# Package 'MRAM'

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**Type** Package

**Title** Multivariate Regression Association Measure

**Version** 0.1.2

**Description** The multivariate regression association measure quantifies the predictability of one random vector from another. This package provides a function for estimating and performing inference on this measure. A variable selection algorithm based on this measure is also included. For more details, see Shih and Chen (2025) <in revision>.

**Depends** RANN

**License** GPL-2

**Encoding** UTF-8

**RoxygenNote** 7.3.2

**NeedsCompilation** no

**Author** Jia-Han Shih [aut, cre],
Yi-Hau Chen [aut]

**Maintainer** Jia-Han Shih <jhshih@math.nsysu.edu.tw>

**Repository** CRAN

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mram *Estimate Multivariate Regression Association Measure*

## Description

Estimate the multivariate regression association measure proposed in Shih and Chen (2025). Standard error estimates are obtained by applying the $m$-out-of-$n$ bootstrap proposed in Dette and Kroll (2024).

## Usage

```
mram(
  y_data,
  x_data,
  z_data = NULL,
  bootstrap = FALSE,
  B = 1000,
  g_vec = seq(0.4, 0.9, by = 0.05)
)
```

## Arguments

| | |
|---|---|
| y_data | A $n \times d$ matrix of responses. |
| x_data | A $n \times p$ Matrix of predictors. |
| z_data | A $n \times q$ matrix of conditional predictors. |
| bootstrap | Perform the $m$-out-of-$n$ bootstrap if TRUE. The default value is FALSE. |
| B | Number of bootstrap replications. The default value is 1000. |
| g_vec | A vector used to generate a collection of rules for the $m$-out-of-$n$ bootstrap. The default value is seq(0.4,0.9,by = 0.05). |

## Details

The value T_est returned by mram is between $-1$ and $1$. However, it is between $0$ and $1$ asymptotically. A small value indicates that x_data has low predictability for y_data condition on z_data in the sense of the considered measure. Similarly, a large value indicates that x_data has high predictability for y_data condition on z_data. If z_data = NULL, the returned value indicates the unconditional predictability.

## Value

| | |
|---|---|
| T_est | The estimate of the multivariate regression association measure. |
| T_se_cluster | The standard error estimate based on the cluster rule. |
| m_vec | The vector of $m$ generated by g_vec. |
| T_se_vec | The vector of standard error estimates obtained from the $m$-out-of-$n$ bootstrap, where $m$ is equal to m_vec. |
| J_cluster | The index of the best m_vec chosen by the cluster rule. |

## References

Dette and Kroll (2024) A Simple Bootstrap for Chatterjee's Rank Correlation, Biometrika, asae045.

Shih and Chen (2025) Measuring multivariate regression association via spatial sign (in revision, Computational Statistics & Data Analysis)

## See Also

vs_mram

## Examples

```
n = 100
lambda_para = 3
sigma_para = 0.4

x_data = matrix(rnorm(n*2),n,2)
y_data = matrix(0,n,2)
y_data[,1] = x_data[,1]+x_data[,2]+lambda_para*sigma_para*rnorm(n)
y_data[,2] = x_data[,1]-x_data[,2]+lambda_para*sigma_para*rnorm(n)

library(MRAM)
res = mram(y_data,x_data,bootstrap = FALSE)
```

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# vs_mram *Variable Selection via the Multivariate Regression Association Measure*

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## Description

Perform variable selection via the multivariate regression association measure proposed in Shih and Chen (2025).

## Usage

```
vs_mram(y_data, x_data)
```

## Arguments

| | |
|---|---|
| y_data | A $n \times d$ matrix of responses. |
| x_data | A $n \times p$ matrix of predictors. |

## Details

vs_mram is a forward and stepwise variable selection algorithm which utilizes the multivariate regression association measure proposed in Shih and Chen (2025). The Algorithm is modified from the feature ordering by conditional independence (FOCI) algorithm from Azadkia and Chatterjee (2021).

## Value

The vector containing the indices of the selected predictors in the order they were chosen.

## References

Azadkia and Chatterjee (2021) A simple measure of conditional dependence, Annals of Statistics, 46(6): 3070-3102.

Shih and Chen (2025) Measuring multivariate regression association via spatial sign (in revision, Computational Statistics & Data Analysis)

## See Also

mram

## Examples

```
n = 200
p = 10

x_data = matrix(rnorm(p*n),n,p)
y_data = x_data[,1]*x_data[,2]+x_data[,1]-x_data[,3]+rnorm(n)
colnames(x_data) = paste0(rep("X",p),seq(1,p))

library(MRAM)
mram_res = vs_mram(y_data,x_data)
```

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