

# Package ‘lancor’

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**Type** Package

**Title** Statistical Inference via Lancaster Correlation

**Version** 0.1.2

**Description** Implementation of the methods described in Holzmann, Klar (2024) [doi:10.48550/arXiv.2303.17872](https://doi.org/10.48550/arXiv.2303.17872). Lancaster correlation is a correlation coefficient which equals the absolute value of the Pearson correlation for the bivariate normal distribution, and is equal to or slightly less than the maximum correlation coefficient for a variety of bivariate distributions. Rank and moment-based estimators and corresponding confidence intervals are implemented, as well as independence tests based on these statistics.

**Imports** acepack, arrangements, boot, graphics, sn, stats

**License** GPL-2

**Encoding** UTF-8

**RoxygenNote** 7.3.1

**Suggests** testthat (>= 3.0.0)

**Config/testthat/edition** 3

**NeedsCompilation** no

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|----------|---|
| ace.test | <i>ACE permutation test of independence</i> |
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### Description

Performs a permutation test of independence using `ace` in package `acepack`. `ace` stands for alternating conditional expectations.

### Usage

```
ace.test(x, y = NULL, nperm = 999)
```

### Arguments

|                    |   |
|--------------------|---|
| <code>x</code>     | a numeric vector, or a matrix or data frame with two columns.   |
| <code>y</code>     | NULL (default) or a vector with same length as <code>x</code> . |
| <code>nperm</code> | number of permutations.   |

### Value

A list containing the following components:

|                   |                                  |
|-------------------|----------------------------------|
| <code>ace</code>  | the value of the test statistic. |
| <code>pval</code> | the p-value of the test.         |

### Author(s)

Hajo Holzmann, Bernhard Klar

### References

Holzmann, Klar (2024) Lancaster correlation - a new dependence measure linked to maximum correlation. arXiv:2303.17872

### See Also

[lcor.test](#)

### Examples

```
n <- 200
x <- matrix(rnorm(n*2), n)
nu <- 2
y <- x / sqrt(rchisq(n, nu)/nu) #multivariate t
cor.test(y[,1], y[,2], method = "spearman")
ace.test(y)
```

---

lcor *Lancaster correlation*

---

**Description**

Computes the Lancaster correlation coefficient.

**Usage**

```
lcor(x, y = NULL, type = c("rank", "linear"))
```

**Arguments**

**x** a numeric vector, or a matrix or data frame with two columns.  
**y** NULL (default) or a vector with same length as x.  
**type** a character string indicating which lancaster correlation is to be computed. One of "rank" (default), or "linear": can be abbreviated.

**Value**

lcor returns the sample Lancaster correlation.

**Author(s)**

Hajo Holzmann, Bernhard Klar

**References**

Holzmann, Klar (2024) Lancaster correlation - a new dependence measure linked to maximum correlation. arXiv:2303.17872

**See Also**

[lcor.comp](#), [lcor.ci](#), [lcor.test](#)

**Examples**

```
Sigma <- matrix(c(1,0.1,0.1,1), ncol=2)
R <- chol(Sigma)
n <- 1000
x <- matrix(rnorm(n*2), n)
lcor(x, type = "rank")
lcor(x, type = "linear")

x <- matrix(rnorm(n*2), n)
nu <- 2
y <- x / sqrt(rchisq(n, nu)/nu)
cor(y[,1], y[,2], method = "spearman")
lcor(y, type = "rank")
```

---

lcor.ci                      *confidence intervals for the Lancaster correlation coefficient*

---

### Description

Computes confidence intervals for the Lancaster correlation coefficient. Lancaster correlation is a bivariate measures of dependence.

### Usage

```
lcor.ci(x, y = NULL, conf.level = 0.95, type = c("rank", "linear"), con = TRUE,
        R = 1000, method = c("plugin", "boot", "pretest"))
```

### Arguments

|            |   |
|------------|---|
| x          | a numeric vector, or a matrix or data frame with two columns.   |
| y          | NULL (default) or a vector with same length as x.   |
| conf.level | confidence level of the interval.   |
| type       | a character string indicating which lancaster correlation is to be computed. One of "rank" (default), or "linear": can be abbreviated.                                  |
| con        | logical; if TRUE (default), conservative asymptotic confidence intervals are computed.  |
| R          | number of bootstrap replications.   |
| method     | a character string indicating how the asymptotic covariance matrix is computed if type ="linear". One of "plugin" (default), "boot" or "symmetric": can be abbreviated. |

### Value

lcor.ci returns a vector containing the lower and upper limits of the confidence interval.

### Author(s)

Hajo Holzmann, Bernhard Klar

### References

Holzmann, Klar (2024) Lancaster correlation - a new dependence measure linked to maximum correlation. arXiv:2303.17872

### See Also

[lcor](#), [lcor.comp](#), [lcor.test](#)

**Examples**

```
n <- 1000
x <- matrix(rnorm(n*2), n)
nu <- 2
y <- x / sqrt(rchisq(n, nu)/nu) # multivariate t
lcor(y, type = "rank")
lcor.ci(y, type = "rank")
```

---

`lcor.comp`*Lancaster correlation and its components*

---

**Description**

Computes the Lancaster correlation coefficient and its components.

**Usage**

```
lcor.comp(x, y = NULL, type = c("rank", "linear"), plot = FALSE)
```

**Arguments**

|                   |  |
|-------------------|--|
| <code>x</code>    | a numeric vector, or a matrix or data frame with two columns.  |
| <code>y</code>    | NULL (default) or a vector with same length as <code>x</code> .  |
| <code>type</code> | a character string indicating which lancaster correlation is to be computed. One of "rank" (default), or "linear": can be abbreviated. |
| <code>plot</code> | logical; if TRUE, scatterplots of the transformed <code>x</code> and <code>y</code> values and of their squares are drawn.             |

**Value**

`lcor.comp` returns a vector containing the two components `rho1` and `rho2` and the sample Lancaster correlation.

**Author(s)**

Hajo Holzmann, Bernhard Klar

**References**

Holzmann, Klar (2024) Lancaster correlation - a new dependence measure linked to maximum correlation. arXiv:2303.17872

**See Also**

[lcor](#), [lcor.ci](#), [lcor.test](#)

**Examples**

```

Sigma <- matrix(c(1,0.1,0.1,1), ncol=2)
R <- chol(Sigma)
n <- 1000
x <- matrix(rnorm(n*2), n)
nu <- 8
y <- x / sqrt(rchisq(n, nu)/nu) #multivariate t
cor(y[,1], y[,2])
lcor.comp(y, type = "linear")

x <- matrix(rnorm(n*2), n)
nu <- 2
y <- x / sqrt(rchisq(n, nu)/nu) #multivariate t
cor(y[,1], y[,2], method = "spearman")
lcor.comp(y, type = "rank", plot = TRUE)

```

---

`lcor.test`*Lancaster correlation test*

---

**Description**

Lancaster correlation test of bivariate independence. Lancaster correlation is a bivariate measures of dependence.

**Usage**

```

lcor.test(x, y = NULL, type = c("rank", "linear"), nperm = 999,
          method = c("permutation", "asymptotic", "symmetric"))

```

**Arguments**

|                     |  |
|---------------------|--|
| <code>x</code>      | a numeric vector, or a matrix or data frame with two columns.  |
| <code>y</code>      | NULL (default) or a vector with same length as <code>x</code> .  |
| <code>type</code>   | a character string indicating which lancaster correlation is to be computed. One of "rank" (default), or "linear": can be abbreviated.                                     |
| <code>nperm</code>  | number of permutations.  |
| <code>method</code> | a character string indicating how the p-value is computed if <code>type="linear"</code> . One of "permutation" (default), "asymptotic" or "symmetric": can be abbreviated. |

**Value**

A list containing the following components:

|                   |                                  |
|-------------------|----------------------------------|
| <code>lcor</code> | the value of the test statistic. |
| <code>pval</code> | the p-value of the test.         |

**Author(s)**

Hajo Holzmann, Bernhard Klar

**References**

Holzmann, Klar (2024) Lancaster correlation - a new dependence measure linked to maximum correlation. arXiv:2303.17872

**See Also**

[lcor](#), [lcor.comp](#), [lcor.ci](#)

**Examples**

```
n <- 200
x <- matrix(rnorm(n*2), n)
nu <- 2
y <- x / sqrt(rchisq(n, nu)/nu)
cor.test(y[,1], y[,2], method = "spearman")
lcor.test(y, type = "rank")
```

---

Sigma.est

*Covariance matrix of components of Lancaster correlation coefficient.*

---

**Description**

Estimate of covariance matrix of the two components of Lancaster correlation. Lancaster correlation is a bivariate measures of dependence.

**Usage**

```
Sigma.est(xx)
```

**Arguments**

xx                    a matrix or data frame with two columns.

**Value**

Sigma.est returns the estimated covariance matrix.

**Author(s)**

Hajo Holzmann, Bernhard Klar

**References**

Holzmann, Klar (2024) Lancaster correlation - a new dependence measure linked to maximum correlation. arXiv:2303.17872

**See Also**[lcor.ci](#)**Examples**

```
Sigma <- matrix(c(1,0.1,0.1,1), ncol=2)
R <- chol(Sigma)
n <- 1000
x <- matrix(rnorm(n*2), n)
nu <- 8
y <- x / sqrt(rchisq(n, nu)/nu) #multivariate t
Sigma.est(y)
```

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