Package ‘GCSM’

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Title Implements Generic Composite Similarity Measure

Version 0.1.1

Description Provides implementation of the generic composite similarity measure (GCSM) described in Liu et al. (2020) <doi:10.1016/j.ecoinf.2020.101169>. The implementation is in C++ and uses ‘RcppArmadillo’. Additionally, implementations of the structural similarity (SSIM) and the composite similarity measure based on means, standard deviations, and correlation coefficient (CMSC), are included.

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Encoding UTF-8

RoxygenNote 7.1.1

URL https://github.com/liuyadong/GCSM

BugReports https://github.com/liuyadong/GCSM/issues

LinkingTo Rcpp, RcppArmadillo

Imports Rcpp

Suggests testthat

NeedsCompilation yes

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**cmsc**

*Composite similarity between vectors*

**Description**

Compute composite measures, GCSM or CMSC, between two vectors.

**Usage**

```r
cmsc(
  x,
  y,
  rescale = FALSE,
  xmin = NA_real_,
  xmax = NA_real_,
  ymin = NA_real_,
  ymax = NA_real_,
  comp = "si"
)

cmsc_e1(
  x,
  y,
  rescale = FALSE,
  xmin = NA_real_,
  xmax = NA_real_,
  ymin = NA_real_,
  ymax = NA_real_,
  comp = "si"
)

cmsc_e2(
  x,
  y,
  rescale = FALSE,
  xmin = NA_real_,
  xmax = NA_real_,
  ymin = NA_real_,
  ymax = NA_real_,
  comp = "si"
)

gcsm(
  x,
  y,
  rescale = FALSE,
  xmin = NA_real_,
```
Arguments

- **x**: A vector.
- **y**: The other vector.
- **rescale**: Rescale or not before computation.
- **xmin, xmax, ymin, ymax**: Normalization parameters. If NA, are calculated from the ranges of x and y, respectively. See Details.
- **comp**: Variable to return. If "si", the composite measure, if "s1", "s2" or "s3", the corresponding component.

Details

These functions compute composite measures between vectors. Missing values are omitted. Normalization parameters are used to rescale x and y, and determine the global minimum (min) and maximum (max). If rescale is TRUE, x and y are rescaled to \((x-xmin)/(xmax-xmin)\) and \((y-ymin)/(ymax-ymin)\); and set min=0, max=1. If FALSE, min=min(xmin,ymin), max=max(xmax,ymax).

Value

A number.

Examples

```r
x = runif(9)
gcsm(x, x)
cmsc(x, x)
# mean shift
gcsm(x, x - 0.2, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
cmsc(x, x - 0.2, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
gcsm(x, x + 0.2, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
cmsc(x, x + 0.2, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
## dissimilarity
y = 1 - x # y is the perfect antianalog of x
gcsm(y, x)
gcsm(y, x - 0.2, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
gcsm(y, x + 0.2, xmin = 0, xmax = 1, ymin = 0, ymax = 1)

# random noise
noise = rnorm(9, mean = 0, sd = 0.2)
gcsm(x, x + noise, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
cmsc(x, x + noise, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
## dissimilarity
 gcsm(y, x + noise, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
```
Description

Compute composite measures, GCSM, CMSC or SSIM, on spatial windows.

Usage

cmsc_sw(  
  x,  
  y,  
  rescale = FALSE,  
  xmin = NA_real_,  
  xmax = NA_real_,  
  ymin = NA_real_,  
  ymax = NA_real_,  
  ksize = 9,  
  globe = FALSE,  
  comp = "si"  
)

cmsc_e1_sw(  
  x,  
  y,  
  rescale = FALSE,  
  xmin = NA_real_,  
  xmax = NA_real_,  
  ymin = NA_real_,  
  ymax = NA_real_,  
  ksize = 9,  
  globe = FALSE,  
  comp = "si"  
)

cmsc_e2_sw(  
  x,  
  y,  
  rescale = FALSE,  
  xmin = NA_real_,  
  xmax = NA_real_,  
  ymin = NA_real_,  
  ymax = NA_real_,  
  ksize = 9,  
  globe = FALSE,  
  comp = "si"  
)
```r
gcsm_sw(
  x,
  y,
  rescale = FALSE,
  xmin = NA_real_,
  xmax = NA_real_,
  ymin = NA_real_,
  ymax = NA_real_,
  ksize = 9,
  globe = FALSE,
  comp = "si"
)

ssim_sw(
  x,
  y,
  rescale = FALSE,
  xmin = NA_real_,
  xmax = NA_real_,
  ymin = NA_real_,
  ymax = NA_real_,
  ksize = 11,
  sigma = 1.5,
  globe = FALSE,
  comp = "si"
)

Arguments

x  A matrix.
y  The other matrix.
rescale  Rescale or not before computation.
xmin, xmax, ymin, ymax  Normalization parameters. If NA, are calculated from the ranges of x and y, respectively. See Details.
ksize  Side length of spatial windows.
globe  Are data at the global scale? If TRUE, two vertical borders will be padded before computation.
comp  Variable to return. If "si", the composite measure, if "s1","s2" or "s3", the corresponding component.
sigma  Standard deviation of Gaussian weighting function depending on the distance between the cell and kernel center.

Details

These functions slide the spatial window over space. Missing values are omitted. Normalization parameters are used to rescale x and y, and determine the global minimum (min) and maximum (max).
If rescale is TRUE, x and y are rescaled to \((x-x_{\text{min}})/(x_{\text{max}}-x_{\text{min}})\) and \((y-y_{\text{min}})/(y_{\text{max}}-y_{\text{min}})\); and set \(\text{min}=0, \text{max}=1\). If FALSE, \(\text{min}=\text{min}(x_{\text{min}},y_{\text{min}}), \text{max}=\text{max}(x_{\text{max}},y_{\text{max}})\). OpenMP is used for parallel computing.

**Value**

A matrix.

**Examples**

\[
x = \text{matrix}(\text{runif}(36), \text{nrow} = 6, \text{ncol} = 6)
\]

\[
\text{gcsм}_\text{sw}(x, x + 0.2, x_{\text{min}} = 0, x_{\text{max}} = 1, y_{\text{min}} = 0, y_{\text{max}} = 1, \text{ksize} = 3)
\]

\[
\text{cmsc}_\text{sw}(x, x + 0.2, x_{\text{min}} = 0, x_{\text{max}} = 1, y_{\text{min}} = 0, y_{\text{max}} = 1, \text{ksize} = 3)
\]

\[
\text{ssim}_\text{sw}(x, x + 0.2, x_{\text{min}} = 0, x_{\text{max}} = 1, y_{\text{min}} = 0, y_{\text{max}} = 1, \text{ksize} = 3)
\]

---

**cmsc_tw**

Composite similarity on temporal windows

**Description**

Compute composite measures, GCSM or CMSC, on temporal windows.

**Usage**

```r
cmсsc_tw(
  xxx,
  yyy,
  rescale = FALSE,
  xmin = NA_real_,
  xmax = NA_real_,
  ymin = NA_real_,
  ymax = NA_real_,
  comp = "si"
)

cmсsc_e1_tw(
  xxx,
  yyy,
  rescale = FALSE,
  xmin = NA_real_,
  xmax = NA_real_,
  ymin = NA_real_,
  ymax = NA_real_,
  comp = "si"
)

cmsc_e2_tw(
```

```r
Arguments

xxx A 3-d array with the 3rd dimension representing time.

yyy The other 3-d array.

rescale Rescale or not before computation.

xmin, xmax, ymin, ymax Normalization parameters. If NA, are calculated from the ranges of xxx and yyy, respectively. See Details.

comp Variable to return. If "si", the composite measure, if "s1","s2" or "s3", the corresponding component.

Details

These functions slide the temporal window over space. Missing values are omitted. Normalization parameters are used to rescale xxx and yyy, and determine the global minimum (min) and maximum (max). If rescale is TRUE, xxx and yyy are rescaled to \((xxx-xmin)/(xmax-xmin)\) and \((yyy-ymin)/(ymax-ymin)\); and set \(min=0, max=1\). If FALSE, \(min=min(xmin,ymin), max=max(xmax,ymax)\). OpenMP is used for parallel computing.

Value

A matrix.

Examples

\[
x = \text{array}((\text{runif}(81)), \text{dim} = c(3, 3, 9))
\]
gcsam_tw(x, x + 0.2, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
cmsc_tw(x, x + 0.2, xmin = 0, xmax = 1, ymin = 0, ymax = 1)
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