Package ‘changeS’

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Type Package
Title S-Curve Fit for Changepoint Analysis
Version 1.0.1
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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
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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.

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**fitS**  

*S-Curve Fit*

**Description**

Finds change(s) in mean.

**Usage**

```r
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.
fitS

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/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
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**
```r
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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