Package 'dcov'

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Type Package

Title A Fast Implementation of Distance Covariance

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Description Efficient methods for computing distance covariance and relevant statistics. See Székely et al.(2007) <doi:10.1214/009053607000000505>; Székely and Rizzo (2013) <doi:10.1016/j.jmva.2013.02.AOS1255>; Huo and Székely (2016) <doi:10.1080/00401706.2015.1054435>.

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R topics documented:

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centering	*Centering method This method implements the double centering and U-centering during computing distance covariance.*

Description

Centering method This method implements the double centering and U-centering during computing distance covariance.

Usage

```
centering(D, type = c("V", "U"))

centering_from_data(x, type = c("V", "U"))
```

Arguments

D	the pairwise distance matrix
type	"V" or "U". "V" for double centering. "U" for U-centering.
x	the matrix of x

Examples

```
x = matrix(rnorm(200),100,2)
D = as.matrix(dist(x))
A = centering(D,'U')
A = centering_from_data(x)
```

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dcor.test	*Permutation test of distance correlation and partial distance correlation*

Description

Simple independence test based on data permutation using distance correlation and partial distance correlation.

Usage

```
dcor.test(x, y, R = 500, type = c("V", "U"))

pdcor.test(x, y, z, R = 500, type = c("U", "V"))
```

Arguments

x	the data of x
y	the data of y
R	the number of replicates
type	"U" or "V"
z	the data of controlling variables. Given z, pdcor between x and y is calculated.

Examples

```
n = 200
z = rnorm(n)
x = rnorm(n)*z
y = rnorm(n)*z
res1 = dcor.test(x,y,R=500)
res2 = pdcor.test(x,y,z,R=500)
```

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dcor.ttest	*Distance correlation T-test It uses the result of U-statistic distance correlation to test independence for high dimensional data*

Description

Distance correlation T-test It uses the result of U-statistic distance correlation to test independence for high dimensional data

Usage

```
dcor.ttest(x, y)
```

Arguments

x	data of x
y	data of y

Examples

```
n = 200
x = rnorm(n)
y = rnorm(n)
res = dcor.ttest(x,y)
```

---

dcov *Distance covariance*

Description

This method implements the method to compute the value of distance covariance proposed by *Székely et al.(2007)* and *Székely and Rizzo(2013)* by Armadillo library. For distance covariance between two one dimensional variables, the fast algorithm proposed by *Huo and Székely(2016)* is used.

Usage

```
dcov(x, y, type = c("V", "U"))

dcor(x, y, type = c("V", "U"))
```

Arguments

x	the matrix of x
y	the matrix of y
type	"V" or "U", for V- or U-statistics of distance covariance or correlation. The default value is "V".

Note

Note that the result of dcov(x,y,"V") and dcor(x,y,"V") is same with the result of energy::dcov(x,y)^2 and energy::dcor(x,y)^2. The result of dcov(x,y,'U') and dcor(x,y,'U') is same with the result of energy::dcovU(x,y) and energy::bcdcor(x,y).

References

Székely, G. J., Rizzo, M. L., & Bakirov, N. K. (2007). Measuring and testing dependence by correlation of distances. The annals of statistics, 35(6), 2769-2794.

Székely, G. J., & Rizzo, M. L. (2013). The distance correlation t-test of independence in high dimension. Journal of Multivariate Analysis, 117, 193-213.

Huo, X., & Székely, G. J. (2016). Fast computing for distance covariance. Technometrics, 58(4), 435-447.

See Also

dcov2d

Examples

```
x = matrix(rnorm(200),100,2)
y = matrix(rnorm(200),100,2)
dcov(x,y)
dcor(x,y)
```

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dcov2d	*Fast distance covariance for two bivariate variables*

Description

This method implements the fast algorithm proposed by *Huo and Székely*. The result of dcov2d and dcor2d is same with the result of energy::dcov2d and energy::dcor2d

Usage

```
dcov2d(x, y, type = c("V", "U"))

dcor2d(x, y, type = c("V", "U"))
```

Arguments

x	the vector of x
y	the vector of y
type	"V" or "U", for V- or U-statistics of distance covariance or correlation. The default value is "V".

References

Székely, G. J., Rizzo, M. L., & Bakirov, N. K. (2007). Measuring and testing dependence by correlation of distances. The annals of statistics, 35(6), 2769-2794.

Székely, G. J., & Rizzo, M. L. (2013). The distance correlation t-test of independence in high dimension. Journal of Multivariate Analysis, 117, 193-213.

Huo, X., & Székely, G. J. (2016). Fast computing for distance covariance. Technometrics, 58(4), 435-447.

Examples

```
x = rnorm(200)
y = rnorm(200)
dcov2d(x,y)
dcor2d(x,y)
```

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mdcov	*Marginal distance covariance This function implements the method of calculating distance covariance between y and each column in x*

Description

Marginal distance covariance This function implements the method of calculating distance covariance between y and each column in x

Usage

```
mdcov(y, x, type = c("V", "U"))

mdcor(y, x, type = c("V", "U"))
```

Arguments

y	the matrix of y
x	the matrix of x, distance covariance is calculated for each variable in x with y.
type	"V" or "U", for V- or U-statistics of distance covariance or correlation. The default value is "V".

Examples

```
n = 200; p = 10
y = matrix(rnorm(n*2),n,2)
x = matrix(rnorm(n*p),n,p)
res1 = mdcov(y,x)
res2 = numeric(p)
for(j in 1:p){res2[j] = dcov::dcov(y,x[,j])}
# res1 is same with res2
res1 - res2
res3 = mdcor(y,x)
res4 = numeric(p)
for(j in 1:p){res4[j] = dcov::dcor(y,x[,j])}
# res3 is same with res4
res3-res4
```

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pcov	*Projection covariance between two random vectors This function implements the projection correlation in Zhu et al.(2017)*

Description

Projection covariance between two random vectors This function implements the projection correlation in *Zhu et al.(2017)*

Usage

```
pcov(x, y)
```

Arguments

x	the matrix of x
y	the matrix of y

References

Zhu, L., Xu, K., Li, R., & Zhong, W. (2017). Projection correlation between two random vectors. Biometrika, 104(4), 829-843.

Examples

```
x = matrix(rnorm(200),100,2)
y = matrix(rnorm(200),100,2)
pcov(x,y)
```

---

pdcov	*Partial distance covariance*

Description

This method implements the method to compute the value of partial distance covariance proposed by *Székely and Rizzo, 2014.*

Usage

```
pdcov(x, y, z, type = c("U", "V"))

pdcor(x, y, z, type = c("U", "V"))
```

Arguments

x	the matrix of x
y	the matrix of y
z	the matrix of z. Given the value of z, pdcov or pdcor between x and y is calcu-ated.
type	"V" or "U", for V- or U-statistics of partial distance covariance or correlation. The default value is "U".

References

Székely, G. J., & Rizzo, M. L. (2014). Partial distance correlation with methods for dissimilarities. The Annals of Statistics, 42(6), 2382-2412.

Examples

```
z = matrix(rnorm(400),200,2)
x = matrix(rnorm(400),200,2)*z
y = matrix(rnorm(400),200,2)*z
pdcov(x,y,z)
pdcor(x,y,z)
```

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