Package 'changeS'

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Type Package

Title S-Curve Fit for Changepoint Analysis

Version 1.0.1

Maintainer Norm Matloff <nsmatloff@ucdavis.edu>

Description Estimation of changepoints using an ``S-curve'' approximation. Formation of confidence intervals for changepoint locations and magnitudes. Both abrupt and gradual changes can be modeled.

Depends R (>= 3.5.0), nls.multstart, ggplot2, stringr

Suggests knitr,rmarkdown

VignetteBuilder knitr

License GPL (>= 2)

URL https://github.com/matloff/changeS

Encoding UTF-8

NeedsCompilation no

Author Lan Jiang [aut],
Collin Kennedy [aut],
Norm Matloff [aut, cre] (<https://orcid.org/0000-0001-9179-6785>)

Repository CRAN

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R topics documented:

cancerRates *Breast Cancer Dataset*

Description

Breast cancer rate for Swedish females between age of 40-50, courtesy of Professor Y. Pawitan. A data frame with 99 observations on the following 2 variables. `Age`: Age of women having the disease. `Incidence`: Number of women of that age.

fitS *S-Curve Fit*

Description

Finds change(s) in mean.

Usage

```
fitS(dataIn,xColIndex=NULL,yColIndex=NULL,slopeIn=NULL,depth=1,
   family_wise_error_rate=0.05,autoTraverse=TRUE,plotTitle = '')
```

Arguments

`dataIn`	Data frame or equivalent.
`xColIndex`	Column number of "x" (typically time).
`yColIndex`	Column number of "y".
`slopeIn`	A fixed slope value for the model. Should be set to a large value for the abrupt-change case. If NULL, the algorithm will estimate the slope (gradual change case)
`depth`	Upper bound for the depth of the binary segmentation ; if this is 1, the algorithm models the situation of (at most) 1 changepoint.
`family_wise_error_rate`	Nominal alpha value for determining whether to proceed with the binary segmentations to the next split. Meaningful only if `depth` larger than 1.
`autoTraverse`	If TRUE, do automatic binary segmentation. Meaningful only of `depth` larger than 1.
`plotTitle`	Title for output plot, if any.

Details

Changepoint detection/estimation for changes in mean, performed by using an S-curve (logistic function) to approximate a step function. This enables asymptotic standard errors, and associated confidence intervals and tests for changepoint locations and change magnitudes. (However, in the multi-changepoint case, the alpha levels are only nominal.)

Note: The location of a changepoint is considered to be a continuous numeric quantity, in contrast to packages such as `changepoints` where the location is integer-valued.

Value

A 'fittedS' object, containing estimates, standard errors and so on.

Author(s)

Lan Jiang, Collin Kennedy, Norm Matloff

Examples

```
# real data

# type ?Nile for background information
nile <- data.frame(t=1871:1970, ht=Nile)
fitS(nile,1,2,10)  # abrupt change model

# type ?cancerRates for background information
data(cancerRates)
fitS(cancerRates,1,2)  # gradual change model



# simulated data, changepoint at i = 367
n <- 500
x <- (1:n)/n
y <- vector(length=n)
trueChangePt <-round(n*2/3)
y[1:trueChangePt] <- rnorm(trueChangePt,10,2)
y[(trueChangePt+1):n] <- rnorm(n-trueChangePt,12.5,2)
d <- data.frame(x=x,y=y)
plot(d)
fitS(d,1,2,10) # abrupt
fitS(d, 1, 2) # gradual

# simulated data, changepoints at  i= 383, 855
n <- 1000
y <- vector(length = n)
x <- seq(1,n,by = 1)
idx <- c(383,855)
part1 <- runif(n = length(x[1:(idx[1]-1)]), min = 0, max = 4) #mean of 2
part2 <- runif(n = length(x[idx[1]:(idx[2]-1)]), min = 0,max = 10) # mean of 5
part3 <- runif(n = length(x[idx[2]:n]), min = 0, max = 2) #mean of 1
y[1:(idx[1]-1)] <- part1
y[idx[1]:(idx[2]-1)] <- part2
y[idx[2]:n] <- part3
df <- data.frame(x = x, y = y)
fitS(df, 1, 2, depth=2, autoTraverse = TRUE)
```

`fitS_linear` *S-Curve Fit, Linear Models*

Description

Estimation of location and magnitudes of change in intercept and slope, for piecewise linear models.

Usage

```
fitS_linear(dataIn,xColIndex=NULL,yColIndex=NULL,plotTitle = '')
```

Arguments

`dataIn`	Data frame or equivalent.
`xColIndex`	Column number of "x" (typically time).
`yColIndex`	Column number of "y".
`plotTitle`	Title for output plot, if any.

Details

Linear model analog of `fitS`. Note: May have long run times.

Value

Object of class `"fittedS_linear"`, with components:

`b1`	The pre-changepoint slope.
`h1`	The post-changepoint slope.
`s1`	S-curve slope for finding regression slope.
`c`	The changepoint.
`b2`	Pre-changepoint intercept.
`h2`	Post-changepoint intercept.
`s2`	S-curve slope for finding regression slope.

The gap at the changepoint is then
(h2 + h2 c) - (b2 + b1 c)

Author(s)

Lan Jiang, Collin Kennedy, Norm Matloff

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