

Package ‘wdm’

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Title Weighted Dependence Measures

Version 0.3.0

Description Provides efficient implementations of weighted dependence measures and related asymptotic tests for independence. Implemented measures are the Pearson correlation, Spearman's rho, Kendall's tau, Blomqvist's beta, Hoeffding's D, and Chatterjee's xi; see, e.g., Nelsen (2006) [<doi:10.1007/0-387-28678-0>](https://doi.org/10.1007/0-387-28678-0), Hollander et al. (2015, ISBN:9780470387375), and Chatterjee (2021) [<doi:10.1080/01621459.2020.1758115>](https://doi.org/10.1080/01621459.2020.1758115).

Depends R ($\geq$ 3.2.0)

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LinkingTo Rcpp

Imports Rcpp

URL <https://tnagler.github.io/wdm-r/>, <https://github.com/tnagler/wdm-r>

BugReports <https://github.com/tnagler/wdm-r/issues>

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wdm-package

*Weighted Dependence Measures***Description**

Provides efficient implementations of weighted dependence measures and related asymptotic tests for independence. Implemented measures are the Pearson correlation, Spearman's rho, Kendall's tau, Blomqvist's beta, Hoeffding's D, and Chatterjee's xi; see, e.g., Nelsen (2006) <doi:10.1007/0-387-28678-0>, Hollander et al. (2015, ISBN:9780470387375), and Chatterjee (2021) <doi:10.1080/01621459.2020.1758115>.

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See Also

Useful links:

- <https://tnagler.github.io/wdm-r/>
- <https://github.com/tnagler/wdm-r>
- Report bugs at <https://github.com/tnagler/wdm-r/issues>

indep_test

*Independence Tests for Weighted Dependence Measures***Description**

Computes a dependence measure and its asymptotic independence test for two numeric vectors.

Usage

```
indep_test(
  x,
  y,
  method = "pearson",
  weights = NULL,
  remove_missing = TRUE,
  alternative = "two-sided",
  seeds = NULL,
  y_continuous = TRUE
)
```

Arguments

<code>x, y</code>	numeric vectors of data values. <code>x</code> and <code>y</code> must have the same length.
<code>method</code>	the dependence measure; see <i>Details</i> for possible values.
<code>weights</code>	an optional vector of weights for the observations.
<code>remove_missing</code>	if TRUE, all pairwise incomplete observations are removed; if FALSE, the function throws an error if there are incomplete observations.
<code>alternative</code>	indicates the alternative hypothesis and must be one of "two-sided", "greater" or "less". You can specify just the initial letter. "greater" corresponds to positive association, "less" to negative association.
<code>seeds</code>	an optional integer vector used to break predictor ties for Chatterjee's ξ . The default uses a fixed, reproducible ordering.
<code>y_continuous</code>	whether the response distribution is known to be continuous for Chatterjee inference. Set this to FALSE for a discrete response even if the sample contains no observed response ties.

Details

Available methods:

- "pearson": Pearson correlation
- "spearman": Spearman's ρ
- "kendall": Kendall's τ
- "blomqvist": Blomqvist's β
- "hoeffding": Hoeffding's D
- "chatterjee": Chatterjee's ξ

Partial matching of method names is enabled. This implementation of Hoeffding's D does not support tied observations; test results are invalid when ties are present. It supports only the two-sided alternative. The natural one-sided alternative for Chatterjee's ξ is "greater".

Chatterjee's ξ measures the dependence of y on x . Analytic inference with unequal weights requires a continuous response and assumes that weights are fixed or depend only on x . It is unavailable when the response is discrete or tied and weights are unequal.

Value

A one-row data frame containing the estimate, transformed test statistic, p-value, effective sample size, method, and alternative.

Examples

```
x <- rnorm(100)
y <- rpois(100, 1)
w <- runif(100)

indep_test(x, y, method = "kendall")           # unweighted
indep_test(x, y, method = "kendall", weights = w) # weighted
```

rank_wtd

*Computing weighted ranks***Description**

For observations without ties, the weighted rank of X_i among $X_1, \dots, X_n$ with weights $w_1, \dots, w_n$ is

$$\frac{n}{\sum_{k=1}^n w_k} \sum_{j=1}^n w_j 1[X_j \leq X_i].$$

Thus, multiplying every weight by the same positive constant does not change the ranks, and unit weights reproduce ordinary ranks. Tied values are handled according to `ties_method`.

Usage

```
rank_wtd(x, weights = numeric(), ties_method = "average")
```

Arguments

`x` a numeric vector.
`weights` an optional vector of nonnegative weights with the same length as `x`.
`ties_method` how to treat ties; one of "average", "min", "first", or "random", as in [rank\(\)](#).

Value

a vector of ranks.

Examples

```
x <- rnorm(100)
w <- rexp(100)
rank(x)
rank_wtd(x, w)
```

wdm

*Weighted Dependence Measures***Description**

Computes a (possibly weighted) dependence measure between `x` and `y` if these are vectors. If either argument is a matrix, the measures between all corresponding columns are computed.

Usage

```
wdm(
  x,
  y = NULL,
  method = "pearson",
  weights = NULL,
  remove_missing = TRUE,
  seeds = NULL
)
```

Arguments

<code>x</code>	a numeric vector, matrix or data frame.
<code>y</code>	NULL (default) or a vector, matrix or data frame with compatible dimensions to <code>x</code> . The default is equivalent to <code>y = x</code> (but more efficient).
<code>method</code>	the dependence measure; see <i>Details</i> for possible values.
<code>weights</code>	an optional vector of weights for the observations.
<code>remove_missing</code>	if TRUE, all pairwise incomplete observations are removed; if FALSE, the function throws an error if there are incomplete observations.
<code>seeds</code>	an optional integer vector used to break predictor ties for Chatterjee's ξ . The default uses a fixed, reproducible ordering.

Details

Available methods:

- "pearson": Pearson correlation
- "spearman": Spearman's ρ
- "kendall": Kendall's τ
- "blomqvist": Blomqvist's β
- "hoeffding": Hoeffding's D
- "chatterjee": Chatterjee's ξ Partial matching of method names is enabled.

Spearman's ρ and Kendall's τ are corrected for ties if there are any. This implementation of Hoeffding's D does not support tied observations; estimates are invalid when ties are present. Chatterjee's ξ measures the dependence of y on x and is generally asymmetric. Consequently, `wdm(x, method = "chatterjee")` need not return a symmetric matrix.

Value

A numeric scalar when both inputs are vectors or one-column objects; otherwise, a matrix containing the dependence measure for every pair of columns.

Examples

```
## dependence between two vectors
x <- rnorm(100)
y <- rpois(100, 1)
w <- runif(100)
wdm(x, y, method = "kendall")           # unweighted
wdm(x, y, method = "kendall", weights = w) # weighted

## dependence in a matrix
x <- matrix(rnorm(100 * 3), 100, 3)
wdm(x, method = "spearman")             # unweighted
wdm(x, method = "spearman", weights = w) # weighted

## dependence between columns of two matrices
y <- matrix(rnorm(100 * 2), 100, 2)
wdm(x, y, method = "hoeffding")         # unweighted
wdm(x, y, method = "hoeffding", weights = w) # weighted
```

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