Package 'mvcor'

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Title Correlation Coefficients for Multivariate Data

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Depends R (>= 4.0)

Imports Rfast, stats

Suggests corrfuns, Rfast2

Description Correlation coefficients for multivariate data, namely the squared correlation coefficient and the RV coefficient (multivariate generalization of the squared Pearson correlation coefficient). References include Mardia K.V., Kent J.T. and Bibby J.M. (1979). ``Multivariate Analysis''. ISBN: 978-0124712522. London: Academic Press.

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Contents

`mvcor-package` *Correlation Coefficients for Multivariate Data*

Description

Correlation Coefficients for Multivariate Data.

Details

Package:	mvcor
Type:	Package
Version:	1.1
Date:	2025-01-08
License:	GPL-2

Maintainers

Michail Tsagris <mtsagris@uoc.gr>.

Author(s)

Michail Tsagris <mtsagris@uoc.gr>

`Adjusted RV correlation between two sets of variables`
Adjusted RV correlation between two sets of variables

Description

Adjusted RV correlation between two sets of variables.

Usage

```
arv(y, x)
```

Arguments

`y`	A numerical matrix.
`x`	A numerical matrix.

Details

The adjusted RV correlation coefficient is computed.

Value

The value of the adjusted RV coefficient.

Author(s)

Michail Tsagris

R implementation and documentation: Michail Tsagris `<mtsagris@uoc.gr>`.

References

Mordant G. and Segers J. (2022). Measuring dependence between random vectors via optimal transport. Journal of Multivariate Analysis, 189: 104912.

See Also

`mrv`, `rv`, `drv`, `sq.correl`, `dcor`

Examples

```
arv( as.matrix(iris[, 1:2]), as.matrix(iris[, 3:4]) )
```

Dissimilarity between two data matrices based on the RV coefficient

Dissimilarity between two data matrices based on the RV coefficient

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Description

Dissimilarity between two data matrices based on the RV coefficient.

Usage

```
drv(y, x)
```

Arguments

y	A numerical matrix.
x	A numerical matrix.

Details

The dissimilarity between the two data matrices is computed as $\sqrt{2}\sqrt{1 - RV(y,x)}$, where $RV(y,x)$is the RV coefficient.

Value

The value of the dissimilarity.

Author(s)

Michail Tsagris

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Josse J., Pages J. and Husson F. (2008). Testing the significance of the RV coefficient. Computational Statistics & Data Analysis, 53(1): 82–91.

See Also

rv, sq.correl, dcor

Examples

```
drv( as.matrix(iris[, 1:2]), as.matrix(iris[, 3:4]) )
```

Distance correlation *Distance correlation*

Description

Distance correlation.

Usage

```
dcor(y, x, bc = FALSE)
```

Arguments

y	A numerical matrix.
x	A numerical matrix.
bc	Do you want the corrected distance correlation? Default value if FALSE.

Details

The distance correlation or the bias corrected distance correlation of two matrices is calculated. The latter one is used for the hypothesis test that the distance correlation is zero.).

Value

A list including:

dcov	The (bias corrected) distance covariance.
dvarX	The (bias corrected) distance variance of x.
dvarY	The (bias corrected) distance variance of Y.
dcor	The (bias corrected) distance correlation.

Author(s)

Michail Tsagris

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

G.J. Szekely, M.L. Rizzo and N. K. Bakirov (2007). Measuring and Testing Independence by Correlation of Distances. Annals of Statistics, 35(6): 2769–2794.

Szekely G. J. and Rizzo M. L. (2023). The energy of data and distance correlation. Chapman and Hall/CRC.

See Also

sq.correl, rv

Examples

```
dcor( as.matrix(iris[, 1:2]), as.matrix(iris[, 3:4]) )
dcor( as.matrix(iris[, 1:2]), as.matrix(iris[, 3:4]), bc = TRUE )
```

Mantel coefficient between two sets of variables

Mantel coefficient two sets of variables

Description

Mantel coefficient between two sets of variables.

Usage

```
mantel(y, x)
```

Arguments

y	A numerical matrix.
x	A numerical matrix.

Details

The Mantel coefficient is simply the Pearson correlation coefficient computed on the off-diagonal elements of the distance matrix of each each matrix (or set of variables).

Value

The Mantel coefficient.

Author(s)

Michail Tsagris

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Abdi H. (2010). Congruence: Congruence coefficient, RV coefficient, and Mantel coefficient. Encyclopedia of Research Design, 3, 222–229.

See Also

rv, dcor

Examples

```
mantel( as.matrix(iris[, 1:2]), as.matrix(iris[, 3:4]) )
```

`Modified RV correlation between two sets of variables`
Modified RV correlation between two sets of variables

Description

Modified RV correlation between two sets of variables.

Usage

```
mrv(y, x)
```

Arguments

y	A numerical matrix.
x	A numerical matrix.

Details

The modified RV correlation coefficient

Value

The value of the modified RV coefficient.

Author(s)

Michail Tsagris

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Smilde A. K., Kiers H. A., Bijlsma S., Rubingh C. M. and Van Erk M. J. (2009). Matrix correlations for high-dimensional data: the modified RV-coefficient. Bioinformatics, 25(3): 401–405.

See Also

rv, arv, drv, sq.correl, dcor

Examples

```
mrv( as.matrix(iris[, 1:2]), as.matrix(iris[, 3:4]) )
```

RV correlation between two sets of variables

RV correlation between two sets of variables

Description

RV correlation between two sets of variables.

Usage

```
rv(y, x)
```

Arguments

y	A numerical matrix.
x	A numerical matrix.

Details

The RV correlation coefficient

Value

The value of the RV coefficient.

Author(s)

Michail Tsagris

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Robert P. and Escoufier Y. (1976). A Unifying Tool for Linear Multivariate Statistical Methods: The RV-Coefficient. Applied Statistics, 25(3): 257–265.

See Also

mrv, drv, sq.correl, dcor

Examples

```
rv( as.matrix(iris[, 1:2]), as.matrix(iris[, 3:4]) )
```

`Squared multivariate correlation between two sets of variables`
Squared multivariate correlation between two sets of variables

---

Description

Squared multivariate correlation between two sets of variables.

Usage

```
sq.correl(y, x)
```

Arguments

y	A numerical matrix.
x	A numerical matrix.

Details

Mardia, Kent and Bibby (1979, pg. 171) defined two squared multiple correlation coefficient between the dependent variable $\mathbf{Y}$ and the independent variable $\mathbf{X}$. They mention that these are a similar measure of the coefficient determination in the univariate regression. Assume that the multivariate regression model is written as $\mathbf{Y} = \mathbf{XB} + \mathbf{U}$, where $\mathbf{U}$ is the matrix of residuals. Then, they write $\mathbf{D} = \left(\mathbf{Y}^T\mathbf{Y}\right)^{-1}\hat{\mathbf{U}}^T\hat{\mathbf{U}}$, with $\hat{\mathbf{U}}^T\hat{\mathbf{U}} = \mathbf{Y}^T\mathbf{PY}$ and $\mathbf{P}$ is $\mathbf{P} = \mathbf{I}_n - \mathbf{X}\left(\mathbf{X}^T\mathbf{X}\right)^{-1}\mathbf{X}^T$. The matrix $\mathbf{D}$ is a generalization of $1 - R^2$ in the univariate case. Mardia, Kent and Bibby (1979, pg. 171) mentioned that the dependent variable $\mathbf{Y}$ has to be centred.

The squared multivariate correlation should lie between 0 and 1 and this property is satisfied by the trace correlation r_T and the determinant correlation r_D, defined as $r_T^2 = d^{-1}\text{tr}\left(\mathbf{I} - \mathbf{D}\right)$ and $r_D^2 = \det\left(\mathbf{I} - \mathbf{D}\right)$ respectively, where d denotes the dimensionality of $\mathbf{Y}$. So, high values indicate high proportion of variance of the dependent variables explained. Alternatively, one can calculate the trace and the determinant of the matrix $\mathbf{E} = \left(\mathbf{Y}^T\mathbf{Y}\right)^{-1}\hat{\mathbf{Y}}^T\hat{\mathbf{Y}}$. Try something else also, use the function "sq.correl()" in a univariate regression example and then calculate the R^2 for the same dataset. Try this example again but without centering the dependent variable. In addition, take two variables and calculate their squared correlation coefficient and then square it and using "sq.correl()".

Value

A vector with two values, the trace and determinant R^2.

Author(s)

Michail Tsagris

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

See Also

`rv`, `dcor`

Examples

```
sq.correl( as.matrix(iris[, 1:2]), as.matrix(iris[, 3:4]) )
```

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