Package 'infocausality'

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Title Information-Theoretic Measure of Causality

Version 1.1

Description Methods for quantifying temporal and spatial causality through information flow, and decomposing it into unique, redundant, and synergistic components, following the framework described in Martinez-Sanchez et al. (2024) <doi:10.1038/s41467-024-53373-4>.

License GPL-3

Encoding UTF-8

RoxygenNote 7.3.3

URL https://stscl.github.io/infocausality/, https://github.com/stscl/infocausality

BugReports https://github.com/stscl/infocausality/issues

Depends R (>= 4.1.0)

LinkingTo Rcpp

Imports methods, reticulate (>= 1.41.0), sdsfun, sf, terra

Suggests gdverse, ggplot2, infoxtr, knitr, Rcpp, rmarkdown, spEDM, tEDM

VignetteBuilder knitr

NeedsCompilation yes

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Repository CRAN

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surd *synergistic-unique-redundant decomposition of causality*

Description

synergistic-unique-redundant decomposition of causality

Usage

```
## S4 method for signature 'data.frame'
surd(
  data,
  target,
  agents,
  lag = 1,
  bin = 5,
  max.combs = NULL,
  cores = 1,
  backend = "threading"
)

## S4 method for signature 'sf'
surd(
  data,
  target,
  agents,
  lag = 1,
  bin = 5,
  max.combs = NULL,
  cores = 1,
  backend = "threading",
  nb = NULL
)

## S4 method for signature 'SpatRaster'
surd(
  data,
  target,
  agents,
  lag = 1,
  bin = 5,
  max.combs = NULL,
  cores = 1,
  backend = "threading"
)
```

Arguments

`data`	observation data.
`target`	name of the target variable.
`agents`	names of agent variables.
`lag`	(optional) lag order.
`bin`	(optional) number of discretization bins.
`max.combs`	(optional) maximum combination order. If `NULL`, the standard SURD decomposition is applied.
`cores`	(optional) number of cores for parallel computation.
`backend`	(optional) `Joblib` backend: `loky`, `threading`, or `multiprocessing`.
`nb`	(optional) neighbours list.

Value

A list.

unique Unique information contributions per variable.

synergistic Synergistic information components by agent combinations.

redundant Redundant information shared by agent subsets.

mutual_info Mutual information measures for each combination.

info_leak Information leak ratio.

References

Martinez-Sanchez, A., Arranz, G. & Lozano-Duran, A. Decomposing causality into its synergistic, unique, and redundant components. Nat Commun 15, 9296 (2024).

Examples

```
columbus = sf::read_sf(system.file("case/columbus.gpkg", package="spEDM"))

tryCatch(
  surd(columbus, "hoval", c("inc", "crime")),
  error = \(e) message("Skipping Python-dependent example: ", e$message)
)
```

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