

Package ‘CPC’

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Title Implementation of Cluster-Polarization Coefficient

Version 2.6.2

Description Implements cluster-polarization coefficient for measuring distributional polarization in single or multiple dimensions, as well as associated functions. Contains support for hierarchical clustering, k-means, partitioning around medoids, density-based spatial clustering with noise, and manually imposed cluster membership. Mehlhaff (2024) <[doi:10.1017/S0003055423001041](https://doi.org/10.1017/S0003055423001041)>.

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URL <https://imehlhaff.net/CPC/>

BugReports <https://github.com/imehlhaff/CPC/issues>

Imports stats, cluster, dbscan, Rfast

NeedsCompilation no

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correlate	<i>Test for Bivariate Correlation</i>
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Description

Calculates correlation coefficient between two variables and returns a list containing the correlation estimate, its standard error, the p-value of a null-hypothesis significance test, and the number of observations used.

Usage

```
correlate(x, y, ...)
```

Arguments

x	a numeric vector.
y	a numeric vector.
...	arguments passed to <code>cor.test()</code> .

Details

Additional arguments to alter the type of null hypothesis significance test, the method used to calculate the correlation coefficient, the confidence level, or other options should be passed to `correlate()` and will be inherited by `cor.test()`. Note that unlike `cor.test()`, both arguments x and y are required.

Value

Returns a list with elements containing the correlation coefficient estimate, its associated standard error, the p-value of a null-hypothesis significance test, and the number of observations used, all as numeric vectors of length 1.

Examples

```
data <- matrix(c(rnorm(50, 0, 1), rnorm(50, 5, 1)), ncol = 2, byrow = TRUE)

correlate(data[, 1], data[, 2])
```

CPC

*Cluster-Polarization Coefficient***Description**

Implements clustering algorithms and calculates cluster-polarization coefficient. Contains support for hierarchical clustering, k-means clustering, partitioning around medoids, density-based spatial clustering with noise, and manual assignment of cluster membership.

Usage

```
CPC(
  data,
  type,
  k = NULL,
  epsilon = NULL,
  model = FALSE,
  adjust = FALSE,
  cols = NULL,
  clusters = NULL,
  ...
)
```

Arguments

<code>data</code>	a numeric vector or $n \times k$ matrix or data frame. If <code>type = "manual"</code> , <code>data</code> must be a matrix containing a vector identifying cluster membership for each observation, to be passed to <code>clusters</code> argument.
<code>type</code>	a character string giving the type of clustering method to be used. See Details.
<code>k</code>	the desired number of clusters. Required if <code>type</code> is one of <code>"hclust"</code> , <code>"diana"</code> , <code>"kmeans"</code> , or <code>"pam"</code> .
<code>epsilon</code>	radius of epsilon neighborhood. Required if <code>type = "dbscan"</code> .
<code>model</code>	a logical indicating whether clustering model output should be returned. Defaults to <code>FALSE</code> .
<code>adjust</code>	a logical indicating whether the adjusted CPC should be calculated. Defaults to <code>FALSE</code> . Note that both CPC and adjusted CPC are automatically calculated and returned if <code>model = TRUE</code> .
<code>cols</code>	columns of <code>data</code> to be used in CPC calculation. Only used if <code>type = "manual"</code> .
<code>clusters</code>	column of <code>data</code> indicating cluster membership for each observation. Only used if <code>type = "manual"</code> .
<code>...</code>	arguments passed to other functions.

Details

type must take one of six values:

"hclust": agglomerative hierarchical clustering with `hclust()`,

"diana": divisive hierarchical clustering with `diana()`,

"kmeans": k-means clustering with `kmeans()`,

"pam": k-medoids clustering with `pam()`,

"dbscan": density-based clustering with `dbscan()`,

"manual": no clustering is necessary, researcher has specified cluster assignments.

For all clustering methods, additional arguments to fine-tune clustering performance, such as the specific algorithm to be used, should be passed to `CPC()` and will be inherited by the specified clustering function. In particular, if `type = "kmeans"`, using a large number of random starts is recommended. This can be specified with the `nstart` argument to `kmeans()`, passed directly to `CPC()`.

If `type = "manual"`, data must contain a vector identifying cluster membership for each observation, and `cols` and `clusters` must be defined.

Value

If `model = TRUE`, `CPC()` returns a list with components containing output from the specified clustering function, all sums of squares, the CPC, the adjusted CPC, and associated standard errors. If `model = FALSE`, `CPC()` returns a numeric vector of length 1 giving the CPC (if `adjust = FALSE`) or adjusted CPC (if `adjust = TRUE`).

Examples

```
data <- matrix(c(rnorm(50, 0, 1), rnorm(50, 5, 1)), ncol = 2, byrow = TRUE)
clusters <- matrix(c(rep(1, 25), rep(2, 25)), ncol = 1)
data <- cbind(data, clusters)
```

```
CPC(data[,c(1:2)], "kmeans", k = 2)
CPC(data, "manual", cols = 1:2, clusters = 3)
```

CPCdata.frame

Data Manipulation for CPC Calculation

Description

Converts numeric matrix to data frame with necessary format for "manual" `CPC()` calculation.

Usage

```
CPCdata.frame(data, cols, clusters)
```

Arguments

`data` a numeric $n \times k$ matrix or data frame.
`cols` columns in data to be used for calculating `CPC()`.
`clusters` column in data giving cluster membership.

Value

Returns a data frame with dimensions identical to those of data.

Examples

```
data <- matrix(c(rnorm(50, 0, 1), rnorm(50, 5, 1)), ncol = 2, byrow = TRUE)
clusters <- matrix(c(rep(1, 25), rep(2, 25)), ncol = 1)
data <- cbind(data, clusters)
CPCdata.frame(data, 1:2, 3)
```

diff_multidim *Multidimensional Difference-in-Means*

Description

Calculates average Euclidean distance between means in arbitrary dimensions.

Usage

```
diff_multidim(data, cols, clusters)
```

Arguments

`data` a numeric vector or $n \times k$ matrix or data frame containing a vector identifying cluster membership for each observation, to be passed to `clusters` argument.
`cols` columns of data to be used in difference-in-means calculation.
`clusters` column of data indicating cluster membership for each observation.

Value

Returns a numeric vector of length 1.

Examples

```
data <- matrix(c(rnorm(50, 0, 1), rnorm(50, 5, 1)), ncol = 2, byrow = TRUE)
clusters <- matrix(c(rep(1, 25), rep(2, 25)), ncol = 1)
data <- cbind(data, clusters)

diff_multidim(data, 1:2, 3)
```

Euclidean

Euclidean Distance from Dimension Means

Description

Calculates two-dimensional Euclidean distance between all points and dimension means.

Usage

```
Euclidean(data)
```

Arguments

data an n x 2 matrix or data frame.

Value

Returns a numeric vector of length 1.

Examples

```
data <- matrix(c(rnorm(50, 0, 1), rnorm(50, 5, 1)), ncol = 2, byrow = TRUE)
```

```
Euclidean(data)
```

SS

Sum-of-Squares Calculation

Description

Calculates sums of squares for uni- or multi-dimensional numeric data using the distance matrix.

Usage

```
SS(data, ...)
```

Arguments

data a numeric vector or n x k matrix or data frame.

... arguments passed to `dist()`.

Value

Returns a numeric vector of length 1.

Examples

```
data <- matrix(c(rnorm(50, 0, 1), rnorm(50, 5, 1)), ncol = 2, byrow = TRUE)
SS(data)
```

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