

Package ‘jcp’

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Type Package

Title Joint Change Point Detection

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Description Procedures for joint detection of changes in both expectation and variance in univariate sequences. Performs a statistical test of the null hypothesis of the absence of change points. In case of rejection performs an algorithm for change point detection. Reference - Bivariate change point detection - joint detection of changes in expectation and variance, Scandinavian Journal of Statistics, <[doi:10.1111/sjos.12547](https://doi.org/10.1111/sjos.12547)>.

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jcp

*jcp***Description**

Joint change point detection - expectation and variance - via bivariate moving sum statistics

Usage

```
jcp(x, H = NA, q = NA, alpha = 0.05, sim = 1000, region = "square")
```

Arguments

x	numeric vector. Input sequence of random variables.
H	NA or numeric vector. Window set. If NA (default), then H is automatically set. If not NA, then H must be an increasing vector of positive integers with maximum $\leq \text{length}(x)/2$.
q	NA or numeric value. Rejection threshold. If NA (default), then the rejection boundary is derived in simulations (from Gaussian process limit) according to sim and alpha. If not NA, then q is considered predefined and must be set a positive real number.
alpha	numeric value. Significance level. Must be in (0,1), default = 0.05. In case of predefined q, alpha is set to NA.
sim	numeric value. Number of simulations of limit process for approximation of q. Must be positive integer, default = 1000. In case of predefined q, sim is set to NA.
region	character string. Defines rejection region, default = "square". Must be chosen either "square", "circle" or "ellipse".

Value

invisible list	
changepoints	detected change points (increasingly ordered)
mean_sd	matrix of estimated means and standard deviations
M	test statistic
q	rejection threshold
H	window set
sim	number of simulations of the limit process (approximation of q)
alpha	significance level
region	rejection region
method	derivation of threshold q, either asymptotic or predefined
x	input sequence

EVrho	list containing the auxiliary processes E, V and correlation rho, for each element of H one list entry
CP_meta	matrix containing meta information of estimation. Estimated change points (increasingly ordered), responsible window h, components E, V and rho of joint statistic at estimated change points (regarding responsible window)
SFA	detected change points of single filter algorithms

Author(s)

Michael Messer

References

Michael Messer (2021) Bivariate change point detection - joint detection of changes in expectation and variance, Scandinavian Journal of Statistics, DOI 10.1111/sjos.12547.

See Also

[plot.jcp](#), [summary.jcp](#)

Examples

```
# Normal distributed sequence with 3 change points at
# c1=250 (change in expectation),
# c2=500 (change in variance) and
# c3=750 (change in expectation and variance)
set.seed(0)
m      <- c(8,10,10,3);  s  <- c(4,4,10,5)
x      <- rnorm(1000, mean=rep(m,each=250), sd=rep(s,each=250))
result <- jcp(x)
summary(result)
plot(result)

# Set additional parameters (window set)
result2 <- jcp(x,H=c(80,160,240))
summary(result2)
plot(result2)
```

plot.jcp

plot.jcp

Description

Plot method for class 'jcp'

Usage

```
## S3 method for class 'jcp'  
plot(x, cex = 1, cex.main = 1, ...)
```

Arguments

x	object of class jcp
cex	numeric, global sizes in plot
cex.main	numeric, size of titles
...	additional arguments

Value

No return value, called for side effects

Author(s)

Michael Messer

References

Michael Messer (2021) Bivariate change point detection - joint detection of changes in expectation and variance, Scandinavian Journal of Statistics, DOI 10.1111/sjos.12547.

See Also

[jcp](#), [summary.jcp](#)

Examples

```
# Normal distributed sequence with 3 change points at  
# c1=250 (change in expectation),  
# c2=500 (change in variance) and  
# c3=750 (change in expectation and variance)  
set.seed(0)  
m <- c(8,10,10,3); s <- c(4,4,10,5)  
x <- rnorm(1000, mean=rep(m,each=250), sd=rep(s,each=250))  
result <- jcp(x)  
summary(result)  
plot(result)  
  
# Set additional parameters (window set)  
result2 <- jcp(x,H=c(80,160,240))  
summary(result2)  
plot(result2)
```

summary.jcp

*summary.jcp***Description**

Summary method for class 'jcp'

Usage

```
## S3 method for class 'jcp'
summary(object, ...)
```

Arguments

object	object of class jcp
...	additional arguments

Value

No return value, called for side effects

Author(s)

Michael Messer

References

Michael Messer (2021) Bivariate change point detection - joint detection of changes in expectation and variance, Scandinavian Journal of Statistics, DOI 10.1111/sjos.12547.

See Also

[jcp](#), [plot.jcp](#)

Examples

```
#' # Normal distributed sequence with 3 change points at
# c1=250 (change in expectation),
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set.seed(0)
m      <- c(8,10,10,3);  s  <- c(4,4,10,5)
x      <- rnorm(1000, mean=rep(m,each=250), sd=rep(s,each=250))
result <- jcp(x)
plot(result)
summary(result)

# Set additional parameters (window set)
result2 <- jcp(x,H=c(80,160,240))
```

```
plot(result2)
summary(result2)
```

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