

# Package ‘CMDMeasure’

February 9, 2018

**Title** Conditional Mean Dependence Measures via Energy Statistics

**Version** 1.0.0

**Date** 2018-01-30

**Description** Implementation of conditional mean dependence measures and conditional mean independence tests in Shao, X., and Zhang, J. (2014) <doi:10.1080/01621459.2014.887012> and Park, T., et al. (2015) <doi:10.1214/15-EJS1047>.

**Depends** R (>= 3.4.0)

**Suggests** testthat (>= 2.0.0),  
energy (>= 1.7-0)

**License** GPL (>= 2)

**LazyData** true

**RoxygenNote** 6.0.1

**Collate** 'CMDMeasure-package.R'  
'functions.R'  
'cmdm.R'  
'cmdm\_test.R'

## R topics documented:

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CMDMeasure-package	<i>Conditional Mean Dependence Measures via Energy Statistics</i>
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## Description

CMDMeasure: A package for mutual dependence measures via energy statistics

## Details

The CMDMeasure package provides measures of conditional mean dependence and tests of conditional mean independence.

### Measuring conditional mean dependence

The conditional mean dependence measures include:

- asymmetric measure  $\mathcal{R}_n$  based on distance covariance  $\mathcal{V}_n$
- symmetric measure  $\mathcal{S}_n$  based on distance covariance  $\mathcal{V}_n$
- complete measure  $\mathcal{Q}_n$  based on complete V-statistics
- simplified complete measure  $\mathcal{Q}_n^*$  based on incomplete V-statistics
- asymmetric measure  $\mathcal{J}_n$  based on complete measure  $\mathcal{Q}_n$
- simplified asymmetric measure  $\mathcal{J}_n^*$  based on simplified complete measure  $\mathcal{Q}_n^*$
- symmetric measure  $\mathcal{I}_n$  based on complete measure  $\mathcal{Q}_n$
- simplified symmetric measure  $\mathcal{I}_n^*$  based on simplified complete measure  $\mathcal{Q}_n^*$

### Testing conditional mean independence

The conditional mean independence tests based on the conditional mean dependence measures are implemented as permutation tests.

### Author(s)

Ze Jin <zj58@cornell.edu>, Shun Yao <shunyao2@illinois.edu>, Xiaofeng Shao <xshao@illinois.edu>, David S. Matteson <matteson@cornell.edu>

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MDD

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*Mutual Dependence Measures*


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### Description

cmdm measures mutual dependence of all components in  $\mathbf{X}$ , where each component contains one variable (univariate) or more variables (multivariate).

### Usage

`MDD(x, y)`

### Arguments

<code>x</code>	A matrix or data frame, where rows represent samples, and columns represent variables.
<code>y</code>	A matrix or data frame, where rows represent samples, and columns represent variables.

### Value

cmdm returns a list including the following components:

<code>stat</code>	The value of the mutual dependence measure.
<code>dist</code>	The distances between all components from all samples.

## References

Shao, X., and Zhang, J. (2014). Martingale difference correlation and its use in high-dimensional variable screening. *Journal of the American Statistical Association*, 109(507), 1302-1318. <https://arxiv.org/abs/1709.02532>.

Park, T., Shao, X., and Yao, S. (2015). Partial martingale difference correlation. *Electronic Journal of Statistics*, 9(1), 1492-1517. <https://arxiv.org/abs/1709.02532>.

## Examples

```
# X, Y is a 10 x 3 matrix with 10 samples and 3 variables
X <- matrix(rnorm(10 * 3), 10, 3)
Y <- matrix(rnorm(10 * 3), 10, 3)
# assume X = (X1, X2) where X1 is 1-dim, X2 is 2-dim
MDD(X, Y)
```

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MDD2	<i>Mutual Dependence Measures</i>
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## Description

cmdm measures mutual dependence of all components in X, where each component contains one variable (univariate) or more variables (multivariate).

## Usage

```
MDD2(x, y)
```

## Arguments

x	A matrix or data frame, where rows represent samples, and columns represent variables.
y	A matrix or data frame, where rows represent samples, and columns represent variables.

## Value

cmdm returns a list including the following components:

stat	The value of the mutual dependence measure.
dist	The distances between all components from all samples.

## References

Shao, X., and Zhang, J. (2014). Martingale difference correlation and its use in high-dimensional variable screening. *Journal of the American Statistical Association*, 109(507), 1302-1318. <https://arxiv.org/abs/1709.02532>.

Park, T., Shao, X., and Yao, S. (2015). Partial martingale difference correlation. *Electronic Journal of Statistics*, 9(1), 1492-1517. <https://arxiv.org/abs/1709.02532>.

**Examples**

```
# X, Y is a 10 x 3 matrix with 10 samples and 3 variables
X <- matrix(rnorm(10 * 3), 10, 3)
Y <- matrix(rnorm(10 * 3), 10, 3)
# assume X = (X1, X2) where X1 is 1-dim, X2 is 2-dim
MDD(X, Y)
```

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