Package 'DODR'

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Type Package

Title Detection of Differential Rhythmicity

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Description Detect Differences in rhythmic time series. Using linear least squares and the robust semi-parametric rfit() method. Differences in harmonic fitting could be detected as well as differences in scale of the noise distribution.

License GPL-2

Depends Matrix, Rfit, npsm, parallel

Imports methods, stats

Encoding UTF-8

RoxygenNote 5.0.1

NeedsCompilation no

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R topics documented:

dodr *Detection of differences in rhythmic behavior between two time series sets*

Description

Detection of differences in rhythmic behavior between two time series sets

Usage

```
dodr(val1, val2, times1, times2 = times1, norm = TRUE, period = 24,
  method = "robust", verbose = options("verbose")[[1]])
```

Arguments

val1	matrix: data for values in first set. One column per sample, one row per time point
val2	matrix: data for values in second set. One column per sample, one row per time point
times1	vector: times of first set.
times2	vector: times of second set.
norm	boolean: whether to normalize the time series (division by mean), prior to the analysis.
period	numeric: period of the oscillations. Same unit as the time points in times1 and times2
method	vector<string>: method(s) to detect differences. Groups of related methods have additional identifiers. Elementary methods: HANOVA, harmScaleTest, harmNoisePred1, harmNoisePred2, robustDODR, robustHarmScaleTest) Groups: • "all"All methods • "robust"Combination of robust detection methods (robustDODR, robustHarmScaleTest) • "lsq"Combination of least square based detetion methods (HANOVA, HarmScaleTest, HarmNoisePred1, HarmNoisePred2) • "ANOVA"Combination of ANOVA like methods (HANOVA, robustDODR) • "scaleTest"Combination of scaleTest methods (harmScaleTest, robustHarmScaleTest) • "harmNoisePred"combination of both scaleTest methods to generate a two sided test
verbose	boolean: verbosity.

Details

This method applies a set of different methods on a pair of two experiments with one measurement matrix each. Samples to compare have to have the same column in both matrices. Different methods could be selected.

Value

A list containing

- 'p.value.table' A table containing the p-values for all the tests specified by `method`. Each row contains the results for one sample. A column `meta.p.val` is added containing the lowest p-value, corrected for multiple testing using a beta-distribution based aproach.
- details A list containing the detailed results from the selected methods

Examples

```
library(DODR)

#defining the parameters for two sets of oscillations
n=50
testTimes1 <- 0:15*3
testTimes2 <- testTimes1
tp <- length(testTimes1)
per1 <- 24
amp1 <- 0.3
ph1 <- 5
sd1 <- 0.1

per2 <- per1
amp2 <- amp1
ph2 <- ph1+4
sd2 <- sd1

#creating artificial oscillation sets
v1 <- 1 + amp1 * cos((testTimes1 - ph1)/per1*2*pi)
noise1 <- rnorm(length(testTimes1)*n, 0, sd1)
val1 <- matrix(v1 + noise1, ncol=n)

v2 <- 1 + amp2 * cos((testTimes2 - ph2)/per2*2*pi)
noise2 <- rnorm(length(testTimes2)*n, 0, sd2)
val2 <- matrix(v2 + noise2, ncol=n)

# run DODR
dodr <- dodr(val1, val2, testTimes1, testTimes2, 24, method = 'all')
dodr$p.value.table[1:3,]

#create another set with alterations in noise scale
ph2 <- ph1
sd2 <- sd1 * 3

v2 <- 1 + amp2 * cos((testTimes2 - ph2)/per2*2*pi)
```

```
noise2 <- rnorm(length(testTimes2)*n, 0, sd2)
val2 <- matrix(v2 + noise2, ncol=n)

dodr <- dodr(val1, val2, testTimes1, testTimes2, 24, method = 'all')
dodr$p.value.table[1:3,]
```

HANOVA *ANOVA applied on harmonic regression*

Description

Detection of differential between rhythms in two time series using llsq fits and ANOVA

Usage

```
HANOVA(val1, val2, times1, times2, period, norm = TRUE,
  verbose = options("verbose")[[1]])
```

Arguments

val1	matrix: data for values in first set. One column per sample, one row per time point
val2	matrix: data for values in second set. One column per sample, one row per time point
times1	vector: times of first set.
times2	vector: times of second set.
period	numeric: period of the oscillations. Same unit as the time points in times1 and times2
norm	boolean: whether to normalize the time series (division by mean), prior to the analysis.
verbose	boolean: verbosity.

Details

This test uses general ANOVA to test for differences between two time series. Therefore the time series are fitted to sine curves with a fixed period length and free phase and amplitude. In one case phase and amplitude have two be the same for both series, in the other case phase and amplitude could differ for the two series.

Value

data frame with columns:

- p.value: P-value for difference between the two time series
- F: F score from the underlying ANOVA test
- diff: Measure for the difference between the two fits

harmNoisePred *Asymmetric variant of Chow method applied on harmonic regression*

Description

A harmonic regression is done on the first set of time series (val1) pair. The differences of the second series to this fit are calculated. By comparison of these distances with the noise estimation of the first series, a decision is made whether the second series could be explained as additional samples of the first series.

Usage

```
harmNoisePred(val1, val2, times1, times2, period, norm = TRUE)
```

Arguments

val1	matrix: data for values in first set. One column per sample, one row per time point
val2	matrix: data for values in second set. One column per sample, one row per time point
times1	vector: times of first set.
times2	vector: times of second set.
period	numeric: period of the oscillations. Same unit as the time points in times1 and times2
norm	boolean: whether to normalize the time series (division by mean), prior to the analysis.

Value

list containing the fits for both time series and the combination and the pValue for differential Oscillation

harmScaleTest *Test for difference in scales upon harmonic regressions*

Description

The Test uses the F-Test for variances to decide wether the two given time series have a comparable noise scale or on of the series has a higher noise level.

Usage

```
harmScaleTest(val1, val2, times1, times2, period, norm = TRUE)
```

Arguments

val1	matrix: data for values in first set. One column per sample, one row per time point
val2	matrix: data for values in second set. One column per sample, one row per time point
times1	vector: times of first set.
times2	vector: times of second set.
period	numeric: period of the oscillations. Same unit as the time points in times1 and times2
norm	boolean: whether to normalize the time series (division by mean), prior to the analysis.

Value

dataframe with following columns:

- p.value: P-value for difference between the two time series
- score: score from the underlying F test

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robustDODR *Asymmetric variant of Chow method applied on harmonic regression*

Description

Asymmetric variant of Chow method applied on harmonic regression

Usage

```
robustDODR(val1, val2, times1, times2, period, norm = TRUE)
```

Arguments

val1	matrix: data for values in first set. One column per sample, one row per time point
val2	matrix: data for values in second set. One column per sample, one row per time point
times1	vector: times of first set.
times2	vector: times of second set.
period	numeric: period of the oscillations. Same unit as the time points in times1 and times2
norm	boolean: whether to normalize the time series (division by mean), prior to the analysis.

Details

This test uses a robust Fitting drop test to test for differences between two time series. Therefore the time series are fitted to sine curves with a fixed period length and free phase and amplitude. In one case phase and amplitude have two be the same for both series, in the other case phase and amplitude could differ for the two series.

Value

data frame with following columns:

- p.value: P-value for difference between the two time series
- F: F score from the underlying `drop.test` test
- diff: Measure for the difference between the two fits

`robustHarmScaleTest` *Robust test for difference in scales upon harmonic regressions*

Description

The Test uses the Fligner-Killeen Test for differences in scales. The test remains valid if the noise distribution contains outliers or is not-Gaussian

Usage

```
robustHarmScaleTest(val1, val2, times1, times2, period, norm = TRUE)
```

Arguments

`val1`	matrix: data for values in first set. One column per sample, one row per time point
`val2`	matrix: data for values in second set. One column per sample, one row per time point
`times1`	vector: times of first set.
`times2`	vector: times of second set.
`period`	numeric: period of the oscillations. Same unit as the time points in times1 and times2
`norm`	boolean: whether to normalize the time series (division by mean), prior to the analysis.

Value

data frame with following columns:

- p.value: P-value for difference between the two time series
- score: score from the underlying `fk.test` test
- factor: Measure for the difference between the two fits

See Also

fk.test

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