$SLK.end - testdata$SLK.start
variable <- c("Curvature", "Deflection", "BLI")

seg1 <- hs(start = "SLK.start", end = "SLK.end", var = variable,
           testdata, method = "shs", range = c(0.1, 0.5)) # 0.3 s
seg2 <- hs(start = "SLK.start", end = "SLK.end", var = variable,
           testdata, method = "cda", range = c(0.1, 0.5)) # 0.7 s
seg3 <- hs(start = "SLK.start", end = "SLK.end", var = variable,
           testdata, method = "mcv", range = c(0.1, 0.5)) # 0.6 s
segid.matrix <- cbind(seg1$seg.id, seg2$seg.id, seg3$seg.id)

data(segid.matrix)
cp <- segcompare(start = "SLK.start", end = "SLK.end", var = variable,
                 testdata, segid.matrix, methods = c("SHS", "CDA", "MCV")) # 4.8 s
cp
plot(cp)
```

---

segid.matrix	*A matrix of segmentations with different methods for data "tsdwa".*

Description

Segmentation results of CDA, MCV and SHS methods for data "tsdwa".

Usage

```
segid.matrix
```

Format

segid.matrix: A matrix with 300 rows and 3 columes, representing segmentations of three methods, CDA, MCV and SHS.

Author(s)

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

---

segplot	*Visualization of homogeneous segments.*

Description

Visualization of homogeneous segments.

Usage

```
segplot(start = "SLK.start", var = "deflection",
                seg.id = "seg.id", data, plot.range = NULL)
```

Arguments

start	A character of start location name of a spatial line.
var	A character or a character vector of variable names, such as a road pavement performance indicator.
seg.id	A character of the name of new segment number.
data	A data frame of a dataset.
plot.range	A vector of plot range.

Examples

```
testdata <- tsdwa[1:300,]
testdata$length <- testdata$SLK.end - testdata$SLK.start
testdata <- shs(var = c("Curvature", "Deflection"), length = "length",
                testdata, range = c(0.1, 0.5))
segplot(start = "SLK.start", var = c("Curvature", "Deflection"),
              seg.id = "seg.id", testdata, plot.range = 1:300)
```

---

segsmooth	*Smoothing data using the moving average method for the homogeneous segmentation.*

Description

A center aligned moving window is used for the moving average method.

Usage

```
segsmooth(var = "deflection", range = 11, data)
```

Arguments

var	A character of the name of a variable in a dataset, such as a road pavement performance indicator.
range	A number of the size of moving window. An odd number is required.
data	A data frame of monitoring data.

Examples

```
# preprocessing
testdata <- tsdwa[1:500,]
testdata <- preprocessing(var = "Deflection", location = "SLK.start", data = testdata)
# smoothing
testdata <- segsmooth(var = "Deflection", range = 11, data = testdata)
# plot
plot(testdata$SLK.start, testdata$Deflection, type = "l",
     col = "lightblue", xlab = "location", ylab = "deflection")
lines(testdata$SLK.start, testdata$smooth.Deflection)
```

---

segsummary   *Statistical summary of homogeneous segments.*

Description

Statistical summary of homogeneous segments.

Usage

```
segsummary(start = "SLK.start", end = "SLK.end", var = "deflection",
                   seg.id = "seg.id", data, by.ctg = NULL)
## S3 method for class 'segsummary'
print(x, ...)
```

Arguments

start	A character of start location name of a spatial line.
end	A character of end location name of a spatial line.
var	A character or a character vector of variable names, such as a road pavement performance indicator.
seg.id	A character of the name of new segment number.
data	A data frame of a dataset.
by.ctg	A character of categorical variable names.
x	A list of segmentation result.
...	Ignore

Examples

```
testdata <- tsdwa[1:100,]
testdata$length <- testdata$SLK.end - testdata$SLK.start
testdata <- shs(var = c("Curvature", "Deflection"), length = "length",
                testdata, range = c(0.1, 0.5))
s1 <- segsummary(start = "SLK.start", end = "SLK.end", var = c("Curvature", "Deflection"),
                 seg.id = "seg.id", testdata)
s1
```

---

shs	*Spatial heterogeneity-based segmentation (SHS) for homogeneous segmentation of spatial lines data.*

Description

Spatial heterogeneity-based segmentation (SHS) for homogeneous segmentation of spatial lines data.

Usage

```
shs(var = "deflection", length = "length", data, range = NULL)
```

Arguments

var	A character or a character vector of variable names, such as a road pavement performance indicator.
length	A character of road length name in data.
data	A data frame of a dataset.
range	A vector of segment length threshold.

Examples

```
testdata <- tsdwa[1:100,]
testdata$length <- testdata$SLK.end - testdata$SLK.start
testdata <- shs(var = "Deflection", length = "length", testdata, range = c(0.1, 0.5))
```

---

splitlong   *Split long segments to segments within length threshold.*

Description

Split long segments to segments within length threshold.

Usage

```
splitlong(var = ″deflection″, length = ″length″,
                    seg.id = ″seg.id″, data, range = NULL)
```

Arguments

var	A character or a character vector of variable names, such as a road pavement performance indicator.
length	A character of length name.
seg.id	A character of the name of new segment number.
data	A data frame of a dataset.
range	A vector of segment length threshold.

Examples

```
testdata <- tsdwa[1:1000,]
testdata$length <- round(testdata$SLK.end - testdata$SLK.start, digits = 10)
testdata <- cda(var = ″Deflection″, length = ″length″, testdata, range = c(0.1, 0.5))
testdata <- splitlong(var = ″Deflection″, length = ″length″,
                      seg.id = ″seg.id″, testdata, range = c(0.1, 0.5))
seglength.summary <- testdata[, .(sum(length)), by = .(seg.id)]
```

---

tsdwa   *Traffic speed deflectometer (TSD) data of pavement deteriorations.*

Description

The "tsdwa" dataset is a sample of the pavement deterioration data monitored and collected by Main Roads Western Australia.

Usage

```
tsdwa
```

Format

tsdwa: A data frame with 5000 rows and 8 variables.

- id. Number of observation.
- SLK.start. Spatial start location of data. SLK is short for the straight line kilometer.
- SLK.end. Spatial end location of data.
- SurfType. Surfacing type.
- PvtType. Pavement type.
- Curvature.
- Deflection.
- BLI. Base layer index.

Author(s)

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

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