

# Package ‘jcp’

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**Type** Package

**Title** Joint Change Point Detection

**Version** 1.2

**Date** 2021-11-06

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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.

**License** GPL-3

**RoxygenNote** 7.1.2

**NeedsCompilation** no

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**Repository** CRAN

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## R topics documented:

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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*

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**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**

|                     |                      |
|---------------------|----------------------|
| <code>object</code> | object of class jcp  |
| <code>...</code>    | 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),  
## 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)  
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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