

Package ‘coupling’

May 15, 2026

Title Analysis of Coupling Coordination Degree

Version 0.1

Description Implements coupling coordination degree (CCD) models and supports metacoupling analysis following Tang et al. (2021) <[doi:10.1016/j.scs.2021.103405](https://doi.org/10.1016/j.scs.2021.103405)>.

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Encoding UTF-8

URL <https://stscl.github.io/coupling/>,
<https://github.com/stscl/coupling>

BugReports <https://github.com/stscl/coupling/issues>

Depends R (>= 4.1.0)

LinkingTo Rcpp, RcppThread

Suggests gdverse, infoxtr, knitr, pc, Rcpp, RcppThread, rmarkdown,
sdsfun, spEDM

VignetteBuilder knitr

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NeedsCompilation yes

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`ccd`*Coupling Coordination Degree (CCD)*

Description

Coupling Coordination Degree (CCD)

Usage

```
ccd(data, weight = NULL, method = c("standard", "wang", "fan"), threads = 1)
```

Arguments

| | |
|----------------------|---|
| <code>data</code> | A numeric matrix or <code>data.frame</code> . Rows are observations, columns are indicators. |
| <code>weight</code> | Numeric vector of indicator weights. Must have length equal to <code>ncol(data)</code> . If <code>NULL</code> , equal weights are used. |
| <code>method</code> | Coupling model. One of "standard", "wang", or "fan". |
| <code>threads</code> | Number of threads used in computation. |

Details

Full model definitions and formulas are available at: <https://github.com/stscl/coupling/discussions/3>

Value

A `data.frame` with:

- C: coupling degree
- D: coordination degree

Note

Input values should be normalized to $[0, 1]$.

Examples

```
set.seed(42)
mat = matrix(runif(20), nrow = 5)
coupling::ccd(mat)
```

| | |
|--------------|------------------------------|
| metacoupling | <i>Metacoupling Analysis</i> |
|--------------|------------------------------|

Description

Metacoupling Analysis

Usage

```
metacoupling(  
  data,  
  swm_peri = NULL,  
  swm_tele = NULL,  
  weight = NULL,  
  method = c("standard", "wang", "fan"),  
  threads = 1  
)
```

Arguments

| | |
|----------|--|
| data | A numeric matrix or data.frame. Rows are observations, columns are indicators. |
| swm_peri | A numeric matrix representing the peri (local) spatial weight matrix . Must be square with dimension equal to <code>nrow(data)</code> . If NULL, a zero matrix is used. |
| swm_tele | A numeric matrix representing the tele (long-distance) spatial weight matrix . Must be square with dimension equal to <code>nrow(data)</code> . If NULL, a zero matrix is used. |
| weight | Numeric vector of indicator weights. Must have length equal to <code>ncol(data)</code> . If NULL, equal weights are used. |
| method | Coupling model. One of "standard", "wang", or "fan". |
| threads | Number of threads used in computation. |

Details

Full model definitions and formulas are available at: <https://github.com/stscl/coupling/discussions/8>

Value

A data.frame with:

- Intra_C: intra-system coupling degree
- Intra_D: intra-system coordination degree
- Peri_C: peri-coupling degree
- Peri_D: peri coordination degree
- Tele_C: tele-coupling degree
- Tele_D: tele coordination degree

Note

Input values should be normalized to $[0, 1]$. Spatial weight matrices are typically symmetric.

Examples

```
set.seed(42)
mat = matrix(runif(20), nrow = 5)
swm1 = apply(matrix(runif(25), 5, 5), 1, \(.x) .x / sum(.x))
swm2 = apply(matrix(runif(25), 5, 5), 1, \(.x) .x / sum(.x))
coupling::metacoupling(mat, swm1, swm2)
```

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