Package ‘ordinalpattern’

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Description

Test for a change in the dependence structure of two time series using ordinal patterns.

Usage

```R
patternchange(tsx,tsy,h=2,conf.level,weight=TRUE,weightfun=NULL,bn=log(length(tsx)),
kernel=function(x){return(max(0,1-abs(x)))})
```

```R
## S3 method for class 'change'
plot(x, ...)
```

Arguments

- `tsx`: numeric vector of first univariate time series.
- `tsy`: numeric vector of second univariate time series.
- `h`: numeric value determining the length of ordinal pattern.
- `conf.level`: numerical value indicating the confidence level of the test.
- `weight`: logical value indicating whether one uses weights of the L1 norm or the empirical probability of identical patterns; see details.
- `weightfun`: function which defines the weights given the L1 norm between the patterns if `weight=TRUE`. If no weight-function is given, the canonical weight function is used; see details.
- `bn`: numerical value determining the bandwidth of the kernel estimator used to estimate the long run variance.
- `kernel`: kernel function for estimating the long run variance.
- `x`: object of class "change".
- `...`: further arguments passed to the internal plotting function (`plot`).

Details

Given two timeseries `tsx` and `tsy` a cusum type statistic tests whether there is a change in the patter dependence or not. The test is based on a comparison of patterns of length `h+1` in `tsx` and `tsy`. One can either choose the number of identical patterns (`weight=FALSE`) or a metric that is defined by the `weightfun` argument to measure the difference between patterns (`weight=TRUE`). If no `weightfun` is given, the canonical weight function is used, which equals 1 if patterns are identical and 0 if the L1 norm of their difference attains the maximal possible value. The value is linear interpolated in between.

The procedure depends on an estimate of the long run variance. Here a kernel estimator is used. A kernel function and a bandwidth can be set using the arguments `kernel` and `bn`. If none of them is given, the bartlett kernel with a bandwidth of `log(n)`, where `n` equals the length of the timeseries, is used.
**Value**

Object with classes "change" and "htest" containing the following values:

- **statistic** the value of the test statistic. Under the null the test statistic follows asymptotically a Kolmogorov Smirnov distribution.
- **p.value** the p-value of the test.
- **estimate** the estimated time of change.
- **null.value** the jump height of the at most one change point model, which is under the null hypothesis always 0.
- **alternative** a character string describing the alternative hypothesis.
- **method** a character string describing the test.
- **trajectory** the cumulative sum on which the tests are based on. Could be used for additional plots.

**Author(s)**

Alexander Dürre

**References**


**See Also**

Estimation of the pattern dependence is provided by `patterndependence`.

**Examples**

```r
set.seed(1066)
a1 <- cbind(rnorm(100),rnorm(100))
a2 <- rmvnorm(100,sigma=matrix(c(1,0.8,0.8,1),ncol=2))
A <- rbind(a1,a2)
testresult <- patternchange(A[,1],A[,2])
plot(testresult)
testresult
```
patterndependence  Ordinal Pattern Dependence

Description

Calculates the standard ordinal pattern coefficient and related values

Usage

patterndependence(tsx,tsy,h=2,block=FALSE,first=TRUE)

## S3 method for class 'pattern'
plot(x, ...)

## S3 method for class 'pattern'
print(x, ...)

Arguments

tsx  numeric vector representing the first univariate time series.
tsy  numeric vector representing the second univariate time series.
h   numeric value determining the length of the ordinal pattern.
block  logical value determining whether patterns are calculated on disjoint blocks or overlapping blocks.
first  logical value indicating which observations are dropped if block == TRUE and the time series length is no multiple of h+1.
x   object of class "pattern", which is the output of patterndependence
...  further arguments passed to the internal plotting function.

Details

The standard ordinal pattern coefficient is a non-parametric and robust measure of dependence between two time series. It is based on ordinal patterns, which are defined as sequences of ranks of h+1 subsequent observations. These sequences of subsequent observations can either move one observation per time or a whole block of h+1 observations. The former is preferred since it uses more information. If one chooses the latter, one has to decide whether the first or the last observations are removed in case that the time series length is no multiple of h+1.

Beside the standard ordinal pattern coefficient, which range from -1 to 1, one can also look at the positive and negative ordinal pattern coefficient, which roughly measures whether there are unusual many identical or opposite patterns in the time series.

The plot function draws both time series and shows the six most frequent coinciding pattern with counts on the right. At the bottom, the location of these coinciding patterns is visualized.
Value

Object of class "pattern" containing the following values:

- **patterncoef**: standard ordinal pattern coefficient.
- **alpha**: positive ordinal pattern coefficient, see details.
- **beta**: negative ordinal pattern coefficient, see details.
- **numbequal**: number of equal ordinal patterns.
- **numbopposite**: number of opposite ordinal patterns.
- **PatternXz**: number of ordinal patterns in first time series.
- **PatternYz**: number or ordinal patterns in second time series.
- **coding**: coding of the ordinal patterns, used in PatternXz and PatternYz.
- **PatternX**: numeric vector representing the time series of patterns in tsx.
- **PatternY**: numeric vector representing the time series of patterns in tsy.
- **tsx**: numeric vector representing the first univariate time series.
- **tsy**: numeric vector representing the second univariate time series.
- **maxpat**: number representing the maximal pattern code.
- **block**: logical value determining whether patterns are calculated on disjoint blocks or overlapping blocks.
- **h**: number of consecutive observations defining one pattern
- **tablesame**: numeric vector representing the number of coinciding patterns, apportioned into different patterns.
- **tablesame**: numeric vector representing the number of reflected patterns, apportioned into different patterns.
- **indexsame**: logic vector indicating whether patterns in both time series coincide.
- **indexsame**: logic vector indicating whether patterns in both time series are reflected.

Author(s)

Alexander Dürrre

References


Examples

```r
set.seed(1066)
patternobj <- patterndependence(rnorm(100), rnorm(100))
plot(patternobj)
```
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